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"Impact of Telemedicine on Healthcare Access in Rural India: Availability, Affordability, and Utilization"

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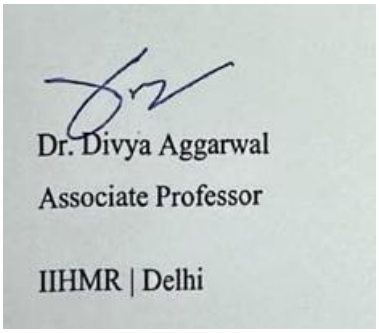
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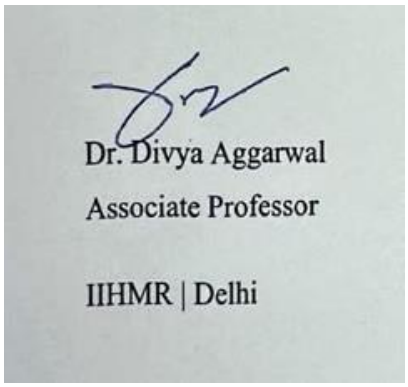
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The Institute's dynamic health care research programmes provide rigorous training in management, health systems, hospital administration, health care financing, economics, and information technology.

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TABLE OF CONTENTS

CHAPTER 1: INTRODUCTION .....
1.1 Background 1
1.2 Policy Context and the Rise of eSanjeevani 2
1.3 Statement of the Problem 2
1.4 Research Objectives 3
1.4.1 Primary Objective 3
1.4.2 Secondary Objectives 3
1.5 Research Questions 4
1.6 Significance of the Study 4
1.7 Scope and Delimitations 5
CHAPTER 2: REVIEW OF LITERATURE .....
2.1 Introduction 6
2.2 Conceptualising Telemedicine and Healthcare Access 6
2.3 Evolution of Telemedicine in India 7
2.4 Availability: Evidence on Service and Specialist Access 7
2.4.1 The Scale of Supply Created 7
2.4.2 Phased Expansion and the Two Models 8
2.4.3 Concentration by Clinical Domain 8
2.4.4 A Critical Caveat: Nominal versus Effective Availability 9
2.5 Affordability: Evidence on Cost and Financial Burden 9
2.5.1 The Structure of the Cost Problem 9
2.5.2 The Empirical Evidence and Its Direction 10
2.5.3 A Complicating Nuance 10
2.5.4 The Evidence Gap 10
2.6 Utilization: Patterns, Growth, and Equity 11
2.6.1 Aggregate Growth 11
2.6.2 Who Uses It: Demographics and the Digital Divide 11
2.6.3 The Demand Side: Awareness and Willingness 12
2.6.4 Geographic Concentration 12
2.7 Clinical Domains: Telemedicine and Chronic Disease 12
2.8 Barriers and Enablers 13
2.9 Research Gap 14
CHAPTER 3: METHODOLOGY .....
3.1 Research Design 15
3.2 Research Questions 15
3.3 Research Philosophy and Approach 16
3.4 Theoretical Framework 16
3.5 Component 1: Narrative Review of the Literature 17
3.5.1 Search Approach 17
3.5.2 Synthesis 17
3.6 Component 2: Descriptive Secondary Data Analysis 17
3.6.1 Datasets 17
3.6.2 Variables and Derived Indicators 18
3.6.3 Analysis Plan 18

3.6.4 Analytical Caution 19
3.7 Integration of the Two Components 19
3.8 Ethical Considerations 19
3.9 Limitations of the Methodology 20
CHAPTER 4: RESULTS .....
4.1 Availability 21
4.2 Affordability 22
4.3 Utilization 23
4.3.1 Aggregate Growth 23
4.3.2 State-Level Per-Capita Analysis 23
4.3.3 Delivery-Model Split 24
4.3.4 Utilization, Literacy, and the Digital Divide 25
4.3.5 Summary of Results 26
CHAPTER 5: DISCUSSION .....
5.1 Synthesis Across the Three Dimensions 27
5.2 Interpreting the Quantitative Findings 27
5.3 Barriers and Enablers 28
5.4 Comparison with Prior Literature 28
5.5 Implications for Policy and Health-System Management 29
5.6 Continuity of Care 29
CHAPTER 6: CONCLUSION .....
6.1 Summary of Findings 30
6.2 Recommendations 30
6.2.1 For Policymakers 30
6.2.2 For Health-System and Hospital Administrators 30
6.2.3 For Programme Designers 31
6.3 Contribution of the Study 31
6.4 Limitations 31
6.5 Directions for Future Research 31
References… 32

LIST OF ABBREVIATIONS

AAM	Ayushman Arogya Mandir (assisted hub-and-spoke model of eSanjeevani)
AB-HWC	Ayushman Bharat – Health and Wellness Centre
ABDM	Ayushman Bharat Digital Mission
ANM	Auxiliary Nurse Midwife
ASHA	Accredited Social Health Activist
CDAC	Centre for Development of Advanced Computing
CHC	Community Health Centre
COVID-19	Coronavirus Disease 2019
HWC	Health and Wellness Centre
ICT	Information and Communication Technologies
IIHMR	International Institute of Health Management Research
MoHFW	Ministry of Health and Family Welfare, Government of India
NCD	Non-Communicable Disease
NFHS	National Family Health Survey
NHM	National Health Mission
OOP/OOPE	Out-of-Pocket Expenditure
OPD	Out-Patient Department (eSanjeevani direct-to-patient model)
PHC	Primary Health Centre
PGDM	Post Graduate Diploma in Management
TETRA	Technology Enabled Remote Treatment and Assistance (Telangana project)
UTs	Union Territories
WHO	World Health Organization

Chapter 1: Introduction

1.1 Background

Access to quality healthcare remains one of the most persistent challenges facing rural India. Despite considerable progress in the country's healthcare infrastructure over recent decades, rural populations continue to experience severe disparities in the availability, affordability, and utilization of healthcare services. The World Health Organization reports that India's physician density remains low relative to need, with the overwhelming majority of doctors concentrated in urban centres, leaving rural communities structurally underserved (1). Independent reviews note that a large share of health workers and specialists practise in cities that account for only a minority of the population (2).

Rural India, home to roughly two-thirds of the national population, is characterised by geographical remoteness, uneven road connectivity, thin healthcare infrastructure, and a chronic shortage of specialist physicians. Patients in remote villages are frequently compelled to travel long distances to reach even basic consultations, incurring substantial costs in transport, lost wages, and time. These structural barriers are compounded by socioeconomic factors including poverty, low literacy, and limited awareness of available services. Critically, India finances a large share of healthcare through household out-of-pocket spending — among the highest proportions of any major emerging economy — which makes the indirect costs of travel and absence from work a decisive deterrent to seeking care (2).

Telemedicine — defined as the delivery of healthcare services through information and communication technologies (ICT) where patients and providers are separated by distance — has emerged as a potentially transformative response to these structural challenges (3). By enabling remote consultation via telephone or internet-based platforms, telemedicine can reduce the need for physical travel, widen access to specialist

expertise, and support more continuous and affordable care for underserved populations (4).

1.2 Policy Context and the Rise of eSanjeevani

India has invested substantially in telemedicine infrastructure over the past decade. The flagship national initiative, eSanjeevani, launched by the Ministry of Health and Family Welfare (MoHFW) in 2019, has grown into one of the largest government telemedicine programmes in the world. It operates through two complementary models: a hub-and-spoke model (eSanjeevani AB-HWC, later Ayushman Arogya Mandir) that links peripheral Health & Wellness Centres to specialists at district hubs, and a direct-to-patient model (eSanjeevani OPD) that connects patients to doctors from home (5). The Telemedicine Practice Guidelines issued in 2020 provided, for the first time, a formal regulatory framework legitimising the practice of telemedicine in India (6).

The COVID-19 pandemic served as a critical inflection point. With physical movement restricted and conventional services disrupted, patients and providers pivoted rapidly to teleconsultation. This period demonstrated both the potential of telemedicine to preserve continuity of care and the significant barriers that continue to limit its reach in rural settings, where internet connectivity and digital literacy remain low (7).

1.3 Statement of the Problem

While telemedicine has been widely promoted as a solution to rural healthcare access, empirical evidence on its actual impact across availability, affordability, and utilization remains fragmented and, in places, inconclusive. Individual studies examine specific facets of telemedicine adoption, but there is a shortage of synthesised analysis that evaluates effectiveness holistically across the three access dimensions for rural populations specifically (7).

Two features of the Indian context sharpen this gap. First, substantial disparities exist across states in telemedicine infrastructure, digital literacy, internet penetration, and the quality of programme implementation, making systematic comparative analysis essential. Second, recent scholarship questions whether headline consultation volumes translate into genuine, equitable access — reports of declining platform footfall and concerns about triage and tele-referral design suggest that growth in usage does not automatically equal improvement in access (8). Understanding which factors enable or constrain telemedicine's effectiveness is therefore critical for policymakers, hospital administrators, and public-health practitioners. This study addresses the gap through a structured analysis of secondary data.

1.4 Research Objectives

1.4.1 Primary Objective

To assess the impact of telemedicine on healthcare access — specifically availability, affordability, and utilization — in rural India through an analysis of secondary data.

1.4.2 Secondary Objectives

- To evaluate the extent to which telemedicine has improved the availability of healthcare services, particularly access to specialist consultations, in rural India.
- To assess the impact of telemedicine on the affordability of healthcare for rural patients, including reductions in out-of-pocket expenditure, travel costs, and wage losses.
- To analyse trends and patterns in telemedicine utilization across rural populations, disaggregated by state and demographic group where data permit.
- To identify the key barriers and enablers influencing the effectiveness of telemedicine adoption across rural populations in India.

1.5 Research Questions

- Has telemedicine measurably increased the availability of primary and specialist consultations for rural populations in India, and how does this vary by state?
- What is the evidence that telemedicine reduces the financial burden of care for rural patients, and how robust is that evidence?
- How has utilization of telemedicine evolved since 2019, and which demographic groups are over- or under-represented among users?
- What are the principal barriers and enablers shaping telemedicine's effectiveness in rural India?

1.6 Significance of the Study

This study contributes a structured synthesis of evidence on telemedicine's impact on rural healthcare access in India, addressing a recognised gap in the literature. By applying the Penchansky and Thomas (1981) framework (9), it offers a theoretically grounded analysis that can guide future research and policy. Its comparative, state-level analysis of official data generates actionable insight for hospital administrators, health policymakers, and programme managers seeking to scale telemedicine effectively, with direct relevance to resource allocation, digital-health infrastructure investment, and the design of community health programmes.

1.7 Scope and Delimitations

The study is confined to India, with emphasis on rural and semi-urban settings, and to literature and data published between January 2015 and March 2026 (seminal older works retained where foundational). It focuses on three of the five Penchansky and Thomas access dimensions — availability, affordability, and utilization — treating accessibility and acceptability as contextual factors. It is a secondary research study and does not

involve the collection of primary data; it synthesises and interprets existing evidence rather than generating new clinical or patient-reported outcomes.

Chapter 2: Review of Literature

2.1 Introduction

This chapter reviews the literature on telemedicine and healthcare access in rural India. It is organised thematically: it first situates telemedicine and the concept of access, then traces the evolution of telemedicine policy and infrastructure in India, before reviewing evidence on each of the three access dimensions central to this study — availability, affordability, and utilization. It then examines the clinical domains in which telemedicine has been studied, the documented barriers and enablers, and finally identifies the gaps this dissertation addresses. The review draws on peer-reviewed articles, government reports, and institutional publications retrieved through PubMed, Google Scholar, and the Cochrane Library, supplemented by official statistics.

2.2 Conceptualising Telemedicine and Healthcare Access

Telemedicine is best understood not as a single technology but as a spectrum of services that vary by modality (synchronous video, audio, or asynchronous store-and-forward), by the parties connected (provider-to-provider versus direct-to-patient), and by clinical purpose. Bashshur and colleagues propose a taxonomy organising telemedicine along the dimensions of functionality, application, and technology (3). This distinction matters here because India's eSanjeevani operates simultaneously as a provider-to-provider hub-and-spoke service and as a direct-to-patient outpatient service, and the two models bear differently on each access dimension (5).

Healthcare access is itself multidimensional. The most influential conceptualisation remains that of Penchansky and Thomas, who define access as the degree of fit between patients and the health system across five dimensions: availability, accessibility, affordability, acceptability, and accommodation (9). This framework is well suited to telemedicine because it captures both supply-side service provision and demand-side

patient experience, and because it makes explicit that improving one dimension does not guarantee improvement in another.

2.3 Evolution of Telemedicine in India

Telemedicine in India predates eSanjeevani by two decades. Early initiatives in the 2000s — including satellite telemedicine and hospital-led teleconsultation networks — established proof of concept and generated early, if methodologically limited, evidence of patient cost savings through avoided travel (4,10). However, much of this early growth took the form of feasibility studies and pilots rather than sustained, system-wide services (10).

The contemporary period is defined by three developments: the launch of eSanjeevani in 2019 as a publicly funded, nationally scaled platform; the 2020 Telemedicine Practice Guidelines, which supplied the regulatory legitimacy previously absent (6); and the COVID-19 pandemic, which accelerated both provider onboarding and patient willingness to consult remotely. An analysis of eSanjeevani adoption documents that the direct-to-patient OPD model expanded from 19 states and union territories in mid-2020 to near-universal coverage by 2023, with a sharp rise coinciding with the pandemic waves, while the hub-and-spoke model grew more gradually as it was integrated into primary care (5).

2.4 Availability: Evidence on Service and Specialist Access

2.4.1 The Scale of Supply Created

The clearest and most consistent evidence concerns availability. By providing remote access to doctors and specialists, telemedicine relaxes the binding constraint of physical provider scarcity in rural areas, where the great majority of specialists practise in urban centres that contain only a minority of the population (11,2). The scale of supply that eSanjeevani has created is, on the government's own figures, substantial: by early 2023

the platform reported having trained on the order of 229,000 specialists and super-specialists, established roughly 15,700 hubs and over 115,000 spokes, and built a capacity exceeding one million consultations per day (12), with provider onboarding reported above 230,000 by December 2024 (13). A recent implementation study describes eSanjeevani as the world's largest documented telemedicine deployment in primary healthcare, facilitating in the order of 0.4 to 0.45 million consultations on a typical day (14). In availability terms, this represents a genuine and measurable expansion of the consultation supply reaching rural India that did not previously exist.

2.4.2 Phased Expansion and the Two Models

Availability did not appear uniformly but was built in phases, and the two service models expanded along different trajectories. An analysis of eSanjeevani adoption documents that the direct-to-patient outpatient model was available in 19 states and union territories by mid-2020, reached 28 states and 7 union territories by early 2022, and achieved near-universal coverage by August 2023, with a sharp rise that coincided with the COVID-19 waves; the hub-and-spoke model, by contrast, grew more gradually and linearly as it was integrated into the primary-care system (5). This distinction matters for interpreting availability, because the direct-to-patient surge was pandemic-driven and concentrated in the period of movement restrictions, whereas the hub-and-spoke build-out represents a more durable structural addition to rural primary-care supply.

2.4.3 Concentration by Clinical Domain

Availability gains have not been spread evenly across all areas of medicine. A comprehensive review of telehealth in Indian primary care finds that Indian studies and services cluster around maternal and child health, mental health, diabetes, hypertension, and infectious disease, delivered chiefly through patient education, remote monitoring, and diagnostic support (7). This implies that, while telemedicine has broadened the

availability of certain services to rural populations, it has not uniformly substituted for the full range of in-person specialist care. A review of rural primary care nonetheless argues that telemedicine meaningfully bridges the consultation gap by extending services to isolated communities (15).

2.4.4 A Critical Caveat: Nominal versus Effective Availability

The critical literature cautions that headline availability should not be equated with effective access. Reports of declining platform footfall in some settings, together with weaknesses in triage and tele-referral design, can blunt the clinical usefulness of services that are nominally available (8). In the language of the access framework, a service can be available — present and reachable — yet poorly accommodated to how patients can actually use it. This tension is examined directly in the results chapter and is central to the discussion.

2.5 Affordability: Evidence on Cost and Financial Burden

2.5.1 The Structure of the Cost Problem

The affordability burden in rural India arises less from consultation fees than from the indirect costs of reaching care. Patients commonly travel long distances to district or city hospitals, incurring transport costs, lodging, the cost of an accompanying escort, and — often most significant for daily-wage households — lost income. Because rural patients' out-of-pocket expenditure is dominated by these indirect costs, any intervention that removes the journey should, in principle, reduce the financial burden of care (4). This logic is amplified by the structure of Indian health financing, in which households meet a large share of health costs out of pocket — a proportion frequently estimated at around 60% of total health spending, among the highest of comparable economies (2,16).

2.5.2 The Empirical Evidence and Its Direction

Empirical confirmation comes largely from small studies and provider perceptions rather than rigorous economic evaluation, but it is consistent in direction. A cross-sectional study of healthcare workers in rural Karnataka found that around two-thirds agreed telemedicine greatly reduced patients' travel costs while allowing a larger population to be covered (17). A knowledge-attitude-practice study at a rural tertiary hospital in central India reported comparable proportions of professionals endorsing savings in patients' travel time and expense (18). Early assessments of satellite telemedicine likewise reported significant patient savings on travel, stay, and treatment (4). The weight of evidence therefore points consistently in one direction: telemedicine reduces the costs of reaching care.

2.5.3 A Complicating Nuance

The patient-side picture is not entirely simple, however. A utilization study of the eSanjeevani outpatient service at a North Indian institution during the pandemic found that the dominant reason patients gave for choosing teleconsultation was avoidance of COVID-19 risk, cited by around 70% of respondents, while monetary benefit was named by only about 2% (19). This does not contradict the cost-saving logic, but it suggests that, at least during the pandemic, patients may not have consciously perceived affordability as their primary motivation — a reminder that measured savings and perceived savings are different things.

2.5.4 The Evidence Gap

Reviews are candid that cost-effectiveness research on Indian telemedicine is underdeveloped, constrained by small samples and inconsistent methods (7,20). Robust monetary estimates of the average saving per rural teleconsultation are largely absent. The affordability evidence assembled here should therefore be read as establishing a

credible and consistent direction of effect rather than a settled magnitude — a limitation this study treats as a finding in its own right and carries into the gap analysis.

2.6 Utilization: Patterns, Growth, and Equity

2.6.1 Aggregate Growth

Utilization is where the data are richest and the equity questions sharpest. Aggregate utilization has grown dramatically. eSanjeevani passed the 10-crore (100 million) cumulative milestone in early 2023 (12), and government statements subsequently reported far higher totals, with one ministerial statement citing 31.86 crore — about 318.6 million — teleconsultations by December 2024 (21). The platform now sustains several hundred thousand consultations on a typical day (8,14). This growth was not linear: the direct-to-patient outpatient model surged during the COVID-19 waves, while the hub-and-spoke model grew more steadily thereafter as it was embedded in primary care (5).

2.6.2 Who Uses It: Demographics and the Digital Divide

Headline demographics appear inclusive. Government figures report that women constitute a majority of eSanjeevani beneficiaries and that senior citizens make up a meaningful share (13). These figures must, however, be read against the rural digital divide rather than in isolation. National survey data indicate that rural men are roughly twice as likely as women to use the internet — on the order of 49% against 25% (22) — and survey estimates suggest that around half of rural women do not personally own a mobile phone (23). The gendered gap in device ownership and digital skills is repeatedly identified as a central equity concern for digital-health programmes (24). Because independent use of the direct-to-patient model presupposes a personal device, data connectivity, and the literacy to navigate an application, these divides translate directly into unequal independent access, even where aggregate beneficiary counts look balanced.

2.6.3 The Demand Side: Awareness and Willingness

A striking feature of the demand side is how little rural populations know about the service. A community-based cross-sectional study in a village in rural Karnataka found that awareness of the eSanjeevani outpatient service was only about 2%, and that none of the surveyed individuals had used the service in the preceding year; yet once the service was explained, around 56% expressed willingness to use it, and unfamiliarity was overwhelmingly the main reason for unwillingness among the rest (25). This gap between very low awareness and reasonably high latent willingness suggests that a substantial part of the utilization shortfall is a problem of outreach and trust rather than of outright rejection. Consistent with this, a hospital-based study reported that a large majority of patients who had tried teleconsultation during the pandemic intended to continue using it (19).

2.6.4 Geographic Concentration

Utilization is also geographically concentrated. Cumulative consultation volumes are heavily skewed towards a small number of states, reflecting differences in digital infrastructure, implementation capacity, and the administrative push behind the programme rather than population size alone (12). This concentration — and the question of what actually drives it — is examined quantitatively in the results chapter, where state consultation counts are normalised per capita and compared against literacy.

2.7 Clinical Domains: Telemedicine and Chronic Disease

A substantial strand of Indian evidence concerns non-communicable disease (NCD) management, which suits telemedicine's strength in remote monitoring and follow-up. The TETRA demonstration project in Telangana equipped non-physician health workers with tablets and point-of-care devices to screen households for hypertension and diabetes and connect patients to a physician remotely, achieving meaningful blood-pressure and

blood-sugar control over 24 months (26). A multi-centre cohort across rural primary health centres reported improved glycaemic control and fewer emergency visits among patients receiving virtual consultations relative to standard care (27), and a systematic review concluded that telemedicine — and teleconsultation in particular — significantly lowers HbA1c relative to standard care (28). Diagnostic applications have also been demonstrated, such as smartphone-based fundus photography for diabetic-retinopathy screening at the primary-care level (29). More recently, work has begun integrating clinical decision support into eSanjeevani to assist remote triage and diagnosis (14). Collectively these studies show that telemedicine's availability gains are most clearly translated into outcomes in chronic-disease care, though sample sizes and designs remain heterogeneous.

2.8 Barriers and Enablers

A growing review literature catalogues the determinants of telemedicine effectiveness in India. The barriers and facilitators are at three levels: at the individual level, limited digital and health literacy, limited device access, unreliable connectivity, and a sociocultural preference for in-person care constrain uptake, while family involvement, training, and community outreach facilitate it; at the provider level, inadequate training, concerns about care quality, and medico-legal uncertainty are barriers; and at the system level, integration with existing infrastructure and data security are challenges, while policy support and investment are facilitators (2). A multi-stakeholder systematic review reaches convergent conclusions, emphasising reliable connectivity, data privacy, and positive sociocultural attitudes as decisive facilitators (30), and a systematic review of developing-country settings proposes a comparable rural-adoption barrier framework (20).

Underlying many of these is the digital divide. Rural internet penetration is estimated at roughly a third of the population against around two-thirds in urban areas, and only a minority of rural users are considered digitally literate (31,32). Infrastructural and literacy

programmes aim to close these gaps, but evaluations note a persistent distance between connectivity provided and connectivity usefully experienced (23). The gendered dimension is pronounced, with women's lower device ownership and internet use repeatedly identified as an equity concern (24).

2.9 Research Gap

Three gaps emerge. First, the literature is fragmented across access dimensions and rarely synthesises availability, affordability, and utilization within a single coherent framework for rural India specifically. Second, affordability evidence is dominated by perception-based and small-sample studies, with rigorous cost-effectiveness analysis largely absent (7). Third, utilization data, though abundant in aggregate, are inconsistently disaggregated by rural-urban status, gender, age, and income, limiting equity analysis. This dissertation addresses the first gap through a framework-anchored synthesis, and the second and third by analysing official data directly and foregrounding the limitations of the evidence as priorities for future primary research.

Chapter 3: Methodology

3.1 Research Design

This study adopts a secondary research design with two components. The primary component is a descriptive and comparative analysis of publicly available quantitative datasets (the eSanjeevani platform, national health surveys, and official statistics). The supporting component is a narrative — or critical — review of the published literature, which establishes the context, the causal mechanisms, and the analytical framework against which the quantitative findings are interpreted. The study is non-experimental and retrospective, relying entirely on previously published, publicly available sources, and collects no primary data.

This design was chosen deliberately. A full systematic or scoping review with dual independent screening and a formal selection flow is difficult for a single researcher to execute to standard within an internship timeframe, and claiming such a method while delivering a partial version would overstate the rigour achieved. A narrative critical review is an accepted method for synthesising a heterogeneous evidence base for context (33), and it carries no expectation of formal screening machinery. The methodological rigour and original contribution of this dissertation rest on the quantitative component — the systematic re-analysis of official datasets, including normalising state consultation counts per capita and comparing them against digital-infrastructure indicators — which is reproducible and generated entirely by the researcher.

3.2 Research Questions

The study is guided by the four research questions stated in Section 1.5, concerning (i) availability and its state-level variation, (ii) the evidence and robustness of affordability gains, (iii) the evolution and demographic distribution of utilization, and (iv) the barriers and enablers shaping effectiveness.

3.3 Research Philosophy and Approach

The study is situated within a pragmatist research philosophy, prioritising the research question over allegiance to a single paradigm and drawing on both quantitative (utilization, expenditure, and connectivity statistics) and qualitative (thematic findings from primary studies) evidence. The reasoning approach is predominantly inductive, with the Penchansky and Thomas framework (9) providing a deductive scaffold for organising the evidence.

3.4 Theoretical Framework

The study is anchored in the Penchansky and Thomas (1981) framework of healthcare access (9), focusing on availability, affordability, and utilization (the last treated as an observable expression of accommodation and acceptability). Accessibility and acceptability are treated as contextual factors. Table 3.1 maps each dimension to its operational meaning and indicators.

Table 3.1: Operationalisation of the access dimensions

Dimension	Definition	Indicators used
Availability	Supply of providers/services relative to need	Teleconsultation growth; provider onboarding; specialist and clinical-domain access; state spread
Affordability	Financial cost of obtaining care	Out-of-pocket expenditure; travel/wage savings; provider-reported cost effects
Utilization	Actual use of services by the population	eSanjeevani volumes and trends; per-capita rates; demographic and state patterns; delivery-model split
Acceptability	Patient attitudes toward remote providers	Sociocultural preference for in-person care (barrier)
Accessibility	Physical/geographical reach	Internet penetration; device ownership (proxies)

3.5 Component 1: Narrative Review of the Literature

3.5.1 Search Approach

Sources were identified through purposive searching for relevant, good-quality literature using combinations of the terms telemedicine, teleconsultation, telehealth, eSanjeevani, rural, India, healthcare access, availability, affordability, out-of-pocket, and utilization, combined with Boolean operators. Reference lists of key reviews were hand-searched. The search was restricted to English-language publications from January 2015 to March 2026, with seminal older works retained where foundational. As a narrative review, sources were selected for relevance and quality rather than through formal record-by-record screening, and no PRISMA flow diagram is reported. Appendix A documents the search approach.

3.5.2 Synthesis

Synthesis is thematic and critical: material from each source is organised under the three access dimensions of Table 3.1, compared and contrasted within each dimension to identify convergent findings, divergent findings, and gaps, and integrated into a narrative argument. A source-summary template (Appendix B) keeps the synthesis traceable to source. Where sources conflict, the disagreement is examined rather than averaged away.

3.6 Component 2: Descriptive Secondary Data Analysis (Primary Method)

3.6.1 Datasets

The quantitative component analyses the named public datasets in Table 3.2. Each was retrieved from its official source, dated, and cited at the point of use.

Table 3.2: Secondary datasets analysed

Dataset	Custodian	Variables drawn
eSanjeevani dashboard / milestone reports	MoHFW / CDAC	State-wise teleconsultations; AB-HWC vs OPD split; provider, hub, spoke counts; beneficiary demographics
NFHS-5 (2019-21)	IIPS / MoHFW	Internet use by sex and residence; schooling; rural health-access indicators
National Health Accounts	NHSRC	Out-of-pocket expenditure share
NSS 75th round	NSO / MoSPI	Household health expenditure; treatment-seeking patterns
Internet penetration data	TRAI / IAMAI	Rural vs urban internet penetration
Population estimates	Census of India 2011	Denominator for per-capita normalisation

3.6.2 Variables and Derived Indicators

From the raw figures the analysis derives: cumulative and annual teleconsultation totals; teleconsultations per 1,000 population by state (raw counts normalised by Census 2011 state population), to correct for the distortion introduced by raw totals; the share of consultations using each delivery model; and the female and senior-citizen share of beneficiaries, set against NFHS-5 internet-use ratios as an equity check.

3.6.3 Analysis Plan

- Descriptive statistics — totals, proportions, and growth rates for teleconsultations, infrastructure counts, out-of-pocket share, and internet penetration.
- Normalisation — conversion of raw state consultation counts to per-capita rates, so adoption is compared fairly rather than by population size.
- Comparative analysis — ranking and grouping of states (leading vs lagging) on per-capita utilization, tabulated against literacy and internet-penetration indicators.

- Association (exploratory) — Spearman's rank and Pearson correlation between state per-capita utilization and literacy. This is descriptive only; with roughly 28-36 state/UT observations and aggregate (ecological) data, no causal inference is drawn.
- Trend analysis — characterising the COVID-19 surge and subsequent trajectory from milestone data.

The analysis was conducted in a spreadsheet (one row per state) and is provided in full in Appendix D and the accompanying workbook.

3.6.4 Analytical Caution

Three cautions govern the quantitative component. First, all associations are ecological (state-level) and cannot be attributed to individuals. Second, eSanjeevani totals are not disaggregated cleanly by rural-urban status, so consultation counts are treated as a whole-state proxy for rural reach. Third, figures are time-stamped and sourced individually, because cumulative totals reported by different bodies and on different dates do not always agree.

3.7 Integration of the Two Components

The components are integrated through triangulation, with the quantitative analysis as the primary evidentiary basis. The narrative review establishes how and why telemedicine affects each access dimension and what barriers operate; the data analysis tests whether the published numbers are consistent with that account and quantifies the state and demographic variation. Convergence strengthens a finding; divergence is reported and interpreted.

3.8 Ethical Considerations

As a secondary study using only publicly available, aggregated, and anonymised data, this dissertation does not involve human participants and does not require ethics-committee approval for primary data collection. The study observes research integrity throughout: all sources are cited in the Vancouver style, figures are reported faithfully with their dates and provenance, no data are selectively omitted, and the limitations of the evidence base are disclosed transparently. Plagiarism is avoided through paraphrasing and full citation of all sources used.

3.9 Limitations of the Methodology

- As secondary research, the study depends on the quality, availability, and consistency of existing data.
- eSanjeevani and survey data are not uniformly disaggregated by rural-urban status, gender, and income, restricting equity analysis.
- Quantitative associations are ecological and descriptive; no causal claims are made.
- Publication bias may over-represent positive outcomes; some figures will date quickly in a fast-moving policy environment.

Chapter 4: Results

This chapter presents the results across the three access dimensions. Availability and the literature-derived findings are reported first; the original quantitative analysis of eSanjeevani and survey data is concentrated in the utilization section, where the data are richest.

4.1 Availability

eSanjeevani has produced a large, measurable increase in teleconsultation capacity reaching rural areas. Government reporting documents more than 230,000 providers onboarded by December 2024 (13), and milestone reporting recorded a dense network of hubs and spokes alongside a daily consultation capacity exceeding one million (12). The direct-to-patient model expanded rapidly during the pandemic, while the hub-and-spoke model grew more steadily as a durable structural addition to primary-care supply (5).

Table 4.1: Indicative eSanjeevani availability infrastructure (verify/update from dashboard)

Indicator	Reported figure	As of	Source
Providers onboarded	~ 2,30,742	Dec 2024	Invest India (ref. in text)
Specialists/super-specialists trained	~ 2,29,057	Feb 2023	MoHFW/PIB
Hubs	~ 15,731	Feb 2023	MoHFW/PIB
Spokes (HWCs/AAMs)	~ 1,15,234	Feb 2023	MoHFW/PIB
Peak daily capacity	> 10,00,000/day	2023	MoHFW/PIB

Availability gains are concentrated in particular clinical domains — maternal and child health, mental health, and the non-communicable diseases — rather than uniformly across all specialties (7). Chronic-disease applications are the best evidenced: remote screening and follow-up for hypertension and diabetes (26,27), teleconsultation lowering HbA1c

relative to standard care (28), and smartphone-based retinopathy screening at primary-care level (29). A critical perspective notes that nominal availability does not guarantee effective access where triage and tele-referral are weak (8).

4.2 Affordability

The dominant cost of rural care is indirect — travel, wage loss, lodging, escorts — which telemedicine directly targets (4). India's high out-of-pocket share amplifies the potential saving (16,2). Available studies are directionally consistent: a majority of rural healthcare workers in Karnataka reported that telemedicine greatly reduced travel costs (17), and a central-India study reported comparable perceived savings in travel time and cost (18).

Table 4.2: Reported affordability effects of telemedicine

Source	Setting	Finding	Evidence type
Rural Karnataka HCW survey	PHCs, Karnataka	Majority: telemedicine greatly reduced travel costs	Cross-sectional (perception)
Central India KAP study	Rural tertiary hospital	Majority endorsed travel time/cost savings	KAP survey (perception)
Early satellite telemedicine	Multi-site	Significant patient savings on travel, stay, treatment	Early assessment

However, robust monetary estimates of per-consultation savings are scarce; where figures exist they derive from small samples or are reported as perceptions rather than validated cost differentials. Reviews explicitly identify the underdevelopment of cost-effectiveness research as a major gap (7,20). The affordability result is therefore best read as a credible, consistent direction of effect rather than a settled magnitude. The absence of rigorous cost data is itself a finding and informs the gap analysis.

4.3 Utilization

4.3.1 Aggregate Growth

Utilization has grown steeply since 2019. eSanjeevani passed 100 million cumulative consultations by February 2023 (12), with a ministerial statement citing about 318.6 million by December 2024 (21), sustaining several hundred thousand consultations per day (8). The growth was not linear: the direct-to-patient OPD model surged during the COVID-19 waves, with the hub-and-spoke model growing more steadily thereafter (5).

4.3.2 State-Level Per-Capita Analysis

Raw consultation totals partly track population, so totals were normalised per 1,000 population using Census 2011 figures (34) (full dataset in Appendix D). Utilization is not merely concentrated but extremely unequal: across the 36 states and union territories, mean utilization was approximately 60 consultations per 1,000 population, the median only around 28, and the standard deviation about 111 — nearly double the mean. Andhra Pradesh is a pronounced outlier at roughly 642 per 1,000, followed at a distance by Karnataka (about 185), Tamil Nadu (about 172), West Bengal (about 135), and Telangana (about 130); several states and union territories recorded fewer than one per 1,000.

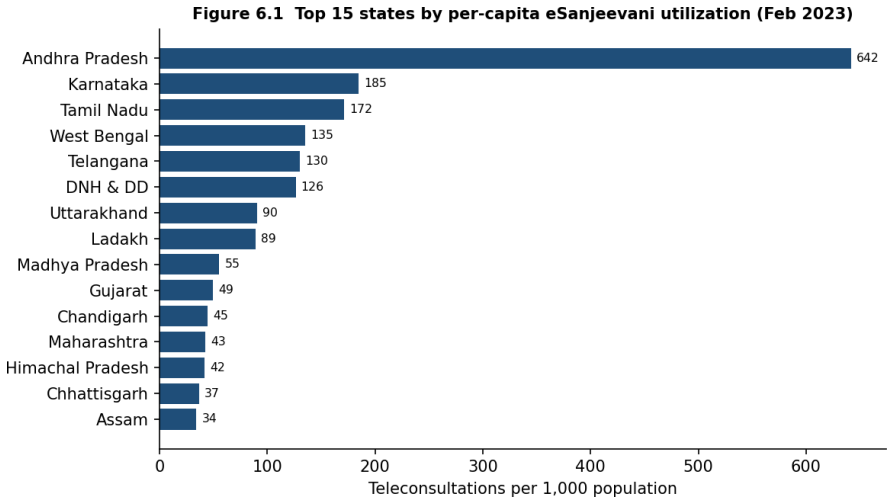


Figure 4.1: Top 15 states/UTs by eSanjeevani consultations per 1,000 population. Source: author's analysis of MoHFW (2023) and Census 2011.

This normalised view changes the interpretation: Uttar Pradesh ranks high on raw totals but falls once its large population is accounted for, while Andhra Pradesh's dominance becomes starker. A standard deviation close to twice the mean indicates that utilization is driven by intensive implementation in particular states rather than uniform national rollout.

4.3.3 Delivery-Model Split

A central result concerns how consultations are delivered. Nationally, the assisted hub-and-spoke model — in which a health worker mediates the consultation at a Health & Wellness Centre — accounted for approximately 90% of all consultations, while the direct-to-patient model accounted for only about 10% (author's analysis of MoHFW (2023) data).

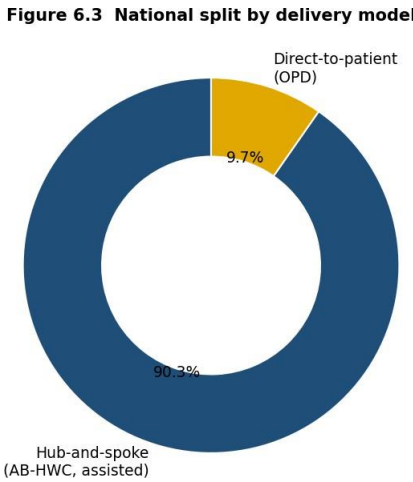


Figure 4.2: National split of eSanjeevani consultations by delivery model. Source: author's analysis of MoHFW (2023) data, as of 16 Feb 2023.

This split is decisive for equity. Because nine in ten consultations are mediated rather than independent, the encouraging headline demographics — a reported female majority and a meaningful senior-citizen share (13) — most plausibly reflect assisted access at spokes rather than evidence that women, the elderly, and the digitally illiterate are independently overcoming the device-and-literacy barrier. This reconciles the apparent

tension between inclusive beneficiary figures and a severe digital divide: the two coexist because the dominant mode of access does not require the patient to own a device or navigate an app.

4.3.4 Utilization, Literacy, and the Digital Divide

If utilization were primarily gated by digital readiness, higher-literacy states would show higher per-capita utilization. The data do not support this. The correlation between state per-capita utilization and Census 2011 literacy is weak and negative (Spearman's rank correlation approximately -0.29; Pearson approximately -0.26). Kerala, the most literate state, records very low per-capita utilization, whereas Andhra Pradesh, with mid-range literacy, dominates.

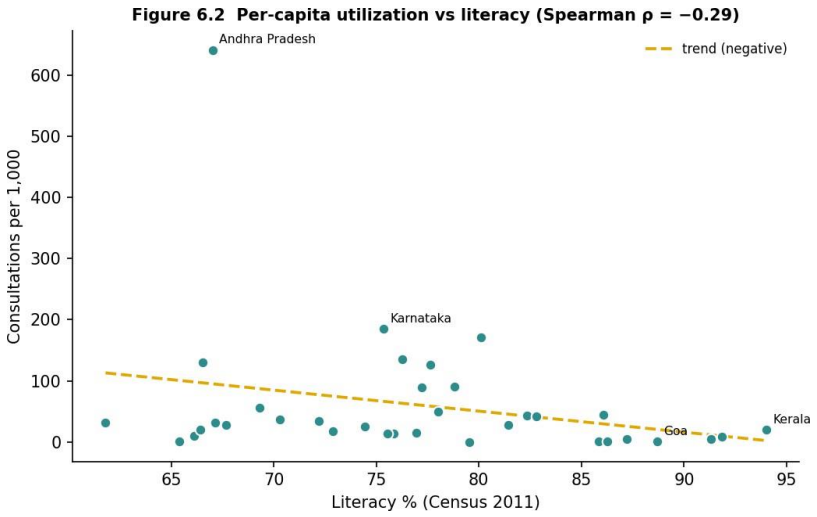


Figure 4.3: State per-capita utilization against literacy. The negative trend indicates that literacy does not explain adoption. Source: author's analysis.

The most coherent interpretation is that, given the predominance of the assisted model, the binding determinant of utilization is the intensity of a state's hub-and-spoke rollout rather than population-level digital literacy. This qualifies the common expectation that adoption is driven chiefly by internet infrastructure. The digital divide remains real — rural internet penetration is roughly 31% against about 67% urban, with only around a quarter of rural users digitally literate (31) — but its main effect is on the independent

direct-to-patient channel and on who can use telemedicine unassisted. A demand-side study reinforces this: awareness of eSanjeevani OPD in a rural Karnataka village was only about 2%, with unfamiliarity the dominant reason for non-use (25).

4.3.5 Summary of Results

- Availability has increased substantially through both delivery models, concentrated in particular clinical domains and states.
- Affordability gains are consistent in direction but lack rigorous monetary evidence.
- Per-capita utilization is extremely unequal across states; about 90% of use is assisted hub-and-spoke; and utilization correlates negatively with literacy, indicating implementation intensity, not digital readiness, as the dominant driver.

Chapter 5: Discussion

5.1 Synthesis Across the Three Dimensions

Telemedicine in rural India has succeeded most clearly on availability, plausibly but unevenly on affordability, and substantially but inequitably on utilization. The strength of the evidence declines in the same order — availability is supported by hard infrastructural and volume data, affordability rests largely on perception, and utilization is well documented in aggregate but poorly disaggregated for equity. The dimensions are not independent: high availability is necessary but insufficient for utilization, and utilization is gated by the same digital-divide factors that also limit the affordability benefit reaching the poorest patients. In framework terms (9), gains in availability have outpaced gains in accommodation and acceptability, producing a system that is increasingly present but not yet uniformly usable.

Table 5.1: Summary assessment of telemedicine impact by access dimension

Dimension	Direction	Strength of evidence	Principal caveat
Availability	Strong positive	High (volume + infrastructure)	Concentrated by domain and state; nominal ≠ effective access
Affordability	Positive (direction)	Low-moderate (perception)	No robust cost-effectiveness estimates
Utilization	Strong growth, uneven	Moderate (aggregate strong)	Gender, age, literacy, and state inequities

5.2 Interpreting the Quantitative Findings

The two most novel results — the ~90% share of assisted hub-and-spoke consultations and the negative literacy correlation — together reframe the policy problem. They imply that eSanjeevani's reach into rural India has been achieved largely by placing a mediating health worker between the patient and the technology, not by patients independently

adopting digital tools. This is consistent with the demand-side evidence of very low awareness and the gendered device gap (25,24), and with the chronic-disease literature, where the best outcomes come from worker-mediated models such as TETRA (26). It also explains why the highest-literacy state need not be the highest-adoption state: adoption follows administrative push, not digital readiness.

5.3 Barriers and Enablers

The synthesis identifies a multi-level barrier structure consistent with the review literature (2,30,20). At the individual level: limited digital and health literacy, low device ownership (especially among rural women), unreliable connectivity, and a preference for in-person care. At the provider level: training gaps, concerns about diagnostic quality, and medico-legal uncertainty. At the system level: integration, data security, and funding durability. Cutting across all three is the digital divide, which simultaneously limits independent utilization and concentrates affordability benefits away from those who need them most. Enablers mirror these: frontline-worker mediation, training, clear guidelines, and connectivity investment.

5.4 Comparison with Prior Literature

These findings both confirm and qualify the prevailing narrative. They confirm that telemedicine has materially expanded rural access, consistent with the optimistic literature (15). They qualify it by aligning with the critical view that consultation volume is not the same as equitable, effective access (8), and with reviews that stress the thinness of cost-effectiveness evidence (7). The contribution here is to hold these strands together within a single framework and to show, with data, that the apparent inclusivity of eSanjeevani rests on assisted access.

5.5 Implications for Policy and Health-System Management

For programme managers, the priority shifts from expanding nominal availability to strengthening the spoke layer — frontline-worker capacity, connectivity quality, and patient facilitation — where equity gains are largest. For policymakers, closing the rural and gender digital divide is central, not peripheral, to telemedicine policy. For hospital administrators, integrating teleconsultation into referral and follow-up pathways is necessary to convert availability into continuity of care. For all actors, the absence of rigorous affordability evidence argues for embedding cost-effectiveness measurement into programme design rather than inferring savings.

- Prioritise the assisted hub-and-spoke (AAM) layer for equity, since mediated consultations reach those excluded by the device/literacy barrier.
- Target the gender digital divide through women-focused device access and literacy.
- Invest in connectivity quality, not just coverage.
- Embed routine cost and outcome measurement to replace inferred savings with evidence.

5.6 Continuity of Care

Continuity is best evidenced in chronic-disease management, where remote monitoring and scheduled follow-up improved control of hypertension and diabetes over extended periods (26,27,28). This suggests telemedicine's continuity benefit is real but, to date, concentrated in NCD programmes rather than demonstrated across the full range of rural care — itself a direction for further work.

Chapter 6: Conclusion

6.1 Summary of Findings

This dissertation assessed the impact of telemedicine on healthcare access in rural India across availability, affordability, and utilization, through a secondary analysis of official data supported by a narrative review and anchored in the Penchansky and Thomas framework (9). Telemedicine, principally through eSanjeevani, has produced a large and well-documented increase in the availability of consultations and specialist reach. It has plausibly reduced the financial burden of care by displacing travel and wage-loss costs, though on methodologically limited evidence. Utilization has grown dramatically since 2019 but remains unequal across gender, age, literacy, and state lines. Across all three dimensions, the binding constraint has shifted from the supply of telemedicine capacity to the usability of that capacity for the populations it was designed to serve.

- idelines, and infrastructure investment.

6.2 Recommendations

6.3.1 For Policymakers

- Treat closing the rural — and gender — digital divide as core telemedicine policy.
- Mandate disaggregated reporting (rural-urban, gender, age, disease category) to enable equity monitoring.

6.3.2 For Health-System and Hospital Administrators

- Strengthen the spoke/AAM layer as the most equitable route to effective access.
- Integrate teleconsultation into referral and follow-up pathways to build continuity of care.

6.3.3 For Programme Designers

- Embed routine cost, utilization, and outcome measurement so affordability and effectiveness are evidenced, not inferred.
- Design for assisted use where independent use is constrained.

6.3 Contribution of the Study

The study integrates availability, affordability, and utilization evidence for rural India within a single framework, distinguishes the differing certainty of evidence across dimensions, and — through original data analysis — reframes the policy problem from expanding capacity to closing the usability gap, showing that eSanjeevani's apparent inclusivity rests on assisted access.

6.4 Limitations

As a secondary study, the dissertation is bounded by the quality and consistency of existing data; disaggregated utilization data are uneven, affordability evidence is thin, the literature component was not systematically screened, quantitative associations are ecological.

6.5 Directions for Future Research

- Rigorous cost-effectiveness studies of rural teleconsultation quantifying per-consultation savings and downstream outcomes.
- Equity-focused utilization studies disaggregated by gender, age, literacy, and income, distinguishing independent from assisted use.
- Evaluation of continuity of care and chronic-disease outcomes beyond first-contact consultations.
- Comparative state case studies linking implementation models to access outcomes.

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3	www.womensrefugeecommission.org Internet Source	
4	Submitted to Australian National University Student Paper	
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11	Kamyar Vaziri, Darius M. Moshfeghi, Andrew A. Moshfeghi. "Feasibility of Telemedicine Detecting Diabetic Retinopathy and Age-Related Macular Degeneration", Seminars in Ophthalmology, 2013 Publication	

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