

The Widening Scope of Telemedicine in India: Delving into Its Economic Aspects and Haptic Technology

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Abstract: The COVID-19 pandemic has affected our nation and economy gravely, which has led to exploiting ways of setting norms for the effective distribution of healthcare advancements beyond geographical boundaries. In this paper, we propose an approach for the rapid advancement and effective distribution of healthcare in India through the enormous potential in telemedicine and haptic technology. We further address the issues in India's current healthcare infrastructure occurring due to non-availability and vacancy of doctors, social development, such as the willingness of people to invest in telemedicine by statistically analyzing bar diagrams, tabulated data, and self-assembled visual graphics. Our study shows that the potential of technology-aided approaches such as telemedicine and haptic systems in healthcare is enormous, and through effective dissemination of awareness, training, and stakeholder involvement, telemedicine and haptics could change the norms in the advancement in the healthcare system of India

KEYWORDS: Telemedicine, haptic technology, rural healthcare, infrastructure development, capacity building, marketing opportunities.



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INTRODUCTION

Health is not just the absence of malady. Individuals can create a possible future during their whole lives. In that sense, health is an advantage people have, which has its inherent worth as instrumental worth: insignificant terms, health impacts mental development, and financial growth. For instance, it decreases generations of misfortunes because of some ignorant disease. It expands adults' profitability to enhance and ensure better performance and work output because of better nourishment. Therefore, because of this reason, the accessibility of health care services becomes a thing of utmost importance but the data points toward the contrary. According to National Health Profile-2019 (NHP-2019), India spends 1.28% of the GDP (2017-18 Budget Estimate) which is quite a low value. According to the Census of India 2011, conducted by government officials, the population's rural-urban distribution is at 68.84% and 31.16%. The problem lies in the fact that the vast majority of healthcare providers in the villages – 68 percent – lack formal medical education, while only 24 percent are trained AYUSH (Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homeopathy) practitioners, and only 8% have an MBBS degree, according to a study led by researchers at the Delhi-based Centre for Policy Research, Georgetown University, and the University of California-San Diego covering 1,519 villages in India's 19 most populous states. This shows that much disparity prevails in the accessibility of health services in the rural areas. Adding to it, unprecedented situations like the COVID-19 pandemic make this disparity more huge. As a result, people would be more reluctant to step out of their houses for in-person health consultations, hence lowering their accessibility to healthcare facilities.

The defined outline of the study is to discuss why there is a need to adopt telemedicine on a large scale backed up by haptic technology as an efficient approach to remedy the shortage of workforce, technology and also increase the equality of the distribution of the services in terms of healthcare in India.

Here, telemedicine refers to the use of information and telecommunications technology to provide health care services to those who do not have adequate access to quality health care facilities. Whereas, Haptics refers to sensing and operating through touch, enabling the

user to touch and feel the optimized virtual reality (VR) or an existing distant object, easing the medical procedures that require in-person interactions with a doctor.

STRUCTURE OF PAPER

The structure of the paper is presented in four sub-sections.

2.1 Telemedicine as a concept

'Telemedicine- A boon' by Pai and Jain (2020) described telemedicine incorporated with haptic technology to be the form of distant and remote diagnosis ensuring treatment of patients through telecommunications technology, thereby providing substantial healthcare to low-income regions mainly focusing on infrastructure and capacity development in the rural areas.

2.2 Abstract development of telemedicine in India

Ministry of Social Justice and Employment (MSJE) assigned 'National Telemedicine Task Force' 2005 that paved the way for the success of various projects like the Indian Council of Medical Research ICMR-Aarogyasri, internet based mobile telemedicine conglomerate.

The Ministry of Health and Family Welfare, 'Rural Statistics Report' (2019) published that telemedicine could contribute to fast-paced growth in rural health infrastructure.

2.3 Conceptual framework around telemedicine and haptic technology

National Institutes of Health (NIH) published 'Experiencing Growth' (2019) which says that there has only been a rough framework proposal in theory and as of no formal framework in our country about Telemedicine in India.

In the coming years, infrastructure development, production capacity are subject to technological advancement. It is only by privatising Pharma & Health infrastructure patent, which has been proposed by the WTO as of February 2021, could bring about developments in this field of study.

2.4 Uses of telemedicine in India

The Ministry of Health and Family Welfare published 'Rural Statistics Report' (2019) which evaluated different types of telemedicine services like store and forward, real-time and remote or self-monitoring which provides various educational, healthcare delivery and management, disease screening and disaster

management services all over the globe. It further proposes that telemedicine can help decrease the burden of the healthcare system to a large extent. Untied grant of ₹25,000 per PHC for local health action, annual maintenance grant of ₹50,000 per PHC and ₹100,000 to Rogi Kalyan Samiti (RKS) to undertake and supervise improvement and maintenance of physical infrastructure is provided.

OBJECTIVES

The COVID-19 pandemic has affected our nation and economy gravely, which has led to exploring ways of setting norms for the effective distribution of healthcare advancements beyond geographical boundaries.

In this paper, I propose an approach for the rapid advancement and effective distribution of healthcare in India through the enormous potential in telemedicine and haptic technology. We further address the issues in India's current healthcare infrastructure occurring due to non-availability and vacancy of doctors, social development, such as the willingness of people to invest in telemedicine by statistically analyzing bar diagrams, tabulated data, and self-assembled visual graphics.

The study shows that the potential of technology-aided approaches such as telemedicine and haptic systems in healthcare is enormous, and through effective dissemination of awareness, training, and stakeholder involvement, telemedicine and haptics could change the norms in the advancement in the healthcare system of India

THE PRESENT SCENARIO

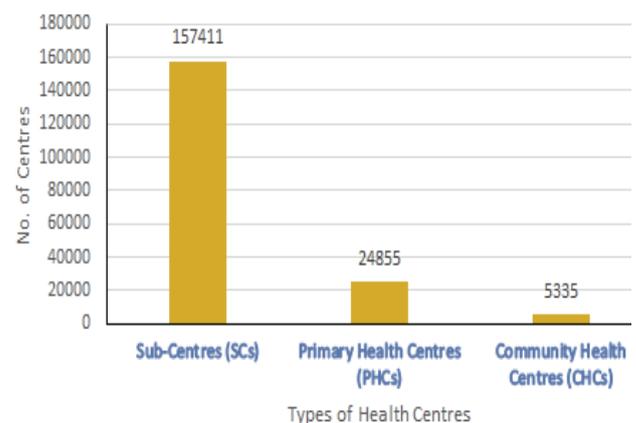
With a rise in people falling sick nowadays and the growing disease burden, the demand for healthcare services is expected to increase manifold. The recent outbreak of COVID-19 and the consequent lockdown following it, left most medical practitioners with no option but to rely on telemedicine as doctors and patients both became reluctant to participate in physical consultations. This implies that the telemedicine sector needs to be strengthened to be equipped to combat such situations. Furthermore, the geographical constraints and inadequate public transportation facilities have been a curse for rural India, even in pre-COVID times. According to the National Transport Policy Committee (NTPC), Fair Weather Roads (AWR) connected only 55% of the villages in India. Thus, it is high time that we

redefine healthcare and strengthen it, especially in the rural areas, as an interdisciplinary team.

STATUS OF INFRASTRUCTURE IN RURAL AREAS

Health centres play an integral part in providing health facilities in rural India. The healthcare infrastructure in rural areas has been developed as a three-tier system. First comes the Sub-Centre, which is the grass-root level of the primary health care system in India. Next is the Primary Health Centre, the basic structural and functional unit of the public health services in developing countries, to provide accessible, affordable, and available primary health care to people. The third is the Community Health Centre which constitutes the secondary level of health care and is designed to provide referral and specialist health care to the rural population. As per the Rural Health Statistics (2019), the status of public health facilities function in the country is 1,57,411 Sub Centres (SCs), 24,855 Primary Health Centres (PHCs) and 5,335 Community Health Centres (CHCs). This is shown in Figure 1.

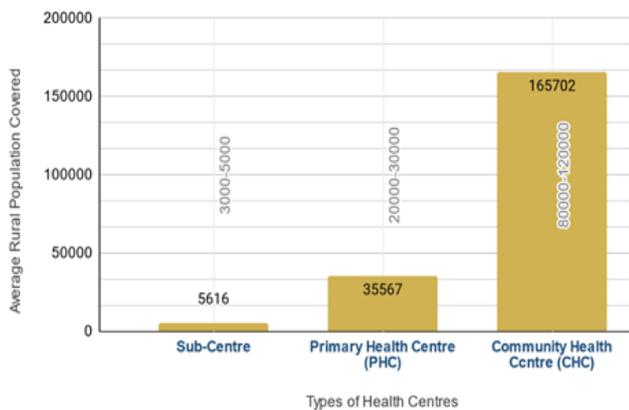
Figure 1: No. of health centres in rural India



Source: Rural Health Statistics 2018-19

Now, for every healthcare centre, there is a prescribed norm of the population that it should cover. It's observed that all the centres cover more than the standard population (norm) they should cover. In other words, the average population covered per centre is more than the norm set by the government as shown in Figure 2.

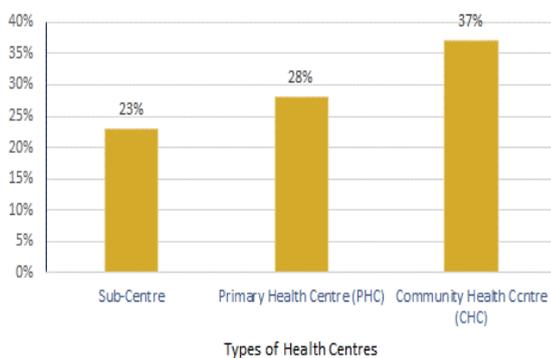
Figure 2: Average rural population covered by health centres



Source: Rural Health Statistics 2018-19

Sub-centers cover about 5616 of the population on average, which is more than the required norm of 3000-5000. Primary health centres cover 35,567, more than the required number of 20,000-30,000. And the average population covered by Community Health Centres is 1,65,702, more than the necessary norm of 80,000-1,20,000. This implies nothing but the fact that infrastructure facilities are not at par with the requirement. Also, it is observed that there is a shortfall of 43,736 SCs (23%), 8,764 PHCs (28%) and 2,865 CHCs (37%) across the country as per the Rural Health Statistics (RHS) 2019 as shown in Figure 3. The figures also explain why the rural population covered under the different types of health centres in rural areas exceeds the set population norms.

Figure 3: Shortfall in health centres



Source: Rural Health Statistics 2018-19

3.1.2 Current status of doctors in rural India

i) Doctors reluctant to work in rural areas

According to the Rural Health Statistics a report published by the Ministry of Health and Family Welfare (2018), ‘reluctance of the doctors to contribute in the rural spaces can be attributed to the professional

environment with issues like deficiency in housing conditions, infrastructure, shortage of clinical equipment and drugs, etc’. Also, Poor living and working conditions, irregular drug supply, weak infrastructure, professional isolation and the burden of administrative work--these are some of the challenges faced by doctors on rural postings, stated a 2017 study by the Public Health Foundation of India.

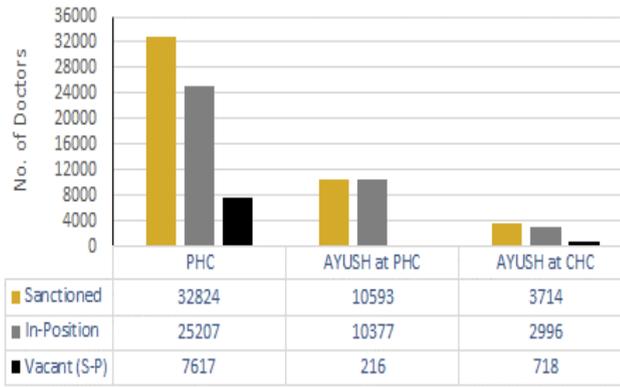
According to the National Center for Biotechnology Information (NCBI), report on ‘General Practitioners perceptions’ (2019) “The doctors also feel that the financial advantages for a posting in rural areas are not quite apt to carry out household responsibilities”.

Established under National Rural Health Mission (NRHM), by the Government of India (2015), AYUSH systems of medicine, an acronym for Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homeopathy is a taskforce commission to provide health care delivery. We base our study of the calculation of doctors on the figures of AYUSH doctors present in PHCs and CHCs. According to the National Center for Biotechnology Information (NCBI), ‘Allopathic, AYUSH and informal medical practitioners in rural India – a prescription for change,’ over time, these AYUSH doctors began to be utilized as assistants to the medical officer in charge of PHCs. Later, they began to be posted as the sole in-charge of remotely located PHCs where modern medicine doctors refused to go. Hence, ensuring a good number of AYUSH doctors bridges the gap between rural people accessing healthcare facilities. We also take the parameter ‘total doctors’ at PHCs’.

This is because PHCs are the first point of contact to keep people well and improve their quality of life. A robust and accessible PHC system reduces pressure on hospitals by supporting people to manage their health issues in society.

Figure 4 depicts the number of doctors in rural areas. From the graph, it is observed that there exist vacant positions for doctors in Primary health centres, AYUSH doctors at Primary Health centres and AYUSH doctors at Community health centres. The maximum vacancy is for PHCs with the unavailability of 7617 doctors and the minimum is for AYUSH at CHCs with the unavailability of 718 doctors.

Figure 4: Number of doctors in rural areas



Source: Rural Health Statistics 2018-19

Note: Sanctioned (S): No. Of doctor positions opened officially by the government;

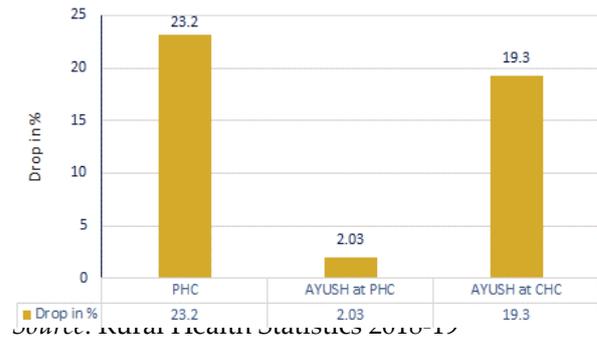
In-Position (P): No. Of doctors actually in the position;

Vacant (P-S): No. Of doctors not available

ii) Vacancy of doctors

According to Rural Health Statistics (2018), the vacancy of positions of doctors in primary health care centres stands at 23.2 per cent, AYUSH doctors at primary health centres at 2.03 per cent and AYUSH at Community health centres at 19.3%. This is depicted in Figure 5.

Figure 5: Vacancy of doctors



3.1.3 Problems in urban areas due to COVID-19

Ever since the outbreak of the COVID-19, people have been very conscious about leaving their houses, let alone human touch. Death rates tend to be higher due to complex factors, including population density, national and international connectivity, and public health responses. Hence, there was a high requirement even in the urban areas to facilitate in-person health consultations from sitting at home only.

3.2 Telemedicine as a viable approach

One of the possible effective ways to solve the problems mentioned above in rural and urban areas in India could be by expanding the concept of telemedicine which would ease the distribution of healthcare facilities so that the facilities may be accessible to everyone from anywhere.

Table 1 shows the SWOT Analysis of Telemedicine-

Table 1: SWOT Analysis

STRENGTH	WEAKNESS	OPPORTUNITIES	THREATS
Improved access to healthcare by overcoming physical barriers.	Uncertainty regarding the failures, risks, and involved in the entire procedure.	Acceptance of telemedicine, by the patient as well as by the surgeons.	The reluctance of patients to use telemedicine services and general lack of infrastructure and resources to sustain them.
The decrease in patient travel for health services thereby saving both time and money.	Excessive reliance on technology leading to the breakdown of the traditional clinician-patient relationships.	Opportunity for patients to reach out with questions, report early warning signs, and make a follow-up appointment to make sure they are on track.	Communities with low levels of literacy from text-based communication technologies such as email might get excluded.
Reduces unnecessary ER visits that are not so urgent.	Lack of professional calibre as well as capacity.	Improved timeliness of care to promote patient care quality.	Lack of patient follow-up making the assessment of the clinical effectiveness of

Quicker and more convenient access to specialists. Problems arising due to the perspective of medical practitioners showing resistance to change.

Involvement in telemedicine projects with other countries that have better knowledge and resources can strengthen our healthcare

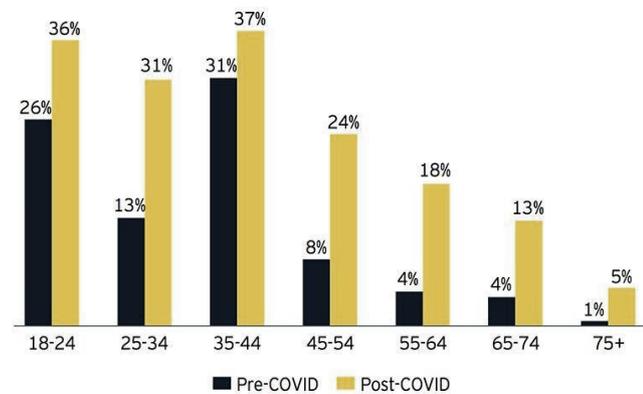
telemedicine services ineffective. Lack of proper medicolegal protocols is also said to be keeping the physicians from embracing the telemedicine practice.

3.2.4 Willingness to book telehealth visits

Despite catering availability and accessibility of this technological advancement, the majority of the masses are unaware of the technicality and know-how of its operation as there were only a few cross-linked collaborations pre-COVID that justified the use of telemedicine services in India's healthcare sector.

According to the EY(Ernst & Young) -IPA Report (2020), however, in the aftermath of COVID-19, the market for telehealth visits has witnessed an upsurge due to patients' restraint to make doctor visits in person. Figure 6 depicts the willingness to book telehealth visits.

Figure 6: Willingness to book telehealth visits



Source: EY IPA

3.3 Laws pertaining to telemedicine in India

No law exists in India relating to telemedicine and virtual consultation up till now. It is regulated by the combination of medical and information technology practices with their corresponding guidelines, regulations or laws. At present, the laws regulating the medical profession and information technology apply to telemedicine in India. To clarify legal issues and resolve technical issues, clear laws regulating the practice of 'telemedicine' are required. Various legislations such as The Drugs and Cosmetics Act,1940,

and the Drugs and Cosmetics Codes, 1945, the Indian Medical Council Act, 1956, the Indian Medical Council (Professional Conduct, Etiquette and Ethics) Regulations, 2002, and the Clinical Establishments (Registration and Regulation) Act, 2010 (Clinical Establishments Act) are some of the laws affecting the medical profession.

Many other such as ICT include the Information Technology Act, 2000 (IT Act), the Information Technology (Intermediaries Guidelines) Rules, 2011, the Information Technology (Reasonable Security Practices and Procedures and Sensitive Personal Data or Information) Rules, 2011, Unsolicited Commercial Communications Regulations, 2007, and Telecom Commercial Communication Customer Preference Regulations, 2010 ('TCCP Regulations').

THE FUTURE OF MEDICINE IN HAPTICS: A RAY OF HOPE

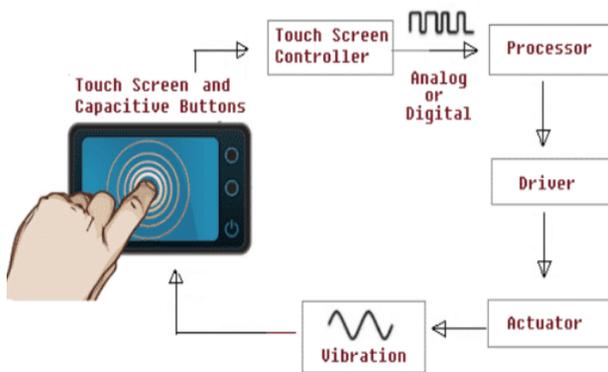
Telemedicine hence has enormous prospects in making life easier for most of us by cutting down on in-person consultancies, travel costs, and making healthcare facilities readily available for the entire nation. Despite having several pros, telemedicine can't carry out the most critical healthcare facilities like surgeries, and operational treatments. In addition to the same,haptic technology comes into play to mitigate this issue and possesses unrealized capabilities to improve healthcare to a large extent. It works on the touch-feedback mechanism. It's the next step of the ladder to enhance the nation's healthcare sector after telemedicine, given that we do have the appropriate infrastructure

4.1 Working of haptic technology in healthcare

Haptics refers to sensing and operating through touch, enabling the user to touch and feel the optimized virtual reality (VR) or an existing distant object. Haptics also provides feedback mechanisms to those who interact with virtual or remote environments, so as to ensure a two-way flow of information. Through this technology,

trained surgeons carry out virtual operations using haptic controls. Haptic feedback is also the key to medical interventions. For example, when a dental surgeon drills into a dental cavity or performs microsurgeries, or when an anaesthetist inserts a Tuohy needle, or when a surgeon makes a cutting. There are special devices like data gloves, joystick, etc. through which operators can receive feedback from software applications in the form of bodily sensations felt in any part of the body. The potential of haptics in the field of medical procedures and the utilization of clinical skills are great and they will affect the medical vocation at large. There is at present a lot of research going on in this particular field and is soon expected to attain its proficient state

Figure 7: Working of haptic technology



Source: Haptic technology working application

DISCUSSION AND RESULTS

From Section 3.1, it is inferred that rural infrastructure is not as per the norm set by the government. Furthermore, it is observed that doctors do not deem it fit to work in rural areas due to a variety of reasons. Therefore there lies a disparity between 'sanctioned' and 'in-position doctors' in those areas of the country.

Next, in sections 3.2.1, we also see, due to patients' aversion to making in-person doctor visits, the requirement for telehealth visits has increased due to the aftermath of COVID-19 which would give rise to broader market opportunities in the field of telemedicine. If it turns out as supposed, in no time, haptic technology would also gain a position in the market, thereby enhancing the health sector of India.

The next section, namely, 3.3, discusses how there are no laws in concept and there is a need for laws relating to telemedicine in India. Currently, only the laws regulating the medical profession and information technology apply to telemedicine in India and scope of haptic technology respectively.

The last section concludes with a brief introduction to the concept of haptic technology. It discusses how it will bring efficacy to telemedicine and its successful operation in India.

CONCLUSION

We conclude telemedicine using haptic technology would be a great and ideal approach to mitigate the shortcomings in our healthcare system of India and will take the health care sector to greater heights. Thus, a better future will need a heightened response to stimuli of touch and remote monitoring. When risen to prominence, haptic technology collaborating with other Virtual Reality will elevate the world to a whole new level of greatness. Distant intelligence has the potential to ensure urgency is taken care of by gathering clinical data from all patients simultaneously. However, some of the disadvantages being that information may be lost due to a software glitch or hardware meltdown. Therefore, relying too heavily on computer systems to prevent errors in healthcare data may be problematic. There has to be a smart balance between total dependence on computer solutions and the use of human intelligence.

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