
Transforming Healthcare Access and Affordability in India

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Abstract

India's healthcare system is at a pivotal moment as the nation aims to achieve developed-country status by 2047. Despite significant progress in medical infrastructure and public health initiatives, the country continues to face systemic challenges in accessibility and affordability, particularly among rural and economically disadvantaged populations. High out-of-pocket expenditure, uneven distribution of healthcare resources, and rising prevalence of both communicable and non-communicable diseases exacerbate disparities. This paper explores a multi-dimensional approach to transforming healthcare in India, emphasizing the integration of artificial intelligence (AI), robotics, telemedicine, Internet of Things (IoT) devices, and indigenous innovation within supportive policy frameworks. Furthermore, it examines sustainable financing models and governance mechanisms that can enable inclusive, equitable, and cost-effective healthcare delivery. By aligning technological innovation with policy and indigenous development, India can achieve universal healthcare access, reduce financial burden on citizens, and position itself as a global leader in affordable medical solutions by 2047.

Keywords: Healthcare access, affordability, artificial intelligence, robotics, telemedicine, indigenous innovation, digital health, universal healthcare.

Introduction

Healthcare is both a universal human right and a fundamental pillar of socio-economic development. In India, this right exists within a paradoxical landscape where world-class hospitals of international repute coexist with large rural regions that lack even the most basic health services [1-2]. With over 1.4 billion citizens, nearly 65 percent of whom live in rural areas, the imbalance in the distribution of infrastructure and professionals skews heavily toward urban centers, leaving vast populations underserved [2-3]. The consequences of this urban-rural divide are evident in preventable illnesses, delayed treatments, and higher mortality rates in remote areas [1-3]. The economic structure of healthcare delivery in India intensifies these disparities. Out-of-pocket expenditure accounts for more than 55 percent of the country's total health spending, placing a substantial burden on households and causing millions of individuals to fall into poverty every year due to catastrophic medical costs [4-6]. Insurance schemes, both public and private, remain inadequate in their scope, especially for outpatient services and management of chronic illnesses, which form the bulk of healthcare needs. In rural and marginalized settings, limited insurance coverage combined with financial vulnerability often leads people to rely on unqualified or informal providers, resulting in substandard care [4].

India's healthcare system, though challenged by deep inequities, has evolved steadily over the decades since independence. The establishment of primary health centers in the 1950s was an early attempt to build a nationwide foundation for public health services, followed by the strengthening of district and tertiary hospitals. Policy milestones such as the National Health Policy of 1983 sought to unify preventive and curative services while focusing on rural outreach. Later reforms, including the National Rural Health Mission launched in 2005, improved maternal and child health outcomes and expanded access to essential services [5-

8]. More recently, Ayushman Bharat, introduced in 2018, has aimed to provide a broad platform for universal health coverage through both health and wellness centers focused on primary healthcare and a large insurance scheme known as the Pradhan Mantri Jan Arogya Yojana, covering millions of vulnerable families [8-9]. Yet despite these initiatives, tribal groups, remote communities, and marginalized populations continue to experience limited access to quality healthcare.

India's health challenges are further complicated by the burden of both communicable and non-communicable diseases. Tuberculosis, malaria, dengue, and other vector-borne infections remain persistently high because of overcrowding, inadequate sanitation, and environmental factors, while at the same time, the incidence of lifestyle-related non-communicable diseases such as diabetes, hypertension, cardiovascular illnesses, and cancers is rising steeply [4,7]. Currently, non-communicable diseases account for more than 60 percent of deaths nationwide, reflecting an epidemiological transition that places equal if not greater pressure on the healthcare system than infectious diseases. This simultaneous battle against two divergent disease profiles demands a flexible model that can handle acute infections while managing long-term chronic conditions.

Addressing these formidable issues requires a multi-dimensional approach that incorporates technology, policy reform, indigenous knowledge systems, sustainable financing, and community empowerment. Digital health tools such as telemedicine, artificial intelligence for diagnostics, and mobile platforms for public health can extend quality services to rural and underserved regions. Policy measures must incentivize skilled professionals to serve in rural areas, strengthen regulatory frameworks for private providers, and ensure greater public investment, which currently lags at only about 1.5 to 2 percent of GDP [7-9]. Integrating traditional systems of medicine like Ayurveda and Yoga into mainstream preventive care can create culturally acceptable, locally grounded solutions. More robust financing models, particularly through expanded insurance, social health protection, and risk pooling, are needed to reduce catastrophic out-of-pocket spending. Lastly, community-based care, mediated through ASHA workers and local governance structures, is essential for ensuring that services are participatory, context-sensitive, and equitable [8-9]. The future of India's healthcare system depends on its ability to overcome structural inequities, embrace innovation, and strengthen both preventive and curative frameworks. If pursued effectively, the path forward can transform healthcare into a truly inclusive, sustainable, and rights-based system that not only safeguards citizens' well-being but also drives the nation's social and economic progress.

2. Challenges in Healthcare Access and Affordability

India's healthcare system is shaped by a convergence of infrastructural deficits, financial constraints, epidemiological transitions, and deeply rooted socio-cultural inequities that collectively restrict equitable access to essential health services. A primary structural challenge lies in the scarcity and unequal distribution of human resources. The country exhibits a doctor-to-population ratio of approximately 1:1,511, which falls short of global standards and is further skewed by the fact that the majority of healthcare professionals practice in urban centers. This maldistribution leaves vast rural populations underserved. Infrastructure inadequacies compound this imbalance, as hospital bed density in rural regions averages only 0.5 per 1,000 individuals compared to 2.2 per 1,000 in urban areas. Such geographic disparities force rural patients to travel considerable distances for specialized or tertiary care, often resulting in delayed diagnosis, disease progression, and poorer health outcomes.

The financial dimension of healthcare access further deepens inequality. A significant proportion of outpatient consultations in rural settings, exceeding seventy percent, are financed directly by households. This

high reliance on out-of-pocket expenditure leads to catastrophic healthcare costs that impoverish millions annually. Insurance coverage remains limited, fragmented across numerous schemes and largely insufficient to cover outpatient and chronic disease care. The escalating prices of diagnostics, pharmaceuticals, and advanced treatment modalities exacerbate economic vulnerability, disproportionately affecting low-income households. Consequently, healthcare utilization patterns remain stratified by income, with disadvantaged groups unable to access timely or high-quality services. Epidemiological trends present additional complexity. India is undergoing a clear transition in disease burden, with communicable diseases such as tuberculosis, malaria, and viral infections persisting alongside a rapidly escalating incidence of non-communicable diseases. Chronic conditions including diabetes, cardiovascular disease, cancers, and respiratory disorders now account for more than half of all deaths in the country. The management of such diseases requires preventive screening, continuous monitoring, and long-term integrated care, yet these necessities remain unattainable in many low-resource contexts where primary health systems are underdeveloped. The coexistence of communicable and non-communicable disease burdens stretches already scarce resources wide, necessitating simultaneous investment in infection control, vaccination, and chronic disease management.

Social inequities interwoven into the fabric of Indian society further complicate healthcare delivery and outcomes. Gender-based disparities create a pattern where women are less likely to seek timely medical attention due to socio-cultural restrictions, lack of decision-making autonomy, or financial dependency. Caste-based exclusion and socio-economic stratification also restrict access to healthcare facilities, nutritious food, sanitation, and health education—factors that play integral roles in determining holistic health outcomes. These inequities exacerbate vulnerabilities, particularly among marginalized and tribal populations, highlighting systemic exclusions within the system itself. The combination of inadequate infrastructure, unaffordable healthcare, epidemiological transitions, and entrenched social determinants illustrates the multifactorial nature of India's healthcare challenges. Addressing these will require comprehensive, inclusive reforms that strengthen health infrastructure, expand financial protection mechanisms, integrate chronic and preventive care at the community level, and dismantle the social and cultural barriers that prevent equitable access to healthcare for all citizens

3. Technological Innovations as Enablers

Technological innovations represent a transformative force in addressing systemic barriers to healthcare access, affordability, and equity. Digital platforms based on telemedicine have already demonstrated the capacity to bridge geographical constraints. For example, platforms such as eSanjeevani provide real-time remote consultation services that reduce the need for long-distance travel, lower associated economic costs, and enable rural populations to access specialists without the requirement of extensive physical infrastructure expansion. By decentralizing healthcare delivery, telemedicine serves as a scalable solution to India's rural–urban healthcare divide.

Artificial intelligence constitutes another pivotal advancement in the modernization of healthcare delivery. Deep learning algorithms and advanced computational models are increasingly employed for the detection of tuberculosis, diabetic retinopathy, and a wide spectrum of oncological conditions. These AI-assisted diagnostic tools significantly enhance early disease identification, reduce delays in initiating treatment, and minimize repetitive hospital visits, thus lowering both individual and systemic costs. When paired with robotic systems, AI further contributes to the field of precision medicine, facilitating minimally invasive surgeries with higher accuracy, reduced post-operative complications, shorter recovery durations, and lower incidences of human error. Collectively, these applications enhance overall efficiency and cost-

effectiveness of health services. Robotic technologies extend beyond surgical systems into diverse functions including rehabilitation, pharmacy automation, and tele-operated procedures. In rehabilitation, assistive robotic devices provide targeted support for patients recovering from neurological impairments, musculoskeletal disorders, or post-stroke conditions. In pharmacological operations, robotic dispensing units improve accuracy and efficiency in medication distribution within high-volume hospital environments or community health facilities, reducing human error and resource strain. Tele-robotics further enables urban-based specialists to extend guidance to rural practitioners or even conduct certain procedures remotely, thereby expanding specialist outreach without necessitating relocation of infrastructure or human expertise. Complementing these advances, the integration of Internet of Things (IoT) devices and wearable biosensors has enabled continuous monitoring of key physiological parameters such as glucose levels, cardiac rhythm, blood pressure, and blood oxygen saturation. These systems allow patients with chronic conditions to receive ongoing monitoring outside the hospital environment, reducing the frequency of inpatient visits and improving the continuity of care. IoT-enabled devices also generate longitudinal health data that can be transmitted to centralized clinical systems, where predictive analytics identify potential health risks, trigger early interventions, and inform personalized treatment regimens.

Taken together, these technological innovations converge to create a digitally integrated healthcare ecosystem. Such a system has the potential to mitigate rural–urban inequities, enhance diagnostic precision, optimize resource utilization, reduce operational expenditures, and expand the reach of quality healthcare to previously underserved populations. Ensuring the success of this transformation, however, depends on overcoming key challenges such as making advanced technologies affordable at scale, maintaining interoperability across diverse health systems and devices, and integrating these solutions seamlessly into existing infrastructure without exacerbating systemic inequalities.

4. Transforming Indian Healthcare

Transforming healthcare in India requires a multidimensional approach that extends beyond technological innovation and encompasses policy reform, governance, capacity building, indigenous innovation, and sustainable financing mechanisms. Programs such as Ayushman Bharat - Pradhan Mantri Jan Arogya Yojana (PM-JAY) have expanded financial protection to over 500 million citizens, thereby reducing catastrophic health expenditures and improving access to secondary and tertiary care. In parallel, the National Digital Health Mission (NDHM) seeks to develop a unified digital health infrastructure through electronic health records and interoperability standards, facilitating seamless data flow and coordination across both public and private healthcare facilities.

Public–private partnerships have emerged as pivotal instruments in bridging systemic gaps and scaling healthcare services across diverse regions. By integrating government oversight with private sector efficiency and innovation, such partnerships have contributed to the creation of diagnostic networks, telemedicine platforms, and mobile health units that improve outreach in rural and underserved areas. Concurrently, fostering indigenous development of health technologies under the Atmanirbhar Bharat initiative aligns with the broader goal of reducing reliance on imported devices while enhancing affordability and local adaptability. Innovations such as low-cost ventilators, AI-based diagnostic kits, tele-intensive care solutions, and portable robotic surgical systems exemplify the potential of local research and manufacturing to address India's healthcare needs. Ensuring sustainability and equity in healthcare delivery requires robust financing models. Transitioning from fee-for-service mechanisms to value-based care, widening insurance coverage, and promoting risk-pooling arrangements are critical to reducing household out-of-pocket expenditure while

incentivizing high-quality and efficient service delivery. Strengthening human resources through capacity building in clinical care, medical technology operations, and digital health data science is equally critical to maximize the potential of technological and systemic reforms across variable healthcare settings.

Looking toward 2047, India's healthcare vision must include universal access to primary care, AI-augmented hospitals, robust telemedicine networks, and widespread integration of IoT-enabled patient monitoring systems. This trajectory positions India not only to ensure affordable and comprehensive domestic healthcare but also to become a global hub for cost-effective medical technologies suited to other low- and middle-income countries. Pilot initiatives already demonstrate this potential: AI-driven tuberculosis screening programs in states such as Telangana have improved detection rates and reduced diagnostic delays, while tele-ICU networks in Karnataka have optimized critical care resources and reduced mortality by enabling remote specialist oversight. Digital health platforms further highlight the role of innovation in preventive and early detection strategies. For instance, mDiabetes has advanced chronic disease monitoring, while Niramai's AI-based thermal imaging system for breast cancer screening provides a non-invasive, low-cost alternative suitable for widespread adoption in rural communities. These examples illustrate how combining artificial intelligence, telemedicine, and localized infrastructure development can yield scalable and sustainable models for healthcare delivery.

Achieving a transformed Indian healthcare system by 2047 requires concurrent progress in research, innovation, and governance. Areas such as precision medicine, predictive analytics, AI ethics, climate-resilient health systems, and low-cost scalable medical devices must receive strategic focus. Building a skilled workforce through specialized training in robotics, artificial intelligence, and digital health tools will be indispensable for effective implementation. Moreover, collaborative mechanisms involving academia, industry, and government can accelerate innovation cycles and facilitate timely translation into practice. India's role in the global healthcare ecosystem can be solidified by exporting indigenous health technologies, participating in international health governance frameworks, and providing expertise to other low- and middle-income nations. By embedding inclusivity, affordability, and technological integration into its health system design, India can achieve universal health coverage, reduce systemic disparities, and improve health outcomes. In achieving these goals, healthcare will not only serve as the foundation of public welfare but also contribute decisively to the nation's broader socio-economic development trajectory.

5. Conclusion

Transforming healthcare access and affordability in India necessitates a holistic and multi-layered approach that integrates technological advancement, strong policy frameworks, indigenous innovation, and sustainable financing models. Emerging technologies such as artificial intelligence, robotics, telemedicine, and IoT-based wearables hold significant potential to reduce rural–urban disparities while enhancing the quality, efficiency, and affordability of healthcare delivery. When supported by effective governance structures, locally driven innovation, and equitable financial mechanisms, these interventions can ensure broader accessibility and affordability of services across all segments of the population. Through such an integrated strategy, India can realize its aspiration of becoming a developed nation by 2047 and establish itself as a global exemplar of inclusive, cost-effective, and technology-enabled healthcare systems.

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