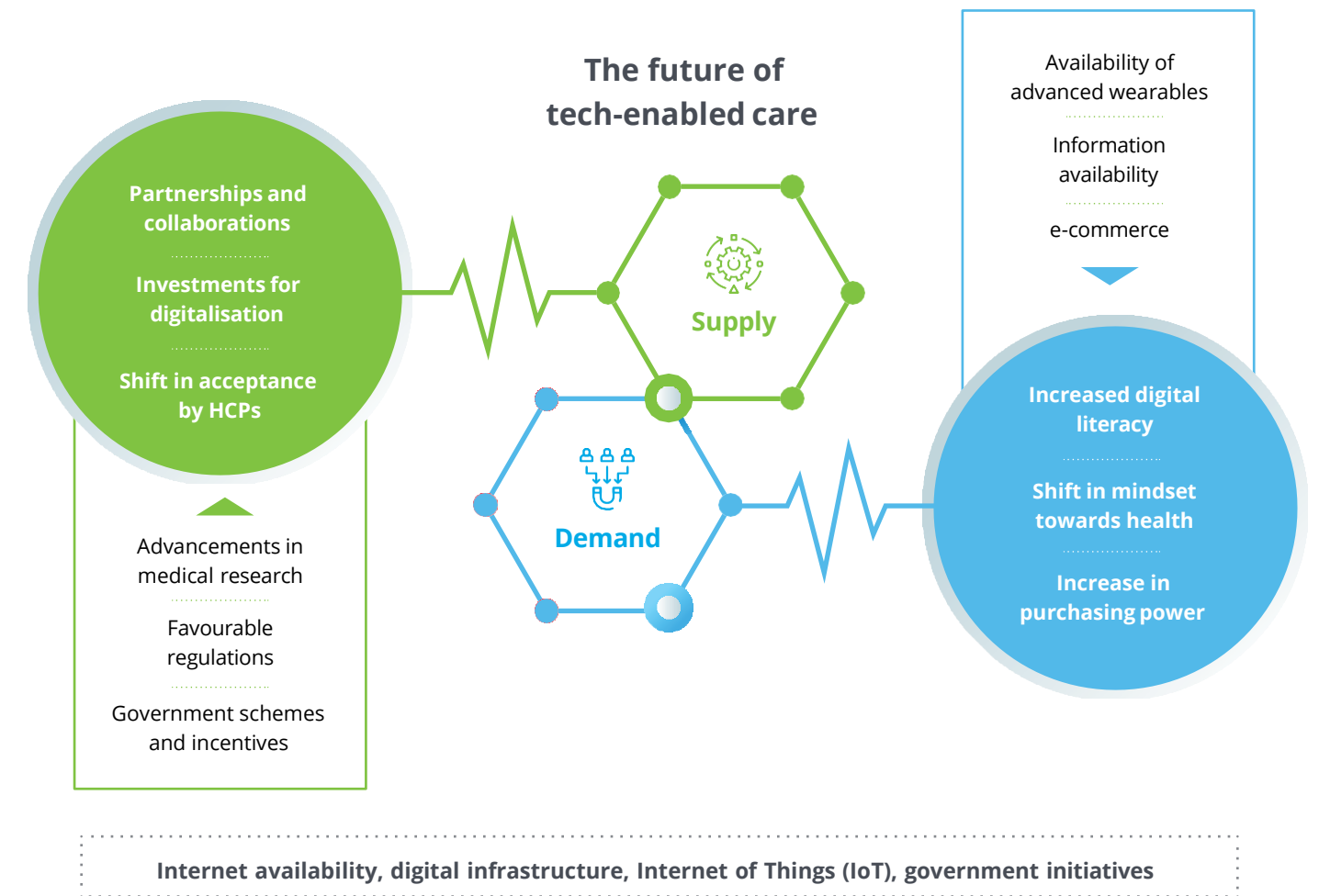


The future of health in India

Tech-enabled care
delivery for empowered
consumers

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Executive summary

In the coming decade, health care delivery in India is expected to be driven by technological advancements and digital health adoption amongst providers and patients. This is likely to be influenced by a mindset shift, technical developments, infrastructure development, government incentives, and other factors.¹ While the government launched notable initiatives, such as the Ayushman Bharat Digital Mission (ABDM) and

e-Sanjeevani, as building blocks to develop a digitised health ecosystem, private players have begun using digital technologies such as robotics, telehealth, AI, and 5G, to deliver tech-enabled care to their patients. Patients are also using technology to stay connected to the health ecosystem and take control of their health.



We firmly believe that the digital health infrastructure can go a long way in tackling the burden of the health care sector in India. However, to transform this dream into reality and leverage it for maximum utility, we need integrated, coordinated, and extensive efforts amongst all stakeholders to enable affordable, accessible, and inclusive health for all as promised in the National Health Mission.

- CEO of IHW Council²



Going forward, hospitals will be the base for acute care and with technology, health care will move into people's homes to provide guidance on their basic medications and wellness.

- Group Head of Medical Strategy and Operations, a multinational private hospital.³

This paper provides insights into the future of health in India, which will involve tech-enabled care delivery for empowered consumers. The first two sections focus on digital interventions from the demand and supply sides, wherein optimal health care will be driven by a successful amalgamation of digital technologies and patient-centric care paradigms. Further, potential action to drive the future of health spans establishing policies, building digital infrastructure, and fostering partnerships across the ecosystem. While there are barriers to implementing tech-enabled care across geographies and socioeconomic groups, various stakeholders including industry incumbents, emerging entrants, and non-native industry incumbents can collaborate to overcome such barriers. The final section presents an outline of how potential technologies for digital health can be implemented in the short-, medium-, and long term.



The future of tech-enabled care

“ 80 percent of health care systems are aiming to increase their investment in digital health care tools in the coming five years. ”

- Minister of State for Science and Technology⁹

“ The Government of India believes that digital tools have immense potential and can play a critical role in strengthening and transforming the health care delivery system ”

- Union Minister for Health and Family Welfare¹⁰

Tech-enabled care delivery transformation

The future of Indian health will be driven by a personalised, digitised, and preventive model of care delivery.⁴ Health will be redefined as a holistic condition of overall well-being that includes mental, social, physical, and economic well-being.⁵ The advancement of new digital technology and discoveries, as well as unique combinations of those existing, will drive India’s current health ecosystem towards a redesigned future of health.

The country currently faces challenges in meeting the growing health care needs of its underprivileged population;⁶ however, it has the potential to build a robust nationwide digital health ecosystem. The establishment of a nationwide system is

complex due to the fragmented health infrastructure.⁷ Nonetheless, efforts are being made to bridge implementation gaps caused by factors such as the lack of infrastructure, language barriers, and socioeconomic status. India can successfully digitise health care by formulating a solid digital inclusion plan to ensure equitable access for all, thereby reducing inequities in the economy.⁸

The country has undertaken initiatives for digitalising the health ecosystem, as industry leaders expect these initiatives to have the potential to mitigate the risks posed by the underlying challenges.

84 percent of Indian health care leaders and professionals plan to increase their budgets on digital solutions and technology initiatives in 2023. (Survey on planned technology spending, n=50, 2023)¹¹

About **88 percent** Indian enterprises are expected to boost their artificial intelligence investments this year, versus **82 percent** a year ago, according to the second edition of Deloitte’s “State of AI in India” survey. Of the survey participants, **60 percent** respondents were from the Life Sciences and Health Care industry, **56 percent** from Financial Services, **45 percent** from Technology, Media, and Telecom, and **35 percent** from Consumer Services.¹²

Drivers of tech-enabled care delivery and use case scenarios

Health care providers are likely to use a combination of emerging technologies to deliver advanced care irrespective of patient location. The subsequent illustration depicts a futuristic scenario of a 40-year-old resident from Thane, a suburb near Mumbai.

Upon experiencing fatigue, light-headedness, and slight perspiration, he visits the nearest health kiosk. He had been

diagnosed with mild cardiac arrhythmia before and has been experiencing mild stress over the last couple of days. At the kiosk, a virtual physician refers him to a satellite centre. The diagnosis reveals the need for surgical intervention. He is admitted to a central health facility where a leading cardiac surgeon performs robotic-assisted cardiac surgery. He is discharged from the hospital and is continually monitored for care at his home.

Patient's suburban neighbourhood



Symptom awareness
The patient experiences uneasiness and searches for the nearest health kiosk using an information app. He visits the kiosk for teleconsultation with a virtual physician.

Health kiosks

The patient scans his ABHA ID-linked PHR app on the phone and connects with a virtual physician over the e-Sanjeevani portal. Following a thorough examination, the physician recommends that the patient visit the nearest satellite centre for further prognosis.

Technologies used:

- Scan and Share QR code
- 5G
- AI



Satellite centres

At the reception, the patient scans the facility's QR code for a quick registration. AI-enabled non-invasive testing detects signs of severe atrial fibrillation. The patient is then transported to the central health facility for emergency care.

Technologies used:

- Personal Health Record (PHR) app
- Telemedicine



Central health facility

The central health facility is an affiliate of a prominent hospital.

The cardiologist has access to patient data from his PHR app and the satellite centre.

Upon further examination, the specialist suggests that the patient undergo emergency surgery. A robot-assisted surgery is conducted in conjunction with an expert cardiac surgeon from a super speciality hospital in the nearest urban centre.

Technologies used:

- Immersive virtual platforms
- Telemedicine
- Medication adherence tools
- Remote monitoring



Recovery and ongoing care

Physicians monitor the patient's recovery through various digital resources. Similarly, the patient can now consult the doctor virtually for any concern during his recovery at home.



Technologies used:

- Robotics
- 5G
- AI
- IoT
- Virtual reality

Emerging technologies for care delivery have the potential to address barriers, such as inadequate health care infrastructure, shortage of medical professionals, and high patient loads. Currently, such technological innovations are largely being explored by private health facilities.



5G

Over 65 percent of India's population lives in villages;¹³ however, only 40 percent of the country's hospitals are present in villages.¹⁴ 5G would accelerate the delivery of optimal health care in such underserved areas through swift and real-time delivery of telemedicine and ambulance care.¹⁵

In April 2022, a leading Indian telecom provider, a multinational health care group, and a digital communications technology conglomerate corporation offered a 5G-connected ambulance. It was equipped with sophisticated medical equipment, patient monitoring programmes, and telemetry devices to transfer patient health data to the hospital in real-time.¹⁶



Satellite centres

~65 percent Indian hospital beds cater to half of the country's population, which implies a growth in hospital beds by at least ~30 percent for equitable access.¹⁷ As such, satellite centres of reputed health facilities in underserved areas could help deliver quality health care services to patients in the areas.

In November 2022, an Indian health tech start-up announced plans to establish 85 eClinics in 2023; these would act as satellite centres in remote locations and primarily provide teleconsultations along with medication delivery and appointment scheduling.¹⁸



Kiosks

During 2021-22, India had a 31 percent shortfall in primary health centres against the mid-year population in rural areas.¹⁴ Kiosks can offer virtual consultations with specialists in areas with a shortage of professionals.

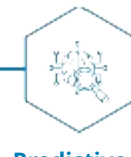
In April 2022, an Indian telehealth company announced plans to open 100 digital health kiosks in Telangana, Andhra Pradesh, and Maharashtra over six months, with an aim to reach 65 percent of the population by 2025.¹⁹



Hospitals without walls

71 percent Indian doctors feel that the volume of structured and unstructured patient health data is unmanageable,²⁰ therefore, there is a need for digitally connected hospitals, enabled by EHR adoption and telehealth.

In December 2021, a hospital in Nagaland became India's first digitally enabled acute care hospital. The hospital is equipped with a patient management and decision support software, which also supports virtual visits for patients.²¹

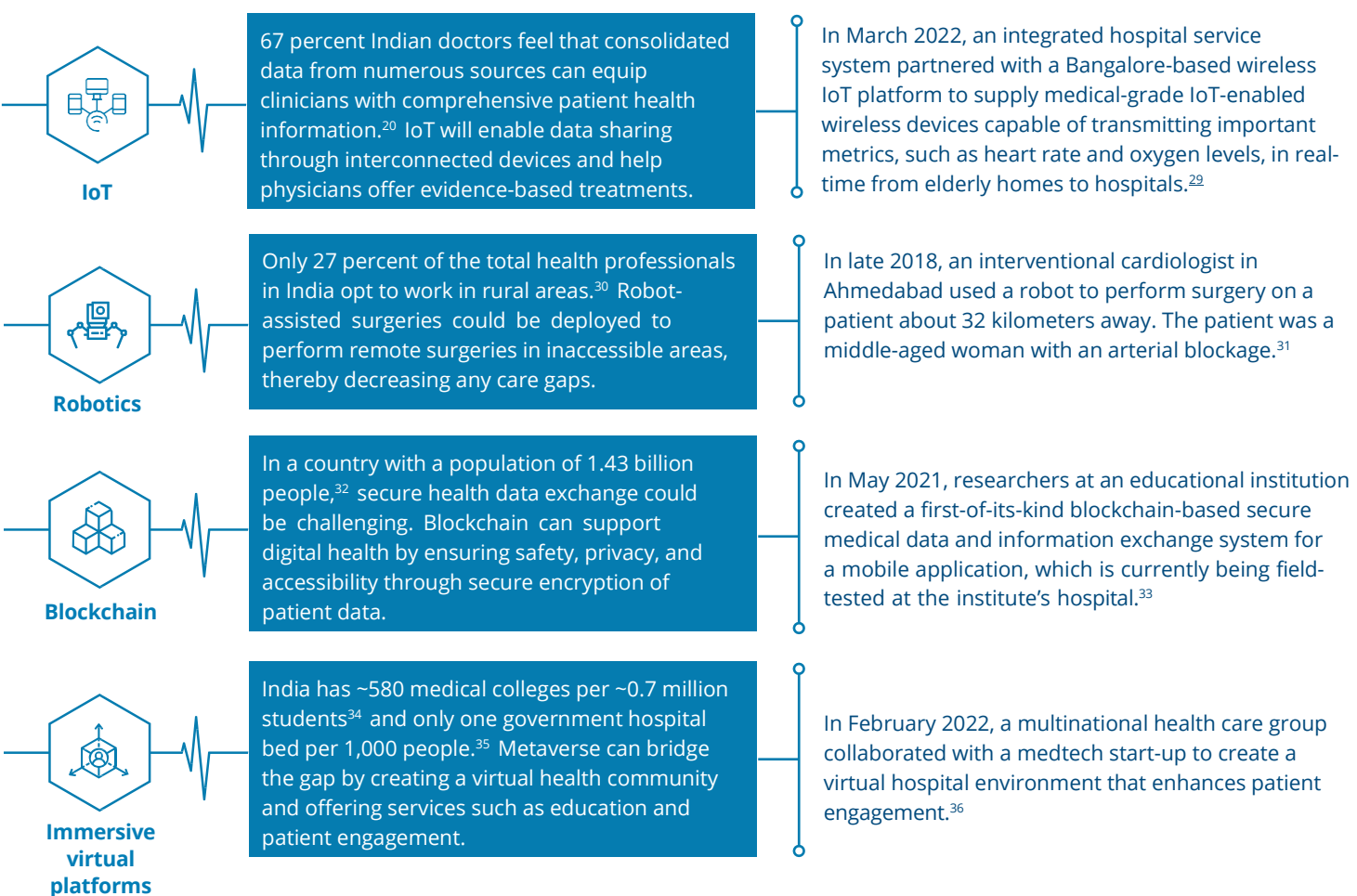


Predictive AI

According to WHO, India will require at least 1.8 million physicians, nurses, and midwives to meet the standard of 44.5 health workers per 10,000 people by 2030.²² AI could be used as a powerful tool to fill these gaps using precision medicine and genomic data to design treatment paradigms.

In September 2022, a renowned cancer hospital and research centre collaborated with a premier educational institution to create India's first fully annotated, relational, de-identified cancer picture bank.²³

- 5G is a global wireless standard with speed, great reliability, and low latency. Its applications in health care include telemedicine, AR and VR immersive training, and remote patient monitoring.²⁴
- A satellite centre is a hub-and-spoke model for advanced patient care in underserved areas.²⁵
- Health kiosks are publicly accessible computer terminals with touch screens. They provide information and services related to self-check-ins, remote consultations, and clinical data collection.²⁶
- A "hospital without walls" is a development that envisions a hospital as a digitally connected community rather than a physical building. It is a digital hospital of the future that combines an in-person and virtual care operating model, enabled through interoperable data, value-based payments, and consumer demands.²⁷
- Predictive AI-enabled intelligent algorithms and tools can be used for treatment design, precision medicine, and remote monitoring, amongst other applications.²⁸



- Connectivity offered by the Internet of Things (IoT) has the potential to transform India's fragmented health care system into an integrated, efficient, and patient-centred system. Applications of IoT in health care include treatment design, precision medicine, and remote monitoring.²⁹
- Robotics combine robots and automation, which can be used in health care for services including telepresence, surgical assistance, sanitation and disinfection, and medical transportation.³⁷
- Blockchain is a decentralised and public digital ledger that captures transactions on several computers such that no record can be changed retroactively without affecting subsequent blocks. Applications of blockchain in health care include medical record management, genomic data protection, organ donation/transplant, and tracking of pharmaceuticals and equipment.³⁸
- 3D-enabled, immersive virtual world augmented by virtual reality could facilitate virtual medical training, remote monitoring, diagnostics, and therapeutics.³⁹

The above examples are a few instances where emerging technologies are driving tech-enabled care. A digital health ecosystem of the future can be based on a combination of these technologies.

Generative AI: An emerging trend in health care

Generative AI has the potential to revolutionise health care and bring in a new generation of technologies.⁴⁰ Generative AI algorithms can help clinicians make more informed decisions, identify chronic diseases early, and overcome barriers around language and personnel limitations.⁴¹

In January 2023, a multinational health-care group launched an AI- and ML-enabled clinical decision support tool in India. The engine is built on the collective intelligence of doctors and peer-reviewed journals. It analyses large datasets and helps providers identify patterns to improve health outcomes.⁴³

Generative AI uses produced medical images and patient data to create improved diagnostic tools and medical imaging algorithms. By producing synthetic data, researchers and health care practitioners can have access to a wider range of information, resulting in specialised and precise medical treatments. Generative AI can also be used to analyse patient data, including electronic health records to identify potential health issues and patterns. By facilitating early diagnosis and treatment, this analysis can improve patient outcomes.⁴²

Successful implementation of generative AI is subject to effective regulatory guidelines and policies around the use of this technology in the medical field. India is taking steps towards the ethical and safe use of AI in health care:

- The Indian Council of Medical Research (ICMR) published "Ethical Guidelines for AI in Healthcare and Biomedical Research" to guide the effective yet safe development, deployment, and adoption of AI-based technologies. It presented 10 important patient-centric ethical standards for all parties to consider when applying AI in the health-care field. These include accountability and liability, autonomy, data privacy, collaboration, risk minimisation and safety, accessibility and equity, optimisation of data quality, non-discrimination and fairness, validity, and trustworthiness. Other important topics mentioned in the guidelines include informed consent and AI tool governance in the health sector.⁴⁴
- A set of rules that will be used to establish the frameworks for generative AI were announced by the National Association of Software and Service Companies (Nasscom) on 6 June 2023. These recommendations are intended to create uniform norms and procedures for the study, creation, and responsible application of AI technology in India. Given that organisations and enterprises are embracing AI increasingly, this is one of the country's initial drafted regulations for the technology.⁴⁵

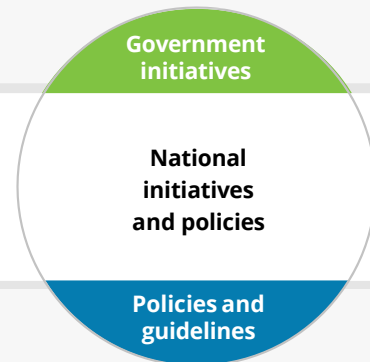


Public health initiatives that are expected to drive tech-enabled care

The government has rolled out various schemes and initiatives for the development of a digital health care ecosystem, such as the Ayushman Bharat Digital Mission (ABDM), a flagship scheme that has successfully helped create digital health

IDs for ~21 percent of Indian citizens to date. Additionally, regulatory bodies have also defined guidelines and policies for creating a secure health data exchange, such as the Digital Personal Data Protection Bill.

- **Ayushman Bharat Digital Mission (ABDM):**⁴⁶
 - A scheme that promotes secure health data exchange across the health ecosystem. It includes components such as a health ID, Unified Health Interface, personal health records, and registries for health professionals and facilities.
 - The government launched a Digital Health Incentive Scheme (DHIS) in January 2023 to boost ABDM adoption, with incentives of up to INR 40 million for health facilities, based on the number of health records they created and linked to the ABHA ID. Further, the Union Budget 2023 allocated INR 3.41 billion to the Ayushman Bharat Digital Mission, which was, 70.52 percent higher than the previous year's allocation.
- **e-Sanjeevani:**⁴⁷
 - India's free, cloud-based, population-scale telemedicine platform enables audio-video consultations between patients and providers and has achieved success in bridging the rural-urban health divide by enabling health care access in remote areas.
 - As of date, the initiative has completed ~90 million teleconsultations, onboarded ~0.2 million providers, and offered a record ~0.4 million OPD consultations in a single day.
- **National Health Stack (NHS):**⁴⁸
 - This is a digital infrastructure that will aid the successful implementation of future government health projects by gathering detailed health care data. It will also enable decision makers to identify fraud in an efficient manner.



- **The Digital India Bill 2023:**⁴⁹
 - A new legislation that would introduce an adaptable regulatory framework for the evolving digital space, handle complexities of the current cybersecurity landscape, and prioritise data privacy rights
- **Digital Personal Data Protection Bill:**⁵⁰
 - An act which allows personal data sharing based on user consent
- **National Digital Health Blueprint (NDHB):**⁵¹
 - A layered framework formed by the committee under the Health Ministry designed to implement the NHS

Deloitte's initiatives for tech-enabled care

Deloitte has launched several initiatives in collaboration with public health institutions to deliver digital health care, using technologies such as telemedicine, remote monitoring, and

mobile-based solutions. These have been implemented in a few districts as pilot projects, and Deloitte plans to use the learning from these to enable digital health care in India.

Anaemia Mukht Mahilayen Campaign⁵²

- In collaboration with the Government of Haryana, District of Gurugram, Deloitte India conducted a three-month pilot project called "Anaemia Mukht Mahilayen" (eradication of anaemia amongst women); the aim was to "test-trace-treat" by **using local community-based workers and volunteers to improve awareness around improved diet, safer sanitation, and medication adherence.**
- The goal was to lower the prevalence of anaemia in the targeted population, with an emphasis on children under the age of six and women between the ages of 15 and 49. The effort resulted in a drop in anaemia incidence rates by 14 percent and the reversal of anaemia amongst 79 percent of severely anaemic patients.
- **Digital solutions such as innovative mascots, text groups, and competitions** were frequently utilised to influence participant behaviour towards achieving better health in a sustainably. Further, participants had access to **specialised helplines and continuous telehealth services.**
- The Central Government of India and the states have plans to address the prevalence of this medical issue. Deloitte intends to offer this programme, which is based on and is an integrated implementation of "Expand the hospital ward", to industry leaders in both the private and public space.

Sanjeevani Pariyojana⁵³

- In collaboration with the Public Health Foundation of India (PHFI) and the Post Graduate Institute of Medical Sciences (PGIMS-Haryana), Deloitte developed an integrated, "fit-for-purpose" module to offer support and resources to patients for **managing care at home and accessing virtual COVID-19 triage facilities and inpatient hospitals.**
- The project was commissioned in the Karnal district and included a **remote command centre setup** to manage limited resources, such as hospital beds, oxygen supply, and ambulances. It also organised **virtual health care services** delivered by medical students and deployed **mobile pharmacies and advanced ambulances.**
- Deloitte launched a **playbook** to help other districts **facilitate the delivery of home health care using digital technologies, such as virtual health, command centres, and online medical training.**
- Deloitte also intends to use the learning from this project to **develop new models of public health management and collaboration.**



Call for action by key stakeholders across cohorts for delivering tech-enabled care ⁵⁴⁻⁵⁸

Public health authorities

Ministries in national and state governments and regulatory bodies

- Strengthen rules and guidelines on cybersecurity and data residency in collaboration with key regulatory authorities (such as the Cyber and Information Security division).
- Standardise GST for the health care industry to attract investments and provide client services at affordable costs.
- Formulate policies that guide value-chain stakeholders on process optimisation, data management, technological advancements, and digital transformation.
- Introduce modules in the curriculum that will train medical professionals to use digital technologies, such as telemedicine, AI, and robotics.

Industry incumbents

Classic industry players, such as hospitals, providers

- Transform educational/training capabilities using immersive platforms for virtual upskilling programmes.
- Adopt advanced encryption frameworks and information management systems for patient data security.
- Use immersive platforms to guide surgeons through quick patient care services, especially during emergencies; conduct remote surgeries using extended reality to precisely position the details of a patient in another country.
- Deploy 5G technology to assist clinicians better visualise their patients' problems, eliminating guesswork, and providing accurate diagnosis.
- Equip Emergency Medical Technicians (EMTs) in connected ambulances with 5G-enabled video calls. This will enable the seamless transmission of a patient's symptoms, vitals, and medical information between doctors and ambulance staff.

Emergent entrants

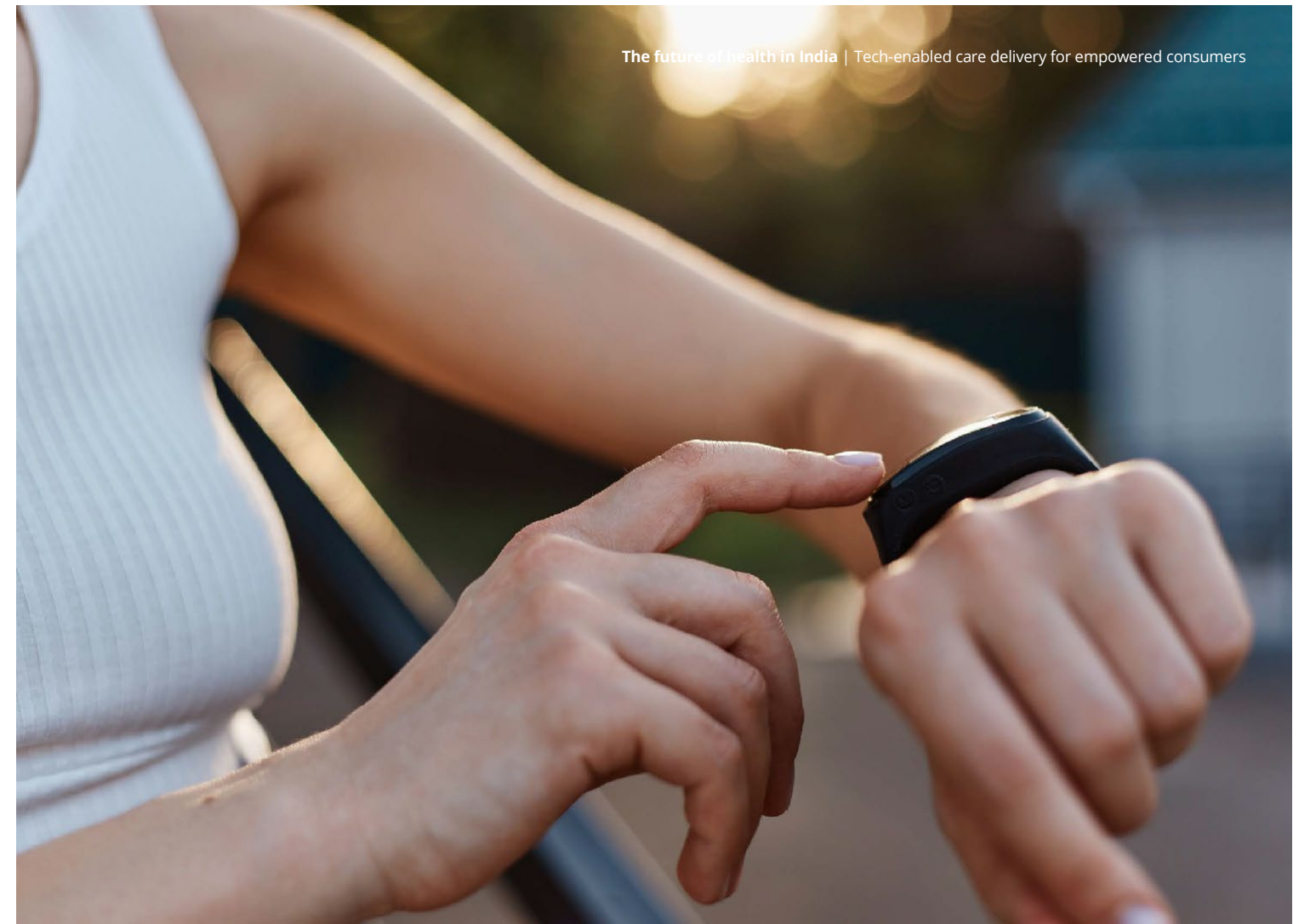
Emergent players within the industry, such as health tech and digital providers

- Build a 5G and AI-enabled infrastructure that would support effective collaboration between stakeholders.
- Foster partnerships with industry incumbents to utilise their expertise related to patient care and combine it with technological knowledge. This will help develop solutions that offer comprehensive care.
- Invest in building effective digital health care interfaces and platforms based on AI and 5G technology.
- Experiment with mixed delivery models that combine online and offline elements, given the limitations on patients' capacity to use digital health in remote India.

Non-native industry incumbents

Established players entering health, such as real estate, tech hyper scalars

- Develop public-private partnerships (PPPs) with governments to help create digital infrastructure that will support the functioning of interoperable public health interfaces and platforms.
- Develop advanced solutions partnerships with governments (PPPs) based on emerging technologies for health care providers and start-ups.



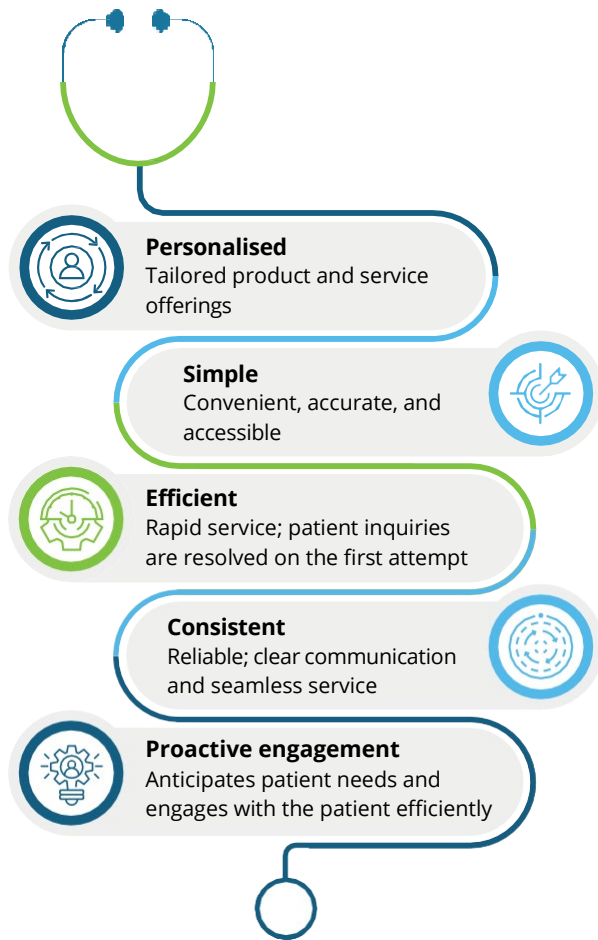
Empowered consumers becoming active participants

The digitally inclined patient persona

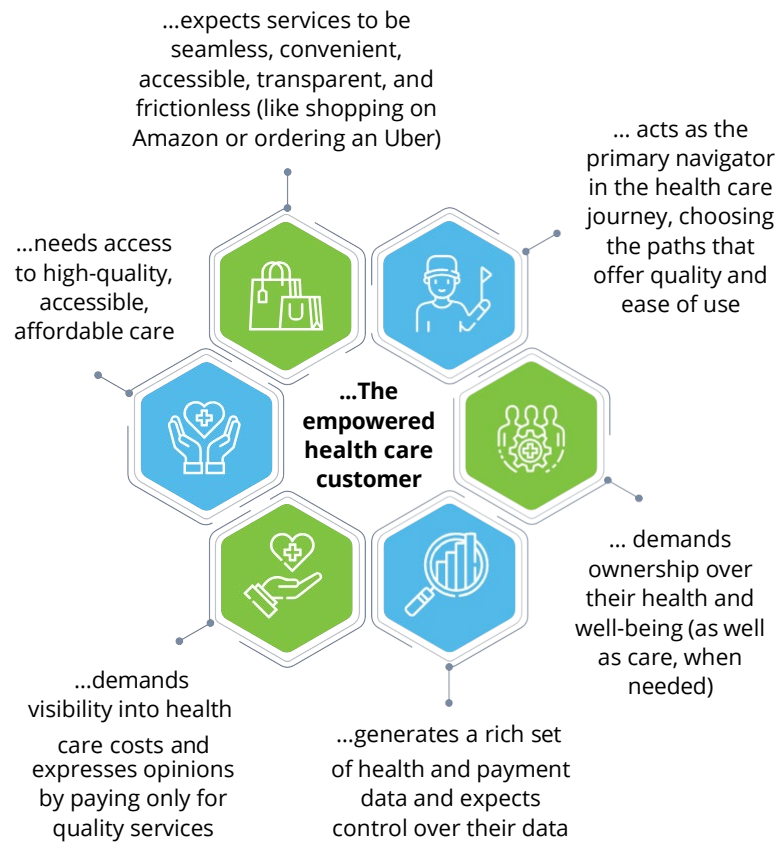
The patient of the future is expected to increasingly demand digital health tools for a connected and personalised care experience using a unified/universal electronic health record, virtual care, health care apps, and access to information. This is

based on the transition from a single touch point in a physical facility to being part of a connected ecosystem with several touch points. The characteristics of an empowered consumer are outlined below:

Key patient experience attributes



The empowered health care customer...



“ Digital health is now the default operating system of health care, and doctors who use digital health will replace those who don't use digital technologies. It is not an option to choose digital health; it is a compulsion. This time, the revolution is driven not by tech providers but by consumers. Consumers are now accustomed to digital tools, be it retail, banking, the government, or communications, and they are expecting the same in health care. Also, chronic diseases require continuous patient engagement to manage their condition, which cannot be done without technology integration. So, there is every reason to adopt technology and no reason to avoid it.

- The Chair of the Global Digital Health Summit and former advisor to the Health Minister of India, October 2022⁵⁹

“ Today, digital connectivity is such that India has 1.2 billion mobile connections, 800 million internet connections, 600 million smartphones, growing at the rate of 25 million per quarter.

- CEO, National Health Authority (NHA), April 2022⁶⁰

Additionally, the digitally inclined patient is expected to use app-based platforms and services to gain more understanding of health information and track basic health parameters and increase the focus on preventive health. Health experts believe that preventive health has great potential to tackle the increasing burden of non-communicable diseases in India.⁶² Moreover, if preventive health care is enabled using advanced digital technologies, it has the potential to reach a higher number of beneficiaries, irrespective of income, education, and understanding. For example, in 2021 a multinational health care group launched an AI-based personalised health risk assessment, which helped lower the HbA1c level by 0.7 percent amongst 100,000 patients, and 64 percent of these patients also reported weight loss. This assessment is part of a personalised, predictive, and preventive screening programme, wherein patients can access the app that provides personalised nudges for healthy habits through SMS or WhatsApp.⁶³

“ The smartphone market is expected to reach one billion users by 2026. This growth is likely to be propelled by the rural sector at a CAGR of 6 percent, compared with the urban sector growing at a CAGR of 2.5 percent from 2021 to 2026. Higher internet adoption is expected to fuel demand for smartphones. This increased demand will be propelled by the need to adopt FinTech, e-health, and e-learning.

- Deloitte TMT predictions, 2022⁶¹

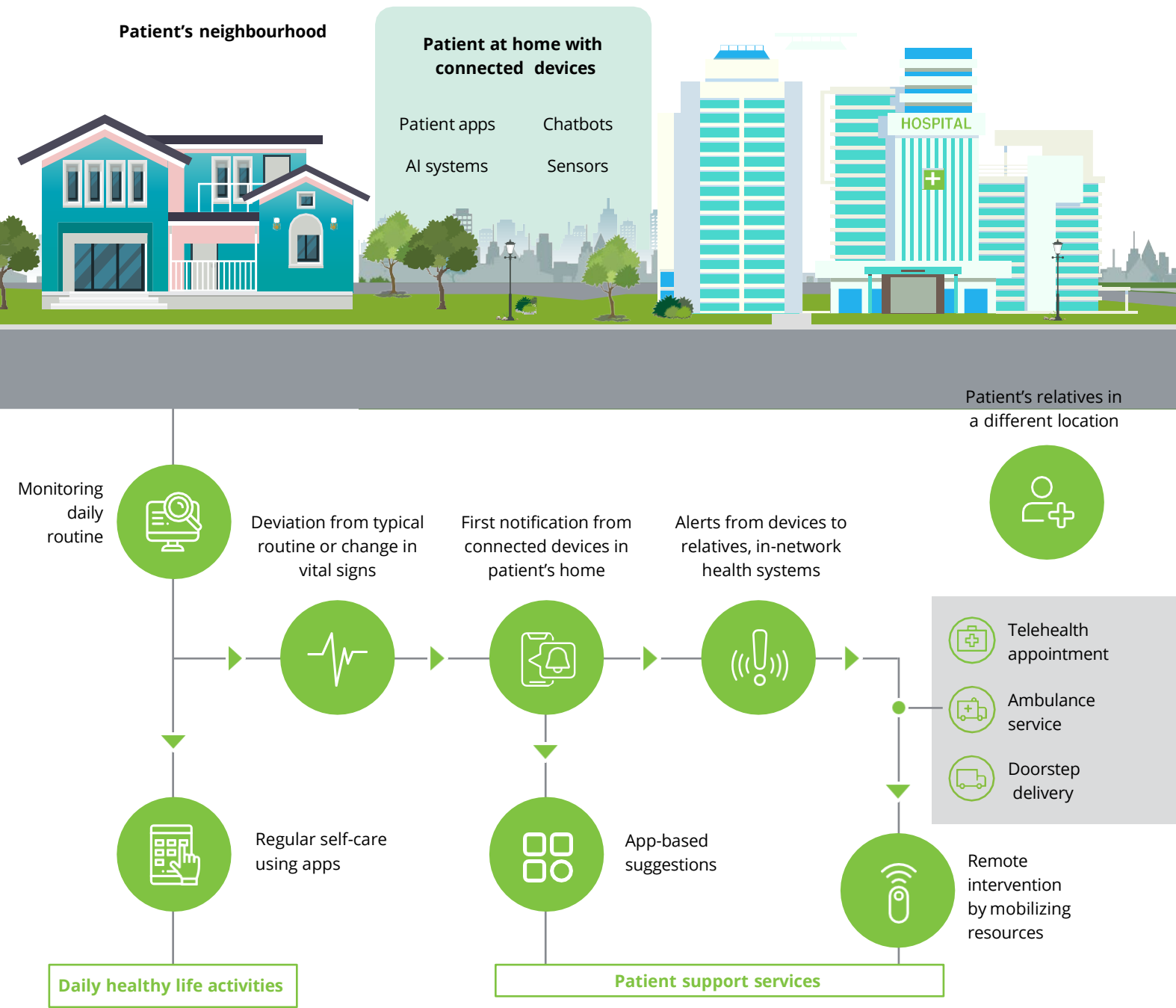


Applications for empowering patients

The digitally empowered patient is expected to use a combination of smart devices, health apps, chatbots, and AI-enabled portals to monitor their daily routine and send alerts to seek help in case of any aberration. The following example depicts a futuristic scenario of a 90-year patient in urban India. As a single occupant of a home that is well-equipped with advanced sensors and AI-based devices, the patient has access to various health apps through their mobile. In case of deviations from their regular routine, the patient's smart home

can deliver suggestions through the app for availing of patient care services. However, in case no action is taken, connected devices can send alerts to the patient's relatives or health systems. The patient's relatives do not reside in the same city; however, they have devices that can receive alerts about the patient vital signs or deviations in routine. The relatives can then arrange services for this patient using apps and online portals such that they receive the necessary care.⁶⁴

Patients in India regularly use technological advancements such as smart devices, health apps, and AI-enabled portals to receive health information and track their health and well-being.





Smart wearables and IoMT

Devices facilitate personalised health care based on real-time and longitudinal health monitoring. Biosensors enable patients to take better decisions and communicate health needs to doctors. Subsequently, doctors can monitor patient health, assess patient responses, and track illness; hence, these are capable of transforming care paradigms from sick care to preventive care.⁶⁶

Several companies are working on prototypes of smart wearables that can be connected to the internet and continuously monitor vitals.⁶⁵ These devices are capable of tracking health parameters such as heart rate, blood pressure, body temperature, stress levels, and oxygen concentration.⁶⁷



Chatbots

Platforms help citizens find answers to health questions and check health information.

In April 2022, a health content specialist website launched a chatbot for a messaging app, which answers questions from citizens and accesses health information, free of cost. It was launched in English, with plans to include other languages, such as Hindi and Bengali.⁶⁸



Health apps and portals

Solutions are accessed by patients conveniently, increasing the accessibility of services, data, and health information.⁶⁹

In October 2022, an integrated PHR app introduced a content platform to deliver quick and reliable health information (verified by health experts) to patients to tackle misinformation and large amounts of unregulated information generated on health topics.⁷⁰



AI

Self-service portals and automated workflows using AI-based algorithms and tools help deliver high-quality patient experience and engagement.⁷¹

In December 2022, the Indian research division of a multinational technology company announced the development of an advanced AI and ML model, which can identify and digitise medicines in handwritten and unstructured prescriptions. This system of assistive technology is expected to be rolled out in the near-term and will help address challenges related to medicine purchases, owing to illegible handwriting in prescriptions.⁷²

Other initiatives indicating the shift towards empowering patients

- **The Open Network for Digital Commerce (ONDC)** initiative aims to promote the creation of open networks and will act as an enabler of digital commerce. This digital infrastructure will facilitate information exchange between providers and consumers. The greatest impact in health care is expected to be in the standardisation of products and services, genuineness of suppliers, and return processes.⁷³
- **National Health Portal** has been established by the Ministry of Health and Family Welfare for providing health-related information to Indian citizens and acts as a single source for consolidated health information. It aims to provide authentic health information in English and five other Indian languages on subjects such as disease descriptions, wellness and healthy lifestyle, and health policies.⁷⁴

Call for action by key stakeholders across cohorts to empower patients ⁷⁵⁻⁷⁹

Public health authorities

Ministries in national and state governments and regulatory bodies

- Adopt digital technology to provide health care for all citizens.
- Develop explicit guidelines and supportive regulatory policies to develop a digital health care ecosystem and incubate indigenous health-tech start-ups.
- Encourage digital health start-ups to develop solutions to drive the creation of a national, integrated digital health system.

Industry incumbents

Classic industry players, such as hospitals, providers

- Adopt a hybrid model of care delivery to suit the requirements of the patients, who demand various modalities of care based on their lifestyle.
- Guide health tech companies to create content in regional languages.
- Create solutions to address problems related to inconsistent care delivery.
- Explore the possibility of utilising virtual interactive platforms to create an immersive patient care experience, e.g., by awarding tokens or rewards for a healthy lifestyle.
- Increase reach to cover more patients and improve focus on preventive health.

Emergent entrants

Emergent players within the industry, such as health tech and e-pharmacies

- Utilise technologies to increase the scale of applications, given the increase in data generated based on the roll-out of the ABDM.
- Develop cost-effective and simple devices for diagnosing and tracking diseases, e.g., less conspicuous devices for Parkinson's disease to increase uptake of digital monitoring, non-invasive wearable devices that use AI algorithms to measure body parameters.
- Design apps that address the changing demands of patients (including interfaces in regional languages).
- Collaborate with fitness experts and leading nutritionists to include their expertise while developing apps for customers.
- Create an ecosystem that connects disparate sources to develop an integrated platform that creates nudges for preventive, proactive, and outcome-based care.

Non-native industry incumbents

Established players entering health, such as tech hyper scalars and marketing companies.

- Partner with companies designing wearable devices to develop an architecture that can derive and maximise value from collected data.
- Deliver technology solutions to start-ups for developing advanced solutions for preventive health and customer engagement.
- Collaborate to develop strategies for customer outreach, engagement, purchasing, and retention.

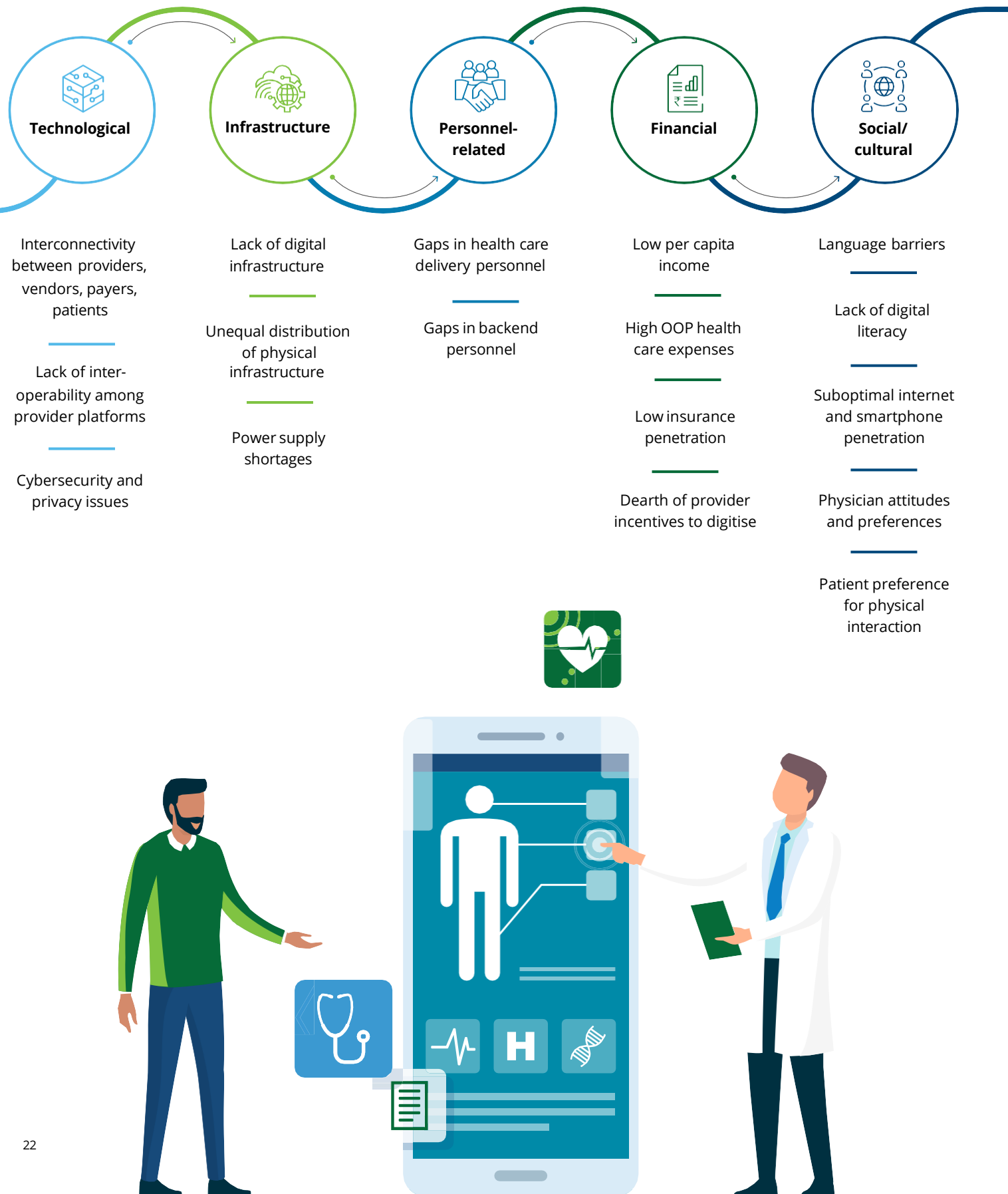


Considerations for implementing digital health in India

The rapidly expanding, mobile-based, and data-intensive digital economy in India is expected to be a major driver of tech-enabled care. India recorded over 75 million 5G Fixed Wireless Access (FWA) broadband subscriptions in 2021 and is expected to reach ~460 million subscriptions by 2030.⁸⁰ However, the gender gap between smartphone users is at 23 percent, and while roughly 71 percent Indian women own mobile phones, only 33 percent have used the internet. Poor digital penetration amongst females in India can be attributed to social and patriarchal norms, higher frequency of online

harassment faced by women, and impediments to digital literacy.⁸¹ Additionally, there is a wide variation in the country across geographies and socio-economic groups, concerning the adoption of digital technology. For example, 67 percent of the urban population can access the internet, whereas only 31 percent of the population in rural areas has internet access.⁸² Hence, these barriers impact the establishment of a nationwide digital health ecosystem in India. The following chart represents key barriers across multiple categories:

Inconsistency in tech-enabled care delivery



Considerations for implementing digital health

	Current interventions (Represented by a ✓)	
	Private players	Government (Policy)
Technological barriers		
<p>Interconnectivity between providers, vendors, payers, patients</p> <ul style="list-style-type: none"> India does not have a national-level database of clinical records of patients. Additionally, there are inconsistencies in the definition of health data. It not only includes medical records but also non-clinical data, such as self-reported data, data from wearables, socio-economic data, and behavioural data. 		✓
<p>Lack of interoperability among provider platforms</p> <ul style="list-style-type: none"> ~30,000 Primary Health Centres (PHCs) use paper-based methods for capturing medical data, which is reflective of the slow adoption of EHRs and digital records in smaller hospitals.⁸³ A few secondary and tertiary care facilities have begun implementing health care IT applications such as Hospital Information Systems, Hospital Management Information Systems, and Electronic Medical Records (EMR) to store patient data electronically; however, these systems are created by multiple vendors who implement several programming languages and databases, making it difficult to standardise these processes. 	✓	✓
<p>Cybersecurity and privacy issues</p> <ul style="list-style-type: none"> According to reports, health care in India faced about 1.9 million cyber-attacks till late November 2022⁸⁴. The attack on the All-India Institute of Medical Sciences (AIIMS) in Delhi in November 2022 was one of the major attacks in the country and was caused by improper network segmentation.⁸⁵ 		✓
Infrastructure barriers		
<p>Lack of digital infrastructure</p> <ul style="list-style-type: none"> Out of 20 percent of the poorest households, ~3 percent have access to a computer and 9 percent have internet connectivity.⁸⁶ About 700 million citizens live in 20,000 remote villages remain unconnected to this day; inaccessibility to digital services is attributed to the absence of a robust digital infrastructure.⁸⁷ 	✓	✓
<p>Unequal distribution of physical infrastructure</p> <ul style="list-style-type: none"> India has 0.5 government hospital beds per 1,000 people compared to the global average of 3.2 beds globally.⁸⁸ Lakshadweep has the highest number of beds (3.68) per 1,000 people, followed by Sikkim (3.40), Chandigarh (3.19), Puducherry (3.17), and Andaman & Nicobar (3.03); Himachal Pradesh (2.03) and Goa (2.00) also have a high number of beds.⁸⁸ Telangana has the least number of beds (0.14) per 1,000 people, followed by Bihar (0.25), Maharashtra (0.27), and Uttar Pradesh (0.30).⁸⁸ 	✓	✓
<p>Power supply shortages</p> <ul style="list-style-type: none"> As of May 2022, the country faced a high coal shortage for electricity generation, leading to load shedding during soaring heat waves in summer. As such, 2 in 3 households in India confirmed facing power outages. The state of Uttar Pradesh had a 3,000 MW deficit against a demand of 23,000 MW.⁸⁹ 		✓

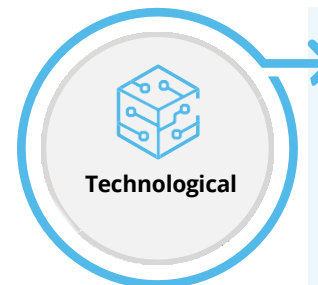
Considerations for implementing digital health	Current interventions (Represented by a ✓)	
	Private players	Government (Policy)
Personnel-related barriers		
<p>Gaps in health care delivery personnel</p> <ul style="list-style-type: none"> India faces a shortage of allopathic doctors (0.76) and nursing personnel (1.96) per 1,000 people vs. WHO standards of 1.0 and 3.0 per 1,000 people, respectively.⁹⁰ India has gaps in the availability of doctors in public vs. private hospitals (11.4 percent vs. 88.6 percent) and across regions,⁹¹ including disparity in rural vs. urban areas (33 percent health workers and 27 percent doctors work in rural areas).⁹² 	✓	✓
<p>Gaps in backend professionals</p> <ul style="list-style-type: none"> The rise in digitalisation will increase the possibility of cyberattacks and hence, health care providers need to develop secure systems based on solutions such as Multi-Factor Authentication (MFA) and Single Sign-On (SSO).⁹³ Large health care providers have the financial capability for these investments; however, a significant number of small, private health facilities have limited funds to recruit and retain IT professionals. 		✓
Financial barriers		
<p>Unequal income distribution</p> <ul style="list-style-type: none"> According to the National Statistical Office, the expected annual per capita (net national income) in current prices for 2022-23 is INR 0.17 million, which represents an almost 99 percent increase from INR 0.09 million in 2014-15; however, even as India's per capita income has seen an increase, the income distribution is concentrated only within 10 percent of the population.⁹⁴ Several research reports indicate that the wealth of India's super-rich has grown rapidly in recent years, while the wealth of low and middle-income Indians has decreased over the two years of the pandemic. 		✓
<p>High OOP health care expenses</p> <ul style="list-style-type: none"> OOP spending represented 50.6 percent of the current health expenditure, whereas the average value across LMIC countries was ~36 percent (2020).⁹⁵ 17.3 percent people faced financial hardship owing to OOPS, as against 9.5 percent, which was the average value across LMIC countries (2017).⁹⁶ 		✓
<p>Low insurance penetration</p> <ul style="list-style-type: none"> In 2021-22, 62.9 percent of the country's population was uninsured.⁹⁷ 		✓
<p>A dearth of provider incentives to digitise</p> <ul style="list-style-type: none"> Health care providers are reluctant to adopt telemedicine as they perceive it to not only add to the workload but also increase the need to take up more training; some feel that telemedicine can decrease patient volumes, as they feel that it will act as a substitute and several patients will prefer consulting with doctors who provide online consultations. 		✓

Considerations for implementing digital health	Current interventions (Represented by a ✓)	
	Private players	Government (Policy)
Social/cultural barriers		
<p>Language barriers</p> <ul style="list-style-type: none"> There are 22 officially recognised languages and 720 dialects; with a new dialect after every 40 kilometres and 122 languages spoken by more than 10,000 people, localisation will be critical in India's journey to go completely digital, with internet users utilising local languages surging by 47 percent YoY.⁹⁸ 	✓	✓
<p>Lack of digital literacy</p> <ul style="list-style-type: none"> About 80 percent of India's total population does not have the technical know-how of using digital devices and services.⁸³ Government-sponsored digital literacy initiatives reach only ~5 percent of the population, are limited to rural areas, and suffer from a variety of design and execution flaws.⁹⁹ 		✓
<p>Suboptimal Internet and smartphone penetration</p> <ul style="list-style-type: none"> In November 2022, there were approximately 518.50 million rural subscribers out of 1.17 billion subscribers (wireless and wireline). According to data from the Telecom Regulatory Authority of India, the entire urban tele density was 134.22 percent in November 2022, while the rural tele density was 57.7 percent.¹⁰⁰ The overall internet penetration rate in India stands at 47 percent; per the National Family Health Survey (NHFS – 5) 2019-21, only about 57 percent males and 33 percent females in India have used the internet.¹⁰¹ Across all states, Goa had the highest percentage of males (~82 percent) and females (~72 percent) to have used the internet.¹⁰¹ Only 20 percent females in Andhra Pradesh and Bihar have ever used the internet.¹⁰¹ According to the data released by the government, 45,180 villages (out of a total of about 644,000 communities) still lack 4G connectivity.¹⁰¹ 		✓
<p>Physician attitudes and preferences</p> <ul style="list-style-type: none"> 41 percent Indian doctors believe that telehealth will impair their ability to empathise with their patients.²⁰ 	✓	
<p>Patient preference for physical interaction</p> <ul style="list-style-type: none"> Elderly patients prefer face-to-face consultations due to limited digital literacy and emotional dependence on doctors. Reports suggest that patients reported poor connection or sense of belonging, which they would otherwise feel after visiting the doctor in person. 	✓	

Strategies related to the aforementioned considerations

Government and public agencies have developed schemes and initiatives to address these considerations. For instance, the Ayushman Bharat Digital Mission (ABDM), which fills in gaps related to interoperability and creates an integrated digital ecosystem, and the Pradhan Mantri Jan Arogya Yojana (PM-JAY), a national health insurance/assurance scheme. Certain private players have also launched apps and platforms

to enable digital access to their patients. However, while some initiatives, such as ABDM, are specific to health care, others, such as the Digital India Programme, provide solutions to address barriers across other verticals and industries. Further, barriers such as unequal income distribution are yet to be addressed by the government as they are related to socioeconomic disparities at a broader level.



Technological

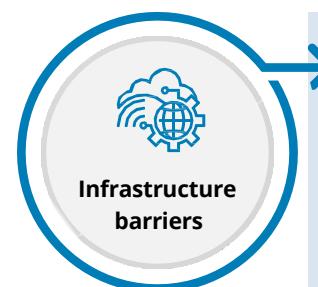
Current solutions are related to data interoperability, inter-connectivity between stakeholders and cybersecurity

Policies and initiatives by the government:

1. The Ayushman Bharat Digital Mission (ABDM) offers health data interoperability between stakeholders by creating digital IDs, facility and professional registries, and a unified health interface.⁴⁶
2. The government launched a Digital Health Incentive Scheme (DHIS) to boost ABDM adoption. Incentives up to INR 40 million would be offered under the new system based on the number of digital health records created and linked to ABHA.⁴⁶
3. The National Health Stack (NHS) is a collection of interoperable health data gathered from various sources such as health facilities, government institutions, and medical apps.⁴⁸
4. The Ministry of Health and Family Welfare has established a Centre of Excellence and the National Resource Centre for EHR Standards (NRCeS) to accelerate and promote the implementation of EHR standards in India.¹⁰²
5. The current Information Technology Act (IT Act) of 2000 in India will be replaced with the Digital India Bill 2023. The goal of this new legislation is to establish extensive control over India's digital landscape while successfully addressing contemporary issues such as cybercrime, data protection, deepfakes, platform competition, online safety, and the negative effects of AI.⁴⁹

Initiatives by private players:

01. A multinational hospital chain implements the HIS, PACS, and EMR solutions through its network, and was awarded HIMSS Level 6 DIAM validation for three areas in 2022; it is the second health care provider in the world to receive this certification.¹⁰³
02. An urban Primary Health Center (PHC) run by a non-profit organisation was the first Indian provider to achieve HIMSS O-EMRAM Stage 6, which assessed EMR implementation for OPD services.¹⁰⁴



Infrastructure barriers

Ongoing solutions are related to digital technologies, physical infrastructure, and power supply

Policies and initiatives by the government:

01. The "Digital India Programme" aims to improve the country's digital infrastructure through projects that focus on aspects such as universal mobile connectivity, public internet access, and e-governance.¹⁰⁵
02. The National Health Mission (NHM) provides financial assistance to states to develop the public health system, including upgrading existing infrastructure or the construction of new infrastructure.¹⁰⁶
03. To account for power-supply issues related to coal shortage, India plans to add 500 GW of non-fossil-based electrical generation by 2030, with non-fossil cleaner fuel accounting for 50 percent of the installed capacity by 2030.¹⁰⁷

Initiatives by private players:

01. A private multinational health care group launched an app, a health ecosystem that offers teleconsultations and home delivery of medications.¹⁰⁸



Personnel-related

Potential solutions are related to gaps in health care delivery and backend support

Actionable insights for public health agencies:

01. Increase the number of medical professionals and institutions by introducing financial schemes, expanding post-graduate programmes, and developing bridge courses to overcome gaps in specialised health care professionals.
02. Enhance the care delivery paradigm by training professionals using digital technology; this will require coordinated efforts and increased participation of stakeholders across the value chain.

Actionable insights for private players:

01. Collaborate with the government to strengthen clinical infrastructure which can help set up medical colleges and institutions for PG and specialisations.



Financial

Solutions to overcome unequal income distribution, high OOPe, low insurance penetration, and dearth of provider incentives to digitise

Policies and initiatives by the government:

01. The PM-JAY provides cashless treatment provisions for poor and underprivileged households; it has significantly decreased their out-of-pocket expenditure.¹⁰⁹
02. IRDAI's extension of the "use and file" procedure for all the health insurance products to help create novel and customised insurance products.¹¹⁰
03. Further actionable insights: Creation of additional health insurance programmes that cover 60–70 percent of the population that is not currently covered by Ayushman Bharat and the missing middle, which is 30 percent of the population that is neither poor enough for government insurance schemes nor rich enough to afford private health insurance.

Initiatives by private players:

01. A private insurance company launched a customisable health insurance package, called "my health care plan".¹¹¹
02. Another private insurance company launched an "OPD add-on" that offers unlimited outpatient consultations.¹¹²



Social/cultural

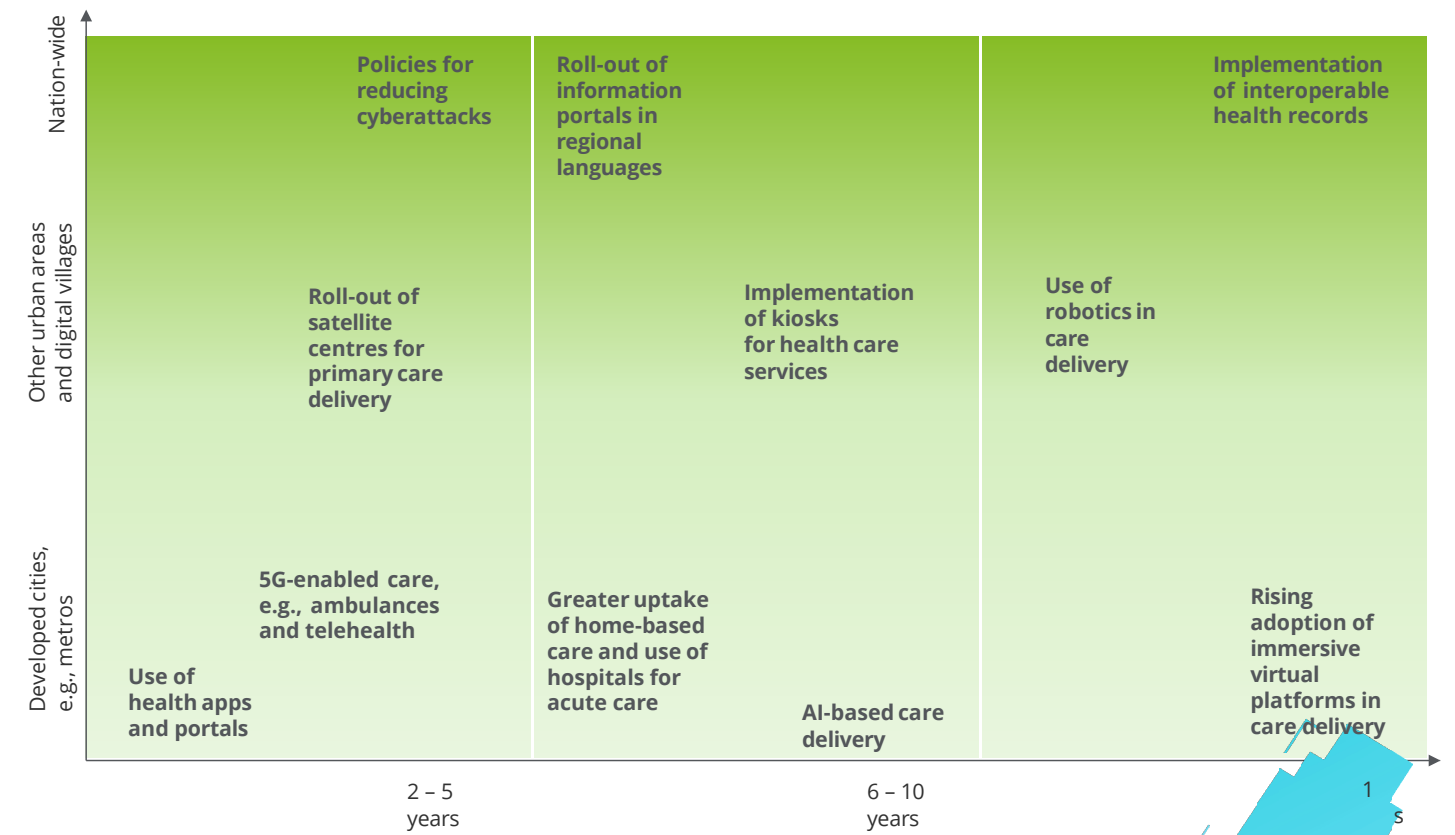
Solutions to overcome challenges related to language, digital literacy, internet and smartphone penetration, provider perception, and patient preferences

Policies and initiatives by the government:

01. The Government of India executed two schemes to provide digital literacy to the masses, namely the "National Digital Literacy Mission (NDLM)" and the "Digital Saksharta Abhiyan (DISHA)".¹¹³
02. Under the National Language Translation Mission (NLTM), the government introduced Bhashini, an AI-based translation system; this will enable Indians to access English content in their native language.¹¹⁴

Initiatives by private players:

01. A health care platform allows teleconsultations with specialists in their mother tongue; this is a beneficial initiative in a country with over 22 official languages and innumerable dialects.¹¹⁵



Implementation of tech-enabled care

Technology-enabled health care is expected to be implemented in a phased manner within the next 10 years in the country. This is based on varying levels of digital maturity, policy implementation, infrastructure development, etc. Further, stakeholders can develop nationwide implementation

roadmaps based on the learning from implementing tech-enabled care in specific regions. The following chart provides representative examples of technologies for care delivery that might be implemented across geographies during the next decade:



Appendix

India's health care system faces challenges that hinder its accessibility, availability, acceptability, and affordability. A few of these challenges stem from internal shortcomings within the system, such as inadequate and underdeveloped physical and digital infrastructure and a shortfall in medical personnel. There are also external challenges, such as increased patient load and insufficient government health expenditure, which in turn, leads to high out-of-pocket expenses. Further, India also has challenges related to inequitable access due to geographic locations and societal prejudices based on gender and caste.

These challenges are prevalent across rural and urban areas and public and private sectors. However, they are concentrated in rural regions and the public sector. Further, the southern states outperform northern states in health care utilisation and availability, owing to fast urbanisation, higher literacy and awareness levels, amongst others.

Key highlights of identified challenges

Challenges	Key highlights
Lack of health care infrastructure	<ul style="list-style-type: none"> • 0.5 public hospital beds per 1,000 people compared to 3.2 beds globally⁸⁸ • High demand-supply gap between the number of medical aspirants and the admission capacity of medical colleges³⁴
Inadequate medical staff	<ul style="list-style-type: none"> • 0.76 allopathic doctors and 1.96 nurses per 1,000 people compared to the WHO standard of 1 doctor and 3 nurses per 1,000 people⁹⁰
High patient load	<ul style="list-style-type: none"> • Surpassed China to become the most populous country in Jan 2023³² • Growing population contributes to increased prevalence of various non-communicable and infectious diseases
Inadequate government funding	<ul style="list-style-type: none"> • Government spending accounts for 40.6 percent of the total health expenses¹¹⁶ • Public health expenditure of 1.8 percent of the GDP in 2020-21 was much lower compared with that of other countries¹¹⁶
High out-of-pocket expenses (OOPE)	<ul style="list-style-type: none"> • OOPE accounts for 48.2 percent of total health expenses¹¹⁷ • ~60 million Indians are pushed into poverty each year due to OOPE¹¹⁸ • Medicines form the major component of OOPE, followed by non-medical costs¹¹⁸
Lower penetration of private insurance	<ul style="list-style-type: none"> • Private health insurance accounts for 6.6 percent of the total health expenses¹¹⁷ • ~62.9 percent of the country's population was uninsured⁹⁷
Inequitable health care access	<ul style="list-style-type: none"> • Vulnerable communities do not have fair access to health services and infrastructure due to barriers related to gender¹¹⁹, caste¹²⁰, and their geographic location¹⁴

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