



India's fast-evolving healthcare industry on the cusp of a digital revolution driven by the Indian consumer

A Bold Vision for 1 Billion Digital Health users in India by 2030

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A report by

ARTHUR LITTLE

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FOREWORD

Across the healthcare spectrum, technological innovations continue to be developed and made available to consumers at breakneck speed. Within this evolving healthcare landscape, care is becoming more personal, more patient centric, less episodic, more omnipresent and fully embedded in the lifestyles of the population. Innovative use of digital technologies therefore creates opportunities to enhance patient experience and at the same time optimize care delivery to ensure affordable health access to all.

Resulting changes in the fundamentals of healthcare delivery affect all components of the healthcare value chain – from outpatient care enabled through telemedicine, to inpatient care optimized through remote care and home health enabled through digitalization, IoT and other interventions.

The COVID-19 pandemic has catalyzed both technological and behavioral change – on one hand, forcing people to embrace digital innovations all walks of life and especially healthcare, and on the other, creating significant pressure on health systems and, exposing supply chain lacunae globally. As a large and growing healthcare market and a hub for innovation and digital entrepreneurship globally, India is poised to see a paradigm shift in digitally enabled healthcare.

In this context, this whitepaper seeks to explore how global trends and success stories in digital health will be relevant in the Indian context, what opportunities could emerge in the near future, how ready is the ecosystem to adapt to the changing landscape, how recent policy interventions have set the stage for accelerated adoption of digital health, what are specific challenges that may need to be overcome and how these translate into innovation opportunities for Indian healthcare players.

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EXECUTIVE SUMMARY

Digital technology has a transformative power that eclipses the capacity of any other force behind earlier socioeconomic revolutions. In healthcare, digital technology is creating a quantum shift, one that could transform healthcare in India almost beyond imagination. India could have 1 billion digital health users by 2030, enjoying an inclusive health system where healthcare keeps expanding but costs keep falling, a system that efficiently prevents and treats diseases, and responds to individual lifestyles and disease profiles with tailored treatments, all at an affordable price.

This is a future that the digitisation of healthcare can achieve. But only if the stakeholders involved step up to the challenge.

The demand already exists. India already has 400 million digital health users, using available services such as tele health, home health, home testing, e-pharmacies and other digitally powered offerings, even without much innovation by large healthcare providers. A survey by Arthur D Little to identify what drives digitized healthcare adoption in India showed up to 65% acceptance of digital health solutions among customers who use e-commerce services. Significantly higher adoption of digital health tools was reported by patients who had long-term disorders such as cardiovascular disease, diabetes, and hypertension. The pandemic forced people to use digital channels for care needs. Having experienced the benefits of digitally enabled healthcare delivery, consumers now consider them a necessity.

However, as too often in India, *supply lags well behind demand.* The underpinnings are already there—India now has a sturdy digital backbone via Ayushman Bharat Digital Health Mission (ABDM). Aiming to capture health data across physicians, providers and patients, the platform promises interoperability, flexibility, security, scalability and wide access.

It is now up to healthcare providers, startups, technology providers, investors and other stakeholders to develop digital health offerings that meet and stimulate demand. Like nature, the economy abhors a vacuum—those who tarry could find that others have already captured the opportunities.

At the moment, the opportunities abound. What India needs is effective, accessible and high-quality healthcare solutions that provide equitable access and that can be rapidly deployed and scaled up.

Conventional healthcare capacity is highly unlikely to catch up with the demand and supply gaps the country suffers now. Digital solutions are the answer, building on the deep penetration of smart devices and increase in connectivity that the country has invested in over the past decades.

The pandemic catalyzed the adoption of tele health, home health, home testing, e-pharmacies and other digital offerings. But there is still a lot of room for growth. Meanwhile, some solutions remain largely unexplored including e-diagnosis and tech-enabled home health and more mature e-pharmacy solutions.

For conventional healthcare players, health technology startups and investors, *this is the time to enter and build a hard to beat position.*

How they could do so and the policy and regulatory support they will need can be summarized as follows:

Providers need to:

1. Develop “Digital First” strategies instead of “Digital as a Bolt-on” for conventional businesses
2. Create digital health offerings that are integrated – from preventative health, to patient first contact, to point of care delivery, onwards to post care follow up and then, recuperative care
3. Build digitally enabled supply chains that are resilient, scalable and efficient

Regulators and Policy Makers should consider:

1. Providing incentives and support for legacy players adopting digital services
2. Developing policy that pushes legacy players towards adopting digital health offerings
3. Creating a regulatory framework that drives trust in digital solutions, ensures data security and addresses other consumer concerns across less mature offerings
4. Encouraging startups through the right regulatory and policy support.

Investors and Startups should:

1. Develop an attractive, independent investment ecosystem for Digital First healthcare plays as against digital health investments as a part of tech or healthcare investments
2. Start targeting brick-and-mortar services from an integration perspective – where some momentum is already observed, notably with large players like Practo and Pristyn Care
3. Target Digital as a key parameter for investment ideation, deal identification, transaction screening and post-deal value creation
4. Finance digital health innovations and platforms through greater emphasis on HealthTech and InsurTech startup ecosystems.

Barnik Chitran Maitra

Managing Partner, India and South Asia
Arthur D. Little

**Global Trends &
Learnings on Scaling
Health-Tech Adoption &
Driving Innovation in
Healthcare Delivery**

Key Trends Impacting the Healthcare Sector Globally

The future of healthcare is being shaped by several trends. Fundamental shifts in demand and epidemiological characteristics, demographic and access improvement in healthcare, emphasis on supply chain resilience, changing consumer preferences and views on healthcare, increasing automation, standardization and efficiency are driving the evolution of the healthcare sector and are driving digital health and health-tech innovation.

Globally, Non-Communicable Diseases (NCDs) are expected to drive a lion's share of disease burdens.¹ NCDs are already the leading cause of mortality and disease burdens globally, contributing to over 70% of deaths globally before the COVID-19 pandemic. The shift has already permeated from developed countries, to developing countries and notably India as well. As many as 75% of NCD deaths globally now occur in developing countries like India. Key ailments like cardiovascular diseases, cancers, respiratory diseases and metabolic disorders – drive a majority of the mortality burden in India as well.

Notwithstanding the impact of COVID-19 in the short term - comorbidities and risk factors such as diabetes, hypertension, cardiovascular susceptibility are well known to have driven significantly higher mortality amongst vulnerable patient groups during the pandemic as well.

As life expectancy increases globally, and especially so in developing markets, the need for healthcare services are expected to increase significantly. Access to better healthcare improves globally. Expected increase in proportion of people above the age of 60 is set to grow 1.5 times over the next 20 years (14% in 2021 to 20% in 2040).²

Elderly population above 80 years old is likely to grow from about 125 million globally to over 434 million by 2050 with sizable growth in this demographic being contributed to by large and (currently) developing markets like India. Public health agencies and experts also suggest that the incidence of long term ailments and chronic conditions such as dementia and Alzheimer's will continue to grow. Estimates point to an increase of this incidence from 47 million in 2015 to 75 million by 2030.

Demand for this demographic segment has larger scale in developed countries with older demographic bases at present. However, as the populations in developing countries age further, younger population ages and fertility rates stabilize - currently developing economies can also expect to see the elderly segment becoming increasingly critical.

[1] World Health Organization: Non Communicable Diseases

[2] World Population Review

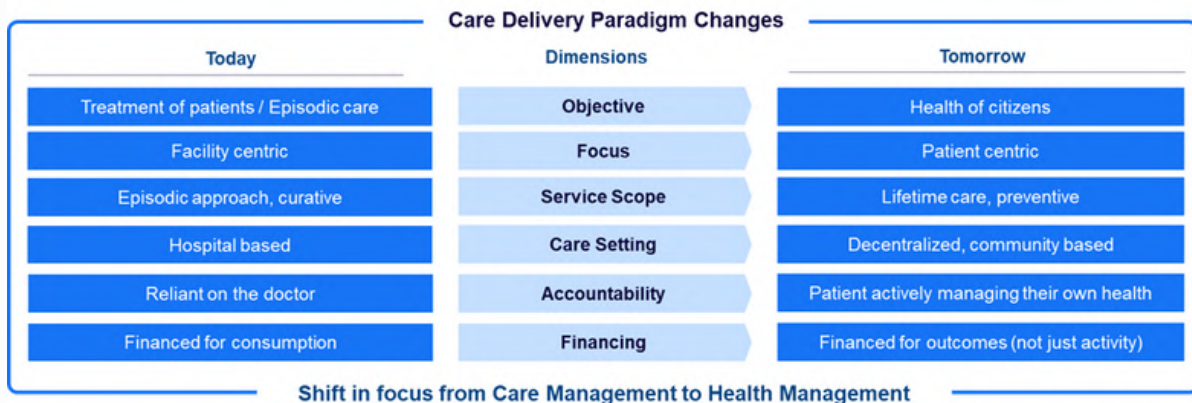
Figure 1: Population Pyramid Evolution - Global
(Population in age brackets - 2020 and 2050 estimates)



Healthcare delivery paradigm shift towards integrated care driven by need for resilient, efficient and scale based solutions in healthcare

As need profile evolves, the care delivery approach to address the demand is also evolving. All dimensions of the care delivery paradigm are being impacted – from overall targeted objectives and design criteria for the healthcare ecosystem, to focus of treatment, service delivery approaches, novel care delivery settings for optimization, shifting accountabilities of health outcomes from physicians to a collaborative approach with patients, to funding of health systems on activity basis to an outcomes / outputs basis.

Figure 2: Evolution in the Care Delivery Paradigm Globally



The emerging paradigm will force care delivery models to go beyond just delivering care outside the provider infrastructure and start to make healthcare more omnipresent with the health consumer. Specifically in an Indian context, care delivery models need to also evolve and create more equitable and democratic access – servicing the marginalized and at-risk population groups more effectively. Tech enabled business models in healthcare therefore likely need to be rethought to create infrastructure and service offerings designed for such delivery modalities.

Global Digital Health Trends & Digital Enablement of Healthcare

Technology enabled change in the healthcare space has also seen significant acceleration in recent years – especially from a perspective of development of new treatment modalities and change in clinical methods. Even traditional areas of technological adoption have seen significant and rapid growth. New vaccine developments are a benchmark example of effective technological adoption in fundamental healthcare delivery. Complex vaccine development activities, typically taking years or decades have been accelerated to be completed in months due in large part to technological advances in genomic sequencing, collaborative research with leading universities and research programs, and rapid scale up of technological offerings.

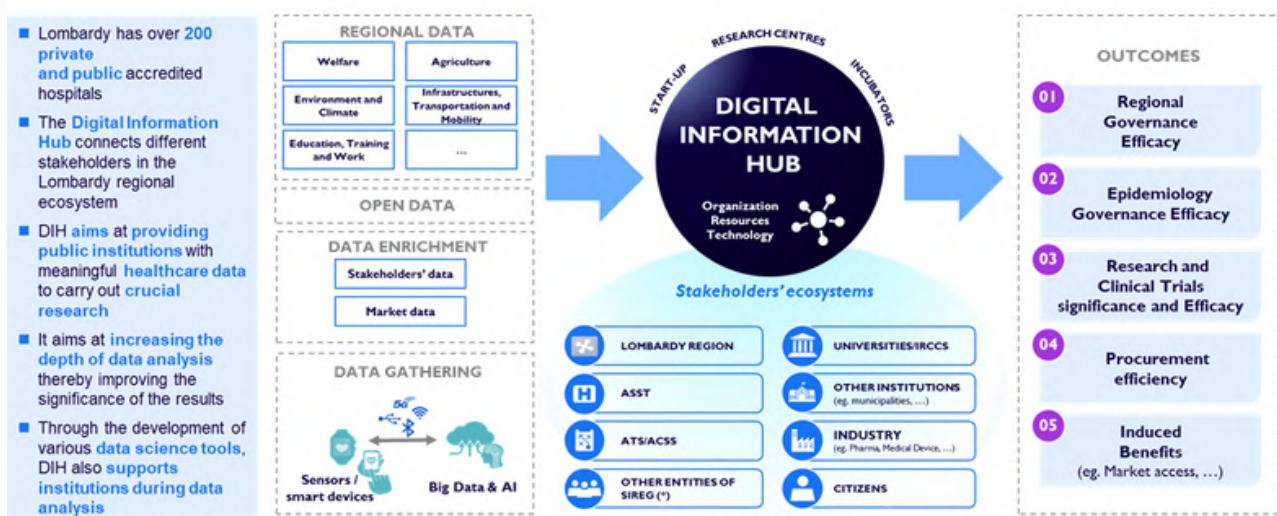
Shift away from digitalization of information, to digital health

Use cases of digital technologies in healthcare target a shift in the way information is received and processed in the healthcare system. The emphasis of emerging, scale based solutions is to move away from pure digitalization of information, and towards developing digital solutions in care delivery.

Health data, at the same time is diverse and collected across a variety of platforms in a complex healthcare ecosystem. Systemic sources of information could be supplemented by data and interpretation of physical testing / diagnosis.

The diversity and lack of unified structure in collected information represents challenges that can be addressed at scale. Connecting collected data from patients and filtering relevant information for clinical decision making is critical for efficient and effective care delivery. Availability of standardized, curated and accurate information regarding patient demographics, health history, prior complications, comorbidity status and severity are all critical decision points that can be integrated for clinical decision making.

Figure 3: Case Study - Lombardy Digital Hub for Health Data



Scale based clinical data collection and standardization can then support Health Information Networks and Exchanges that enable research activities such as clinical trials, payor optimization and transfer of information amongst different health information systems that may be in large scale use, in addition to supporting treatment decisions by physicians.

Remote Health and Virtual Care Delivery Becoming Mainstream

With patient care moving away from facility based treatments to virtual models, ecosystem trending towards maximizing care access to all patient groups and improving access to telecommunications infrastructure, multiple remote health and virtual care use cases are gaining significant traction globally. These include offerings across the entire spectrum of patient care – from tele-diagnosis and tele-consultations services which are lower complexity in overall delivery, to e-ICUs and Virtual Hospital concepts. Telemedicine, virtual hospitals, and e-ICU concepts have already seen mainstream traction, catalyzed by COVID-19 related travel restrictions and infection issues. In addition, the use cases for Telemedicine concepts also allow for lower cost higher volume countries like India to become referral centers for higher income, lower volume countries.

Figure 4: Case Example - E-ICU as a Virtual Care Platform



COVID-19 as a catalyst of change in Digital Health

COVID-19 has had a significant impact on the growth of technology and digital solutions across several use cases in healthcare globally. Solutions have, as a result of COVID, become more personalized, cognitive and integrated within the lives of patients and providers. Adoption of digital tools such as tele consultations, virtual diagnosis, digitalized mental health support, home testing and report generation, and e-pharmacies.

ADL's interviews with senior leaders indicates that a large number of the beneficiaries / early adopters of these programs have been patients with chronic ailments with a need for periodic follow ups and patients who require significant post-acute recuperative care, and other similar patients in vulnerable comorbidity groups

Emerging potentially scalable consumer use cases from key global case studies

AI ML Enhanced Decision Making and Automation:

A broad set of offerings powered by AI/ML applications in healthcare are gaining traction globally. First, supporting clinical decision making, diagnostics, laboratory and other direct care delivery aspects are getting increasingly automated. Diagnostic / lab review, decision making support short of consultations and other care delivery automation activities are under consideration. Second, AI and ML applications in non-therapeutic interventions in mental health and wellness are also areas of deep ongoing exploration. Third, AI/ML solutions automating and enhancing routine processes such as coding, logging, case tracking and documentation activities post procedure are also targeting efficiency and physician bandwidth enhancement opportunities. NLP applications in patient information capture through ChatBots, supporting preliminary self-diagnoses for pre-consultation reporting and pre-diagnosis / lab prep for patients also have the opportunity to enhance efficiency.

Health Personalization:

With a shift away from episodic care, towards preventative care, personalization of health is becoming a key focus area within the Digital Health space. Consumers of health services are also more aware than ever before. Personalized health solutions can therefore be a critical component of the overall preventative care approach in the market. Gamification and reward also ensure that digital healthcare is embedded deeper in the lifestyles of patients.

Several technological developments such as miniaturization and acceptance of wearable devices by the population support adoption of personalized healthcare. As technological maturity remains lower than the levels required to enable clinical interventions through wearable tech, the segment is currently restricted to higher level health data metrics, as other health sensor technologies become mainstream. Consensus estimates of growth in the wearables segment point to 13-15% growth over the next five years, with the market volumes set to grow three-fold over the next 4-5 years to close to 775 bn devices every year.³

[3] Mordor Intelligence

Figure 5: Case Example – Dacadoo, personalized HealthTech and InsurTech






Augmented Reality / Virtual Reality for Training and Care Delivery:

With COVID-19 creating significant travel barriers since 2020 and increasing prevalence of low-latency, high speed network connectivity worldwide, Augmented Reality / Virtual Reality based applications are gaining significant traction. AR/VR based healthcare training for physicians, specialized technicians and other clinical delivery staff are becoming increasingly mainstream globally, especially in surgical and other specialized therapy areas where availability of physical trainers may be limited. Mixed reality offerings also can offer not just the audiovisual experience but significant components of tactile feel in several therapy areas. In addition, patient linked use cases for AR/VR are also likely scalable and appropriate for management / enhancing functional outcomes in patients with behavioral and developmental disorders.

Predictive Modeling:

Capacity planning and surge flow management challenges at a healthcare system level have been brought to light by the COVID-19 crisis. Given facilities and policy makers now capture large amounts of data from clinical indications to case progression, geospatial data and clinical and non-clinical demographic data – predictive modeling may allow multi-factor analysis, identification of growth and evolution patterns in epidemiology to assess capacity requirements on a dynamic basis.

Figure 6: Use cases in Digital Health

Use of AI for detecting cardiac arrests	Home hospitals	Predictive modelling
 <ul style="list-style-type: none"> The city of Copenhagen has rolled out the use of Corti.ai in its triage centers to diagnose heart attacks using speech recognition Corti listens into emergency calls and uses a sound recognition software to alert dispatchers if it believes that a heart attack is in progress It can help dispatchers reach 92% accuracy when detecting out-of-hospital cardiac arrests and can detect cardiac arrest 30 seconds faster than human operators on an average 	 <ul style="list-style-type: none"> Health systems are supplementing their healthcare capacity by the creation of virtual hospitals to treat patients at their homes Home hospitals utilize telemedicine, AI, clinical decision-making software, remote monitoring as well as advanced analytics to provide continuous care to patients at their homes Home hospitals can improve the safety and quality of care, reduce readmissions and lower the capital and operating costs for hospitals 	 <ul style="list-style-type: none"> Electronic medical records are being used to detect patterns and estimate the number of hospital visits, number of patients who would return to the hospital within 72 hours, length of stay, etc. Researchers at St. Michael's Hospital in Toronto have developed an algorithm that can predict the no. of visitors in the ED with 95% accuracy depending upon the day of the week, relationship to major holidays, temperature and climate

Impact of Digital on Healthcare Operations from Select Global Case Studies

Digital health offerings are accelerating innovation and are deeply impacting procurement functions in the healthcare sector. Healthcare facilities tend to utilize a wide variety of consumables. A typical healthcare facility may stock several thousands of medical product types and SKUs within their inventory and ensure inclusion of tens to hundreds of thousands of SKUs within their overall formulary - for procurement and usage.

These products are also widely varied in their characteristics. Storage requirements such as temperature, humidity, lighting etc may vary significantly and have a direct impact on quality of clinical outcomes. Clinical shelf life may vary from a few months to a few years for products. Technological changes to products and delivery mechanisms may change. Product recall and safety management create complexity in supply chain management. Products varying from lower cost basic medications to high end, high valued medical devices, to legally controlled substances need to be procured, stored, managed and tracked through a unified ecosystem by healthcare enterprises. Critically from an enterprise viability perspective, procurement cost and pilferage risks may be high or prohibitive as well – which healthcare organizations need to balance. All these complexities necessitate a responsive, effective and adaptive supply chain management solution for healthcare players.

Big data and tech enabled use cases in procurement thereby potentially enable the adoption of value based procurement opportunities in the healthcare sector.

The Indian market has its unique share of challenges in this context, given the need for cost efficiency of the solution. Given lower affordability of healthcare in the country and lower penetration of health insurance among the population base, viability of specific use cases for supply chain management. Leading CTO / CIOs in the healthcare space in India, interviewed by ADL interactions make the case for data driven and digitally enabled procurement – but also highlight the criticality of:

- Right usage of hard technology for product identification and segregation based on criticality and value of the product vs investment required to collect information on product stocks / usage
- Standardization of materials for procurement
- Ensuring effective governance around the supply chain to ensure appropriate usage of materials
- Enabling genuine integration with financial systems and usage of tech platforms as their core
- Transition planning from non-digital approaches to digital approaches
- Ensuring multidisciplinary team engagement at solution design phase and training of workforce to ensure alignment with targeted procurement outcomes

**Indian Digital Health
Landscape & Demystifying
the “Indian Digital
Health Consumer”**

Overview of the key constituents of Digital Health in India

Most prominent and mature digital health platforms in India have historically targeted enhancement of front end consumer facing activities within the care pathways. Penetration of services have largely centered around peripheral activities to core healthcare delivery. Activities such as scheduling of visits and appointments, physician / practitioner identification, home diagnostics / sampling, case history management have seen traction in the Indian marketplace.

Four broad categories of product suites largely exist in the consumer facing activities:

- Integrated Health Provider Applications – cover a wider variety of healthcare activities – from Physician selection, appointments, lab and testing, medical records and other associated core healthcare delivery services. Allied services such as claims and payment management, billing etc may also be provided. Primarily developed by large scale players with significant capacity, geographical outreach and internal system maturity to support integration of offerings. Targeted value proposition for these applications is to ensure customer stickiness, patient relationship management, and long term convenience for patients – especially for chronic care cases.
- Service Specific Health Provider Applications – cover a limited but selective offering of specialized services such as labs, diagnostics, dentistry etc. with key services including scheduling, home pick up of samples and report delivery. Targeted value proposition for these applications is largely to expand outreach and enable wider patient capture on a shorter term basis
- Integrated Health Aggregators – cover a wide variety of services including consultation scheduling, tele-consultations, lab sampling, diagnostics selection etc. but with no / limited support from brick and mortar infrastructure under own umbrella. Primary focus is to enable differentiation through better information sharing with patients and their family members.
- Service Specific Health Aggregators – Cover narrow / niche segments of care delivery and operate as information sharing platforms with consumers, with aggregation within a limited service set.

Figure 7: Examples of Healthcare Application Categories Prevalent in India (Illustrative)

	Aggregator	Healthcare Provider	
Integrated Health			<ul style="list-style-type: none"> Covers broader care pathway activities such as consultation scheduling, lab, diagnostics, physician reviews etc Largely developed as in-house platforms / solutions by scale oriented groups
Service Specific			<ul style="list-style-type: none"> Limited services such as diagnostics, fitness, home sampling, e-pharmacy etc Servicing a limited part of the care pathway and little-to-no overall linkage and outcomes
	<ul style="list-style-type: none"> No / limited direct healthcare provision Plays a role to inform customer and/or provide interface services 	<ul style="list-style-type: none"> Direct healthcare provision Augmenting brick-and-mortar care delivery through digital 	

From an operations standpoint, a variety of digital offerings have been deployed by healthcare providers in the country. These span from information management applications such as HIS platforms, Supply Chain Management and Vendor Management platforms, to integrated financial and Management reporting systems.

ADL survey findings on Digital health adoption and acceptance amongst the Indian consumers

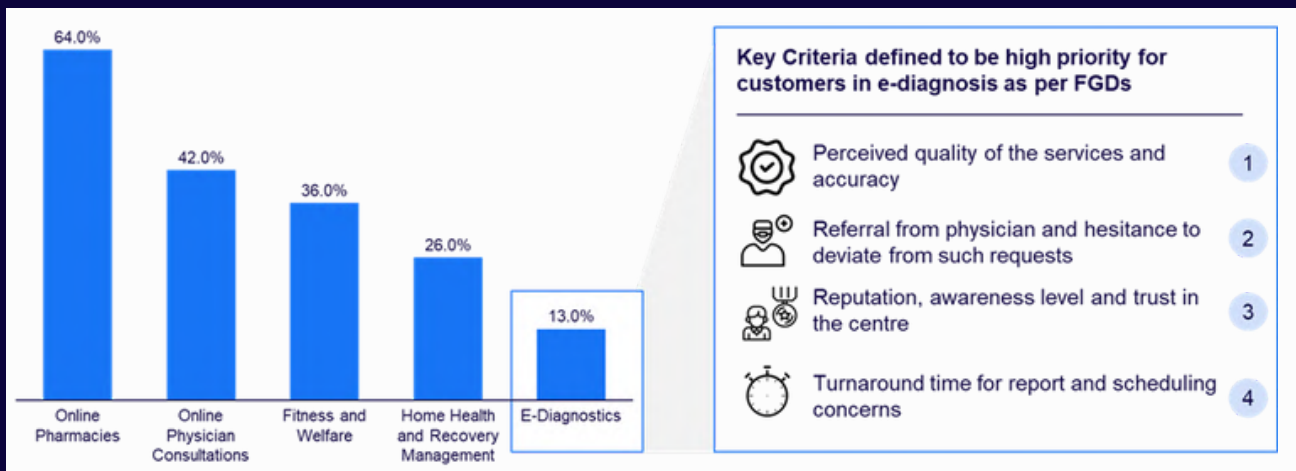
In order to understand the core drivers underpinning the digital health consumer in India, ADL commissioned a broad-based consumer survey administered across the country. Longitudinal data collected from prior surveys and Focus Group Discussions were also used to draw upon recent trends and validate findings and understand trends.

Several key trends have been observed in the customer survey that starkly bring to light the behavioral trends observed amongst Digital Health consumers in India.

- 1. Deep penetration of Digital Health solutions in the Indian consumer market, with significant headroom for growth.** ADL's survey indicated significant traction amongst consumers on the use of online pharmacies, physician consultations, fitness and wellness applications. All of these applications observed between 35-65% acceptance amongst customers who utilize e-commerce services. This indicates that as many as 400 million Indians already have experience utilizing healthcare services.

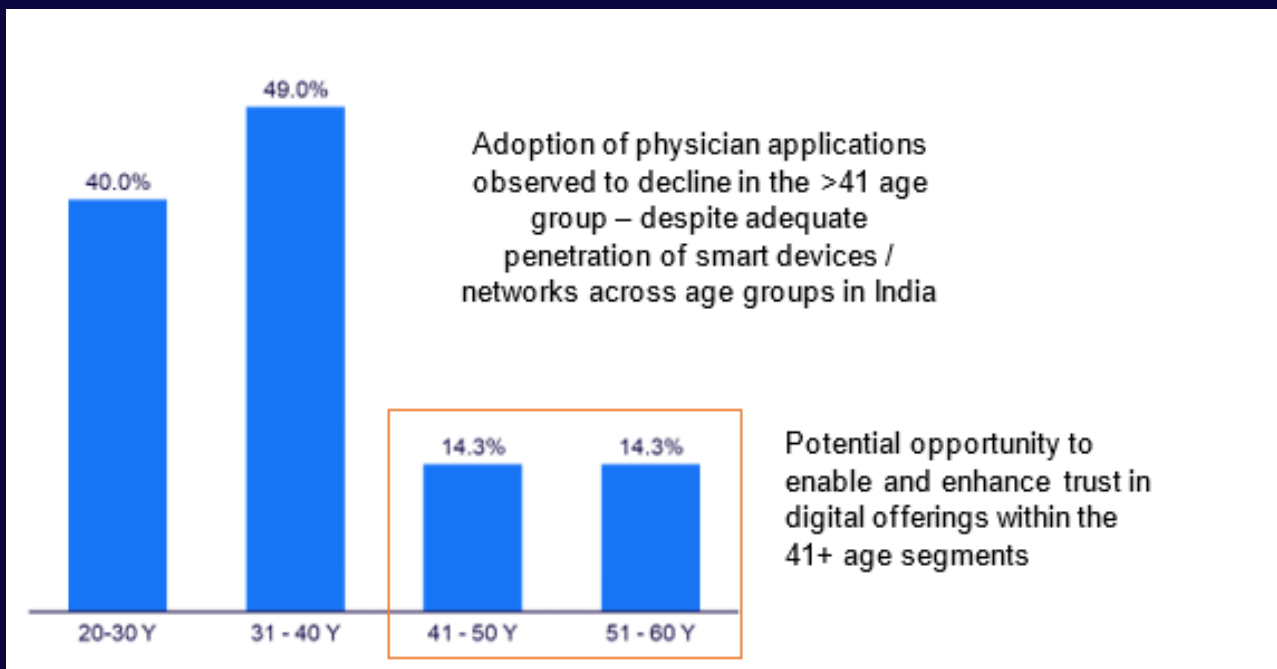
This indicates that as many as 400 million Indians already have experience utilizing healthcare services. Specifically in case of online pharmacies, experiential similarity vis-à-vis e-shopping and online retail, already deeply penetrated in the . Lower traction in E-diagnostics – understood to be on account of perceived quality and accuracy of diagnoses, patient desire not to interfere with physician recommendations, and the facility operations (turnaround time, reputation etc.)

Figure 8: Digital Health Offerings Usage Amongst E-Commerce Users



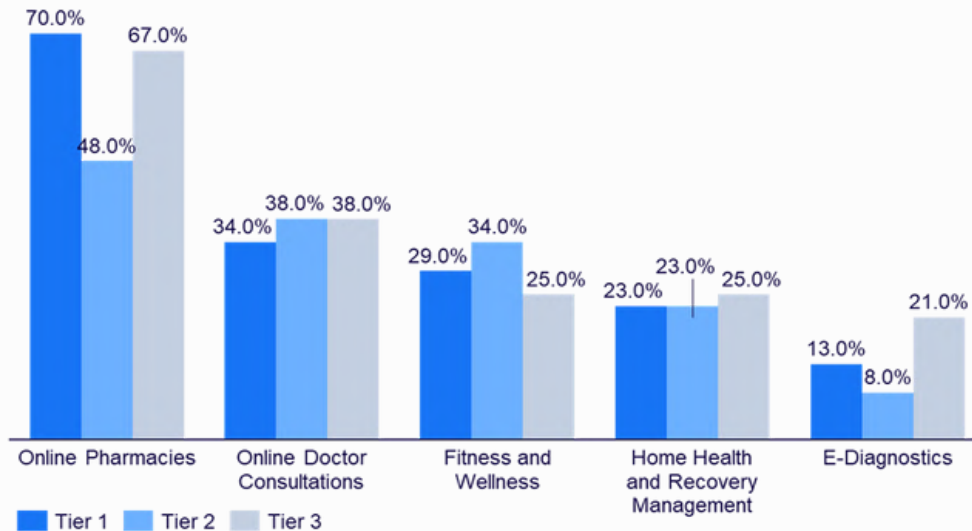
In addition, a clear divide is visible amongst the key age groups in the acceptance of digital health tools – with the 40+ segment being about 1/3rd as likely to use digital tools, largely because of familiarity and tool awareness amongst the younger population. The opportunities do remain relevant for this segment given routine health examinations and lifestyle ailments start to emerge amongst the population within the 41-50 y age bracket.

Figure 9: Doctor consultation adoption preferences by age group



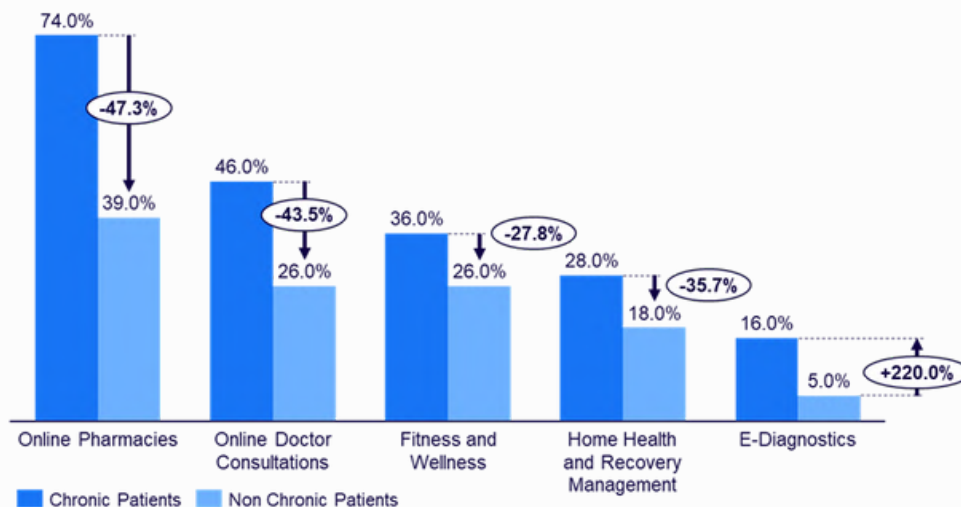
2. Larger value pools in Tier 2 and 3 cities are becoming more evident for Digital Health Offerings. With the exception of adoption of e-diagnostics and online pharmacies which have some variance, all tiers of cities are observed to have comparable degree of adoption for digital services indicating that the technology divide prevalent in the past in India is now abating. Tier 2 and 3 customers are also becoming increasingly aware of the benefits of digital technologies in healthcare and now demand conveniences from digital health offerings.

Figure 10: Adoption of Digital Health Offerings in Tier 1, 2 and 3 Cities in India



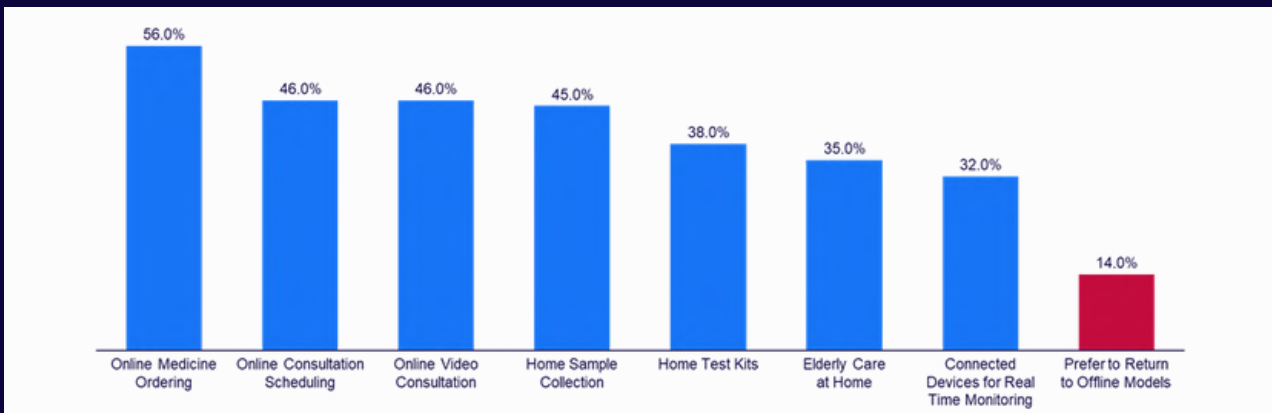
3. Stickiness is high, patients using digital healthcare services more frequently tend to keep using them. Significantly higher adoption of digital health tools were reported by patients who had long term disorders / ailments such as CV disease, diabetes, hypertension or allied indications. These patients tend to use healthcare services more regularly and in a more organized manner. As these patients adopt digital healthcare solutions and appreciate value, they keep utilizing platforms more and more. Digital Health solutions must therefore target greater usage of digital tools and track the value of health information communicated to the consumer pool.

Figure 11: Adoption of Digital Health tools by Patient Type



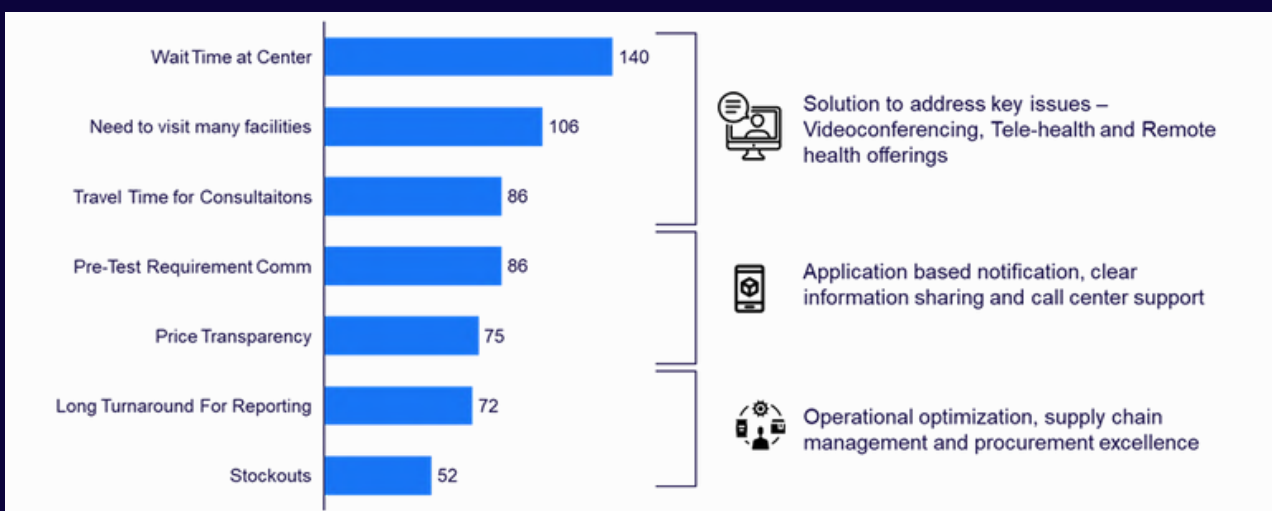
While chronic patients do appear to have a higher degree of adoption of digital health tools, COVID appears to have catalyzed sustained use of digital healthcare tools in the country. Patients were initially compelled to utilize digital channels for care needs due to movement restrictions and infection risks. However, as benefits of digitally enabled healthcare delivery were actively perceived, these are now increasingly considered as necessities. It is no surprise that once consumers got accustomed to using digital health services, only ~14% of respondents indicated the preference to go back to offline modes for health.

Figure 12: Post COVID Preferences for Use of Digital Health Applications



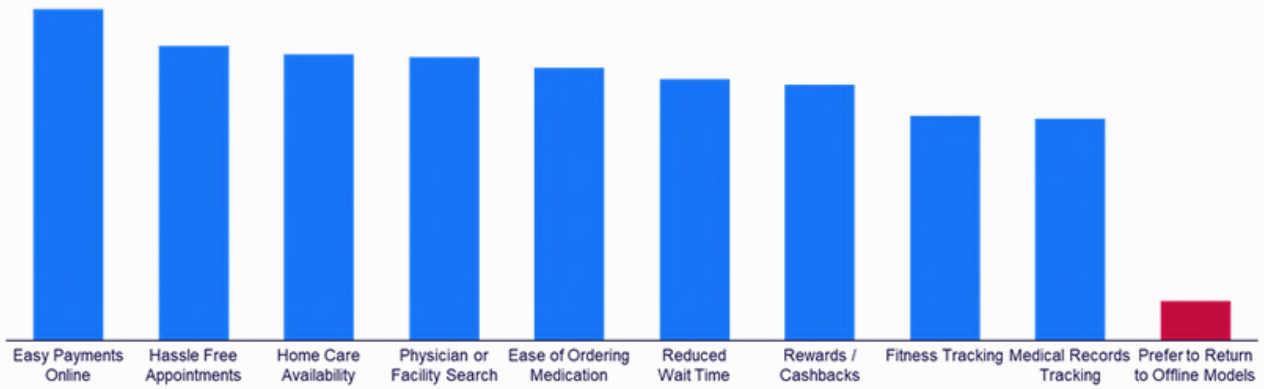
4. Seamless integration across the consumer journey will be critical for success. Key pain points for consumers remain in the brick and mortar components of health – things that can potentially be resolved through digital health offerings, but only if deeper integration of tech-solutions with Brick and Mortar care delivery are made. Physical interactions if minimized either through implementation of Videoconferencing, Telehealth or remote healthcare solutions, or through application based updating and support, or through operational transformation to ensure ready access to findings and medical supplies can also be enabled digitally.

Figure 13: Key Pain points identified by consumers in healthcare services
 (# of respondents)



In addition to the above, several experiential and non-transactional aspects of digital care delivery are considered to be important by customers.

Figure 14: Customer reasons for remaining on digital platforms



5. Patients have a predominant preference for integrated applications providing the whole spectrum of healthcare offerings

Figure 15: Integrated Application Preferences – Focus group discussion findings

Insights from FGDs								
	T1	T2	T3		T1	T2	T3	
Type of App	Integrated healthcare app			At-home diagnostics	●	●	●	
Health records management	●	●	●	AI & ML based diagnostic reports	●	●	●	
Smart reports with test interpretation	●	●	●	Subscription plans & loyalty benefits	●	●	●	
E-Pharmacy	●	●	●	Personalized diet tips based on test results	●	●	●	
Fitness tracker	●	●	●	Therapeutics	●	●	●	
Genetic Testing	●	●	●	Health advisor	●	●	●	
Medication reminders	●	●	●	Self testing kits	●	●	●	

● Very Strong
 ● Strong
 ● Moderate
 ● Weak
 ● Very Weak

Digital Health Opportunities in India



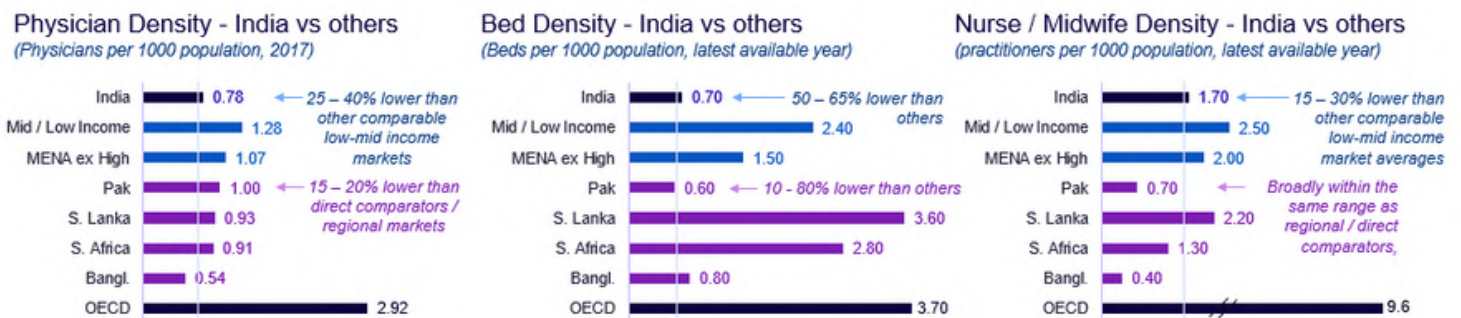
The case for at-scale digital adoption in India

The Indian healthcare system faces several structural and strategic challenges which create opportunities for novel and innovative healthcare solutions. India's healthcare capacity – both in terms of infrastructural capacity and caregiver coverage remains behind regional and international benchmarks.

In terms of Bed Density, India currently ranks lower than both international benchmarks, as well as a majority of regional economies. This is compounded by the fact that in Tier 2/3 cities and below, healthcare systems and access are significantly challenged and undersupplied.

From a care delivery staff perspective as well, India is largely under-resourced to deliver care to its citizens, as compared to international as well as regional benchmarks. Plugging these gaps conventionally may require incrementally training and developing thousands of physicians, nurses/midwives and other clinical staff, likely a herculean challenge given the time required to educate, train and nurture a high performing healthcare practitioner and the limitations that exist in health education infrastructure in the country.

Figure 16: Key healthcare metrics - India and Comparators



At the same time, significant strides have been made in the recent past in India from a utility infrastructure (Power access, water access etc), telecommunications infrastructure deployment and information access perspective – which create an effective foundation for digital health platforms and solutions to be established on. India now boasts the second largest number of cell phones anywhere in the world and smart device penetration stood at about 54% in 2020, up from only 22% in 2016. With omnipresence of low cost smart devices, penetration is expected to reach near full saturation by 2030-2035. India also had amongst the highest data usage globally, at about 12 GB per month per user in 2020, a number which is expected to double by 2025. As 5G network access becomes accessible to urban centers, the digital revolution in healthcare will have an effective connectivity backbone.

Potential impact of Ayushman Bharat Digital Mission deployment

In addition to the hard infrastructure and supporting connectivity related interventions that have progressed rapidly in the recent years, healthcare policy has also aimed at creating a foundation for digital healthcare innovation in India through the Ayushman Bharat Digital Mission (ABDM) program. ABDM primarily aims to improve the quality and knowledge base of the healthcare sector in India in a consistent, unified and standardized manner.

The ABDM Program is critically important for the digital health platforms in India to affect a step change. With a primary objective to establish a health data capture framework, the program can support an eventual development of a 'single source of truth' for personal and facility level health data across the entire population.

The core of the ABDM program is the Unified Health Interface (UHI) framework. In order to eventually support and sustain an insurance covered healthcare model, having a reliable source of data and leveraging it to analyze performance and drive improvement is critical.

As information travels across the continuum of care, it becomes difficult to measure health care quality and healthcare facility performance. All health stakeholders and policymakers require a consistent data foundation that delivers actionable information from a consolidation of various data sources. The UHI is targeted at precisely that.

- UHI aims at streamlining the digital health service experience for the providers of health service and the patient by establishing and standardizing the technology pathways that enable such services to be given.
- UHI is envisioned as an open protocol for various digital health services. UHI Network will be an open network of End User Applications (EUAs) and participating Health Service Provider (HSP) applications.
- UHI would enable interoperable connections over a nationwide decentralized open, secure and inclusive network. It will use Registries in NDHM, that keep a list of the entities participating in the network and Gateways that enable entities to communicate using the standard protocols.

Enabling safe storage and easy access of medical records, ensuring access to accurate information on healthcare providers will allow better decision making by the Government. Geography and demography based monitoring and effective evaluation of various programmes and interventions can be affected depending on patient outcomes.

The overall architecture of the program includes a 4-layered structure (principally) with

- Public digital goods such as Aadhar for patients, Facility Registry for Hospitals, Professionals registry for practitioners in order to create unique identification databases as the foundation layer
- Health data at both patient, practitioner and facility level to be collected and maintained in the overall
- Unified health interface to enable consistent and secure access to relevant health information
- User applications such as Aarogya Setu and other cases to deploy solutions that accept information from the UHI layer.

The program, upon full implementation, has the potential to realize several benefits to stakeholders across the healthcare ecosystem. Specifically for key participants of the healthcare ecosystem, there may be several opportunities:

- For Patients – a singular and consistent clinical history will enable better diagnosis, comorbidity management, easier case reviews and second opinions, better availability of health data resulting in diversified and lower health premia, reduced transaction time and costs for health insurance and systematic tracking of health progress
- For Healthcare professionals – collecting standardized and unified health information will enable better clinical decision making, greater data availability for patient treatment, better and easier assessment of clinical risks and easier and more streamlined clinical protocol monitoring
- For Healthcare providers – Enabling community partnerships, easier linkage with governmental and social programs as they get deployed, greater access to patient pools, better clinical risk monitoring, better morbidity management / tracking and enhancing competitiveness vis-à-vis other market participants. Effective data use can also enable catchment expansion for high quality and efficient facilities, reduced marketing and patient outreach costs resulting in increased visibility of the hospitals' doctors
- For Health Insurers – Optimizing the insurance life cycle, as adopting the health ID as a patient ID could enable consent based access to linked health records. Opportunities in policy portability and information exchange Allowing patients to link a single health ID to multiple provider and insurance IDs for cross insurer consistency checks and fraud prevention. Optimization in policy premiums for lower risk/healthier individuals and enablement of addition of more diversified and larger risk pools.

- For Researchers – to enable clinical variations for enhancement in care pathways, new product development, clinical trials management and selection, and outcomes enhancement
- Policy makers – effective capacity tracking and monitoring, surge capacity management, redirection of policy initiatives towards emerging areas of lacunae.



Opportunities across the care continuum for digital health and services in India

Opportunities that are created by ABDM to make healthcare delivery in India much easier and faster by leveraging information and communication technology. Given the market gaps and digital access enablement for external solutions – coverage and capability improvement measures may represent significant growth opportunities in the Indian marketplace.

Use cases that can likely see good traction in the market could center around:

1. Digitally enabled home healthcare, chronic care, and extended care:

Home healthcare for chronic diseases and lifestyle ailments may offer potential for digital enhancement. Patients and families of patients have historically relied on fragmented and unstructured recruitment of home healthcare practitioners through personal networks, regional ads etc. Aging and life expectancy increases have resulted in increasing clinical care provided in a home setting. These services can be potentially aggregated and provided in a structure like ad hoc workers.

Several use cases emerge in geriatric care and home healthcare involving the use of IoT and wearable devices. GPS Devices to track and monitor geographical position of patients through portable devices that may be affixed to patients' clothing or person can assist caretakers in cases of patients with cognition challenges. Geofencing also allows alerting caregivers to patients leaving / crossing certain thresholds/boundaries. Tracking patients on an active basis also allows patients freedom in movement within and outside facilities while retaining the ability for caregivers to find and assist in case of any emergencies.

Wireless Home Monitoring technology solutions are also becoming increasingly mainstream as streaming video devices become more miniaturized, more energy efficient and better networked even in markets with lower disposable incomes like India. These technologies allow caregivers to identify and monitor patient behavior and in-home appliance usage to minimize risks associated with injuries, enables greater household safety and speedier response in case of adverse events.

2. Preventative care enabled through use of IOT devices:

Wearable sensor technology to track routine activities such as walking patterns, location and positioning, fall / injury detection, emergency messaging / SOS, heart rate or vitals monitoring also enable caregivers to provide and extend care to larger patient pools, in addition to providing more customized care and monitoring to specific cases. IOT devices are becoming increasingly affordable – especially wearables and are gaining traction among the population – with wearables alone registering growth of 93.8%⁴ by volume with large market share captured by value segment players like Noise, boAt, Realme and other players launching products in the affordable INR 3,500 – 6,000 range. Collected data from sensors over a period of time – if collected in a platform approach – can be used for preventative care rather than responsive care as well.

3. EMR Adoption and Diagnostic data integration:

EMR adoption is the next digital frontier in Indian healthcare, primarily driven by the Ayushman Bharat Digital Mission. The next wave of growth in medical data generated from HIS systems is catalyzing the next iteration of care delivery – utilizing Big Data and Evidence Based Care.

Applying big data analytics and evidence based care principles to enable:

- Precision medicine - Utilization of research and centralized data to promote enhanced diagnosing & personalized patient care
- Safety practices - Use of predictive analytics to promote quality care and patient safety (e.g. Infection risk monitoring)
- Population health management - Utilization of analytics for use in epidemiology. (E.g. Linking EMRs with GIS to identify healthcare trends in specific areas)
- Readmission Analytics - Analysis of EMRs reveals trends that highlight patients likely to need additional treatment to prevent readmission
- Data security - Securing medical records by identifying changes in network traffic or behavior that indicates a cyber attack
- Insurance claims - Improve the efficiency of medical insurance claims by revealing claim trends and streamlining claims processing
- Consistency and standardization in data being collected from diagnostics can also allow longitudinal tracking of key biomarkers and

[4] IBEF, Medical Devices Industry in India

4. Tech-enabled capacity augmentation:

Concepts such as e-ICUs and Virtual Hospitals (some of which are already under pilot deployment with startups/large healthcare groups) enable efficient deployment of critically scarce intensivists and at the same time enable asset-light operations in the conventional healthcare delivery approach. e-ICUs and Virtual hospitals may allow several advantages⁵ over conventional facilities. Lowered headcounts (on a per patient served basis) for highly trained and skilled intensivists, reduced risk of nosocomial infections due to lower contact, reduced hard capex cost in 'real estate' components of healthcare provision, and at the same time superior distribution of super-specialty intensivists' capabilities across a wider group of healthcare facilities or geographical centers.

Consultations in India represents another opportunity to pursue digitally – both for Primary Care Visits as well as post care follow up discussions. Digitally enabled consultations and post care follow ups could represent a significant opportunity.

India is also a significant healthcare destination from a Medical Value Travel (MVT) perspective. Historically, India's positioning as an MVT destination has been largely on account of the high quality and deep experience of physicians practicing in the marketplace, significantly cheaper cost of care on a dollar-to-rupee basis and soft-power presence of India as a nation. Opportunities exist for digital health to provide pre and post procedure support through digital offerings.

5. Scalable supply chain and aggregated value-based procurement solutions:

Developing aggregated but scalable solutions. Healthcare provider networks in India straddle a large spectrum of capability areas and sizes – from single facility family-owned healthcare organizations to integrated and broad-based chains with dozens of hospitals operating thousands of beds across multiple cities exist in the marketplace. Smaller players represent opportunities to aggregate supply chain services under a data and digitally enabled umbrella.

6. Predictive / prescriptive digital supply chain management solutions:

For large scale players, standardization is a critical factor enabled by digital offerings. Processes, such as procurement of any materials, their management and tracking, need to be made consistent across network(s). A universal approach leads to effective supply chain and vendor management as systems move to a central procurement management model across the entire spectrum of supplies.

[5] National Center for Biotechnology Information (NCBI) - Electronic intensive care unit: A perspective amid the COVID-19 era

Such systems if executed well can also provide necessary checks from a supply chain governance perspective. Systematic tracking to prevent pilferage and misuse of items can lead to significant revenue losses. Systems should also be integrated to the financial systems such as invoicing and digital payments. Integration and automation of supplier reviews and consolidation of supply also supports in maintaining relationships with vendors and suppliers.

7. AR/VR based training in specialized care:

AR/VR based applications represent opportunities for a variety of training and capability development sessions. For low complexity physician education programs by pharma and medical devices companies, pure AR / VR solutions may suffice. However, for more technically complex medical devices / implant-based training and development activities, Mixed Reality applications are also emerging – reducing the training gap vis-à-vis real life, by enabling physicians and care givers to gain tactile experience in addition to audiovisual experiences.

8. Digitally enabled aggregation for standalone facilities:

A large majority of India's healthcare system is disaggregated and consists of standalone facilities. These facilities may not have the scale to reap benefits from digital health enhancements even if they choose to invest. Capabilities to effectively deploy effective and integrated digital health solutions in these facilities may also be a constraint in a large majority of such facilities. Nor will it be easy for smaller facilities to comply with or leverage unified health information structures as will be rolled out under the ABDM program. This represents a clear opportunity for HealthTech enterprises to potentially develop modular, scalable, customizable, and easily implementable solutions for such players.

Similar opportunities also exist in digitally enabled supply chains and procurement value creation initiatives as well. Standalone facilities may have demand variabilities and challenges in integrating digitally with suppliers. These may also not have right capability set to push value-based procurements concepts viably. However, intermediaries who can aggregate and have ability to digitally interface with both suppliers and consumers, can potentially allow for smoothening and predictability, managing economic order quantities and enable efficiencies in procurement.

9. Other medium-to-long term opportunities

In addition, several other opportunities can be digitally enabled and made more effective. Digital loans, funding linked to clearly defined digital readiness and easier financing access can allow health organizations to invest in digital and improve their “Digital IRR”. However, this may require the digital health ecosystem in India to become more formalized and digital health plays become more standardized and segregated.

As digital penetration starts to hit critical mass, the middle- and lower-income segments in India will also start to become viable from a service delivery perspective. These segments already have growing penetration of smart devices and platforms to support digital health. With increasing availability and critical mass, the fortune at the bottom of the healthcare pyramid in India can become digitally accessible also.

Over the longer term, as overall health delivery system matures, India may move towards coordinated health, and eventually towards a managed health network. However, this will require the entire ecosystem to be able to exchange information on a common framework – something that will be enabled through digital health offerings.

Innovation & Digital Imperatives for the Indian Healthcare Ecosystem

India presents a unique opportunity of having a vibrant existing Digital Health user community of 400 million. With the further penetration of smartphone, 5G adoption and service provider innovation, by 2030 India could easily have over 1 bn Digital Health users. This will help catalyze a transformation in the Indian healthcare creating the platform to provide quality, affordable care to all Indians. The government has also created a scalable technology architecture (through Ayushman Bharat Digital Mission) for healthcare ecosystem players to drive technology-led transformation of the sector. The healthcare industry now needs to step up and break-through the digital divide. To realize the full potential of Digital Health, we propose the following imperatives for the various industry stakeholders:

Providers need to rethink their approaches towards digital health. Unlike a historical focus on utilizing digital as a 'good to have', digital will now become a 'must have'. Specifically, healthcare providers will have to be "Digital First" at a strategic level. Unless they do so, providers will run the risk of being disrupted by digital interventions, entrepreneurs, and competitors. The offerings that providers create need to be deeply integrated as well. Integration, as is evident from consumer behavior trends, is a critical requirement to capture and retain the consumer base over the long term. At the same time, digital should not just be considered as a front-end / patient interface activity.

Cost effective healthcare delivery and capturing efficiency gains from investments is also critically important. This will require developing digitally enabled supply chains that are able to tide over disruptions, allow consistency in a difficult market like India, and are a scalable and efficient

While Regulators and Policy Makers have taken steps in the right direction, they will also need to become the system's conscience as Digital Offerings are rolled out. The most critical imperative for the policy makers will be to ensure the program is governed effectively and appropriately. Data access, availability and privacy are concerns of global consequence and with greater consumer awareness, it will be necessary for the regulators to be the custodians of the health data generated. Regulators will need to play an active role in a) being an ombudsman looking to balance compliance with the prescribed standards and, commercial and policy support considerations and b) supporting new and incumbent digital player to garner and secure funding for HealthTech startups.

Likely the most critical role in the transformation will be played by Investors and Startups. As the startup ecosystem and linked investor base starts to deploy resources aggressively in new product and service line development and new ventures targeting digital health opportunities, an attractive and independent ecosystem could gradually emerge supporting Digital First offerings will be critical. These will require to be nurtured and effectively managed by the investor group. Investors will also need to consider digital ability as integral in their deal flow and screening processes and not just an incremental differentiator. In parallel, the startup ecosystem needs to integrate and penetrate brick-and-mortar healthcare delivery as well, to enable access to care.

However, a “Digital First” investment / resource allocation approach should not become a “Digital Only” approach for investors and health tech startups. True integration is only possible with both the digital realm and brick-and-mortar realms being seamlessly integrated. Ensuring investment / M&A targets will need to be screened and scored on a Canada visa. All of these should be targeted at developing an attractive, independent, and lucrative investment ecosystem for investment in health, health tech or digital health trends.

Digital health should also be considered by investment houses during the deal evaluation, deal assessment and eventually, a value creation plan. Financing digital health innovations and platforms through greater emphasis on HealthTech and InsurTech startup ecosystems.



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