

Domain : Healthcare

19th Aug 2024, Session 6

Health care Sector: News



FE Home Healthcare Interviews Diagnostics Health Tech

Healthcare Journey

A major challenge confronting healthcare startup is securing access to hospitals for testing, designing, and positioning their services.

Written by [Guest](#)
February 29, 2024 12:00 IST



hospital settings. And we are now seeing an increasing trend of startups addressing clinical management, in-patient care solutions, disease detection & cure, and medical devices.

This trend is particularly noticeable in the MedTech sector which entails the development of devices and equipment to improve patient care. Historically, a very large portion of any hospital's higher-end equipment and devices have been imported, but the revitalized focus on manufacturing, via the '[Make in India](#)' initiative, adds to the promising outlook for the growth of MedTech startups.

Two pivotal factors that have hindered, and if addressed, can greatly boost the growth of MedTech in India startups in India: Enhanced access to hospitals for testing and deployment, achieved through strategic interventions, and Availability of "patient" capital specifically tailored to the unique challenges of the healthcare sector. potentially sourced from within the healthcare

Our Healthcare Expert

The image shows a guest session flyer for Dr. Raghavendran L. at the Desai Sethi School of Entrepreneurship. The flyer features a blue header with the Indian Institute of Technology logo. Below it, the title 'ENT 603 : INTRODUCTION TO ENTREPRENEURSHIP' and 'GUEST SESSION' are displayed. The main title 'HEALTHCARE LANDSCAPE' is in large orange letters. A portrait of Dr. Raghavendran L. is shown in a yellow-bordered hexagonal frame. His title is 'DR. RAGHAVENDRAN L.' and his role is 'OPERATIONS LEAD KOITA CENTRE FOR DIGITAL HEALTH'. A brief bio states he is an experienced data analyst with a decade of expertise in bioinformatics, applying AI/ML to drive healthcare innovation. Another section highlights his ability to extract insights from complex data and implement secure solutions. The event details are 'MONDAY, AUGUST 19 7:00PM-8:30PM LA 002'. The bottom right corner features the 'INSTITUTION'S INNOVATION COUNCIL (Ministry of Education Initiative)' logo.

DESAI SETHI
SCHOOL OF ENTREPRENEURSHIP

ENT 603 : INTRODUCTION TO
ENTREPRENEURSHIP

GUEST SESSION

HEALTHCARE LANDSCAPE

DR. RAGHAVENDRAN L.

OPERATIONS LEAD
KOITA CENTRE FOR DIGITAL HEALTH

DR. RAGHAVENDRAN IS AN EXPERIENCED DATA ANALYST WITH A DECADE OF EXPERTISE IN BIOINFORMATICS, APPLYING AI/ML TO DRIVE HEALTHCARE INNOVATION.

KNOWN FOR EXTRACTING INSIGHTS FROM COMPLEX DATA AND IMPLEMENTING SECURE SOLUTIONS TO ENSURE DATA INTEGRITY. THRIVES IN DYNAMIC ENVIRONMENTS, CONSISTENTLY DELIVERING HIGH-QUALITY RESULTS IN CHALLENGING SITUATIONS.

MONDAY, AUGUST 19
7:00PM-8:30PM
LA 002

INSTITUTION'S
INNOVATION
COUNCIL
(Ministry of Education Initiative)

Education

Bachelor's , Physics
Master's, Bio-physics
Advanced Diploma, Bioinformatics
Doctorate, Max Planck Institute
(Bioinformatics, Computational Bio)

11 years of Post-Doc Research

Lifelong Learner

Expertise

Data Analyst
Leveraging AI/ML solutions for clinical decision making
Insights from complex healthcare data



Healthcare: Landscape and Opportunities

Dr. Raghavendran Lakshminarayanan,
Operations Lead / Senior Program Officer,
Koita Centre for Digital Health, IITB.





IIT Bombay - Koita Centre for Digital Health (KCDH) Overview

July 2024



Koita Centre for Digital Health (KCDH) at IIT Bombay



- Established at IIT Bombay in 2021, first-of-a-kind Centre for Digital Health in India
- Focus on creating a robust ecosystem for Digital Healthcare in India, by:
 - Addressing the need for **engineering and clinical professionals and entrepreneurs** in Digital Health
 - Creating **research and employment** opportunities in Digital Health
 - **Partnering with leading hospital systems, healthcare research and academic organizations** which have strong capabilities in different branches of medicine and healthcare
 - Supporting **roll-out of the Ayushman Bharat Digital Mission (ABDM)** in India
- Supported by Koita Foundation (www.koitafoundation.org), led by IIT Bombay alumni Rekha and Rizwan Koita

KCDH: Transforming Healthcare Through Partnerships

Engineering and Math Expertise:

- Computer Science
- AI / Machine Learning
- Large Language Model
- Image processing
- Statistics / Analytics
- Electronics
- Bio-Engineering

Digital Health Vision

To become a globally renowned Centre in Digital Health and Health Informatics. The Centre will drive research, entrepreneurship and employment in Digital Health to transform healthcare in India, partnering closely with clinical professionals and healthcare organizations.

Clinical and Pharma Expertise:

- Medicine
- Biology
- Physiology
- Mental Health
- Pharmacy
- Diagnostics

KCDH: International Advisory Board

KCDH is proud to have a world class advisory board with renowned members from diverse backgrounds including the CEOs and ex-presidents of leading global medical technology firms, directors of renowned hospitals and professors from top universities of the world.



Prof. Anurag Mairal,
Adjunct Prof, School of Medicine
Stanford University



Dr Basant Garg, IAS officer,
Additional CEO, National
Health Authority



Prof. Bhramar Mukherjee
John D. Kalbfleisch Collegiate
Professor of Biostatistics, Univ of
Michigan School of Public Health



Clark Golestani,
Ex-President, Emerging
Businesses & Global CIO,
Merck



Dr. C S Pramesh
Director, Tata Memorial
Hospital



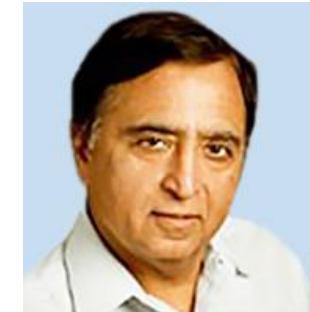
Dr. Devi Prasad Shetty
Chairman, Narayan
Hrudayalaya Limited



Dr. Kip Webb, Ex-MD
Accenture, Faculty at University
of California, Berkeley School of
Public Health.



Dr. M. Srinivas
Director, All India Institute
of Medical Sciences



Prof. Narendra Ahuja
Electrical & Computer Engg,
University of Illinois



Dr. Nitish Thakor
Professor, Biomedical Engg,
Johns Hopkins University;
National Univ of Singapore (NUS)



Dr. Shravan Subramanyam,
Advisor, Healthcare & Med-
tech Investments

KCDH: Adjunct/Visiting Faculty

KCDH engages extensively with experts from the Digital Health field



Dr. Bharat Aggarwal,
Max Healthcare

Expertise: Radiology AI, Image post processing, Cognitive Disorders of Brain and Oncology, Radiomics, and Teleradiology



Prof. Kaustubh Patil,
Forschungszentrum Jülich GmbH

Expertise: Applied Machine Learning, neuroimaging, and precision psychiatry



Prof. N. R. Jagannathan,
KCDH IITB

Expertise: Cancer research using molecular imaging, and MRI and MR spectroscopy studies on breast and prostate cancers



Dr. Nirmal Punjabi,
KCDH IITB

Expertise: Cancer research using molecular imaging, and MRI and MR spectroscopy studies on breast and prostate cancers



Prof. Raghu Machiraju,
Ohio State University

Expertise: Data analysis and visualization in biology, medicine and engineering, Biomedical informatics, and Computer graphics



Dr. Sandip Mandal,
KCDH IITB

Expertise: Infectious disease epidemiology, addressing policy-relevant questions using mathematical and statistical modelling, and Public health



Dr. Smisha Agarwal,
Johns Hopkins University

Expertise: Health Systems, Primary Healthcare, Community Health Worker, Natural Language Processing, Chatbots, and Digital Health



Prof. Yogesh Rathi,
Harvard Medical School

Expertise: Diffusion MRI, Computer Vision, Machine Learning, Statistics, Particle filters, Control systems, Graph Theory, and Biomedical image analysis

KCDH: Multi-Disciplinary Faculty Team



Prof. Ganesh Ramakrishnan
PIC, KCDH



Prof. Dr. Kshitij Jadhav (MD, PhD)



Prof. Saket Choudhary

IIT Bombay Faculty from 20 Departments Associated with KCDH			
Prof Ganesh Ramakrishnan, CSE (PIC, D, P)	Prof Amit Sethi, EE (P)	Prof Neeta Kanekar, BSBE	Prof Kaustubh Patil, KCDH*
Prof Petety Balaji, BSBE	Prof Manjesh Hanawal, IEOR	Prof Nivethida T., BSBE	Prof Raghu Machiraju, KCDH*
Prof Soumyo Mukherjee, BSBE	Prof P. Balamurugan, IEOR	Prof Ankur Kulkarni, SCE	Prof Mithun Mitra, PHY
Prof Sanjeeva Srivastava, BSBE (D, P)	Prof Ashutosh Mahajan, IEOR (P)	Prof Puja Padhi, HSS	Prof V. Jayendran, IEOR
Prof Ranjith Padinhateeri, BSBE (D)	Prof Narayan Rangaraj, IEOR	Prof Satish Agnihotri, CTARA	Prof Krishnendu Sinha, Aero
Prof Debjani Paul, BSBE	Prof Rajani Joshi, Math	Prof Harish Phuleria, ESED	Prof Rohit Srivastava, BSBE
Prof Hari Varma, BSBE	Prof Siuli Mukhopadhyay, Math (D,P)	Prof Rashmi Gupta, HSS	Prof Santanu Ghosh, BSBE
Prof Pramod Wangikar, ChE (D)	Prof B. Ravi, ME	Prof Darshan Shah, ME	Prof Kshitij Jadhav, KCDH (D)
Prof Sarika Mehra, ChE (D)	Prof Rama Pal, HSS	Prof Usha Ananthakumar, SOM	Prof Prakriti Tayalia, BSBE
Prof Santosh Noronha, ChE	Prof Souvik Banerjee, HSS (D)	Prof Mahendra Shahare, HSS	Prof Nishant Sharma, IDC
Prof Suyash Awate, CSE	Prof Siby George, HSS	Prof Aditi Chaubal, HSS	Prof Smisha Agrawal, KCDH*
Prof Abir De, CSE	Prof Pravesh Jung Golay, HSS	Prof Arnab Dutta, ChE	Prof Om Damani, CSE
Prof Preethi Jyothi, CSE	Prof Ambarish Kunwar, BSBE (D)	Prof Debasish Chatterjee, SCE	Prof Janani Srree Murallidharan, ME
Prof Swati Patankar, BSBE	Prof Ashish Pandey, SOM	Prof Dipti Gupta, Meta	Prof Kalyani Addya, KCDH#
Prof Ajit Rajwade, CSE (P)	Prof Ashutosh Kumar, BSBE (P)	Prof Mrinmoyi Kulkarni, HSS	Prof Azizuddin Khan, HSS
Prof Arnab Jana, CPS	Prof Nirmal Punjabi, KCDH#	Prof Biplob Banerjee, CSRE	Prof Deepak Agarwal, BSBE
Prof Amit Agrawal, ME (P)	Prof Shantanu Tripathi, ME	Prof Yogesh Rathi, KCDH*	Prof Saket Choudhary, KCDH(D)
Prof Manoj Gopalakrishnan, EE	Prof Siddhartha Duttagupta, EE	Prof NR Jagannathan, KCDH**	

#: Adjunct

*: Visiting

**: Distinguished Visiting

P: PGC member

D: DPC member

KCDH: Key Academic, Research and Outreach Focus



Academic Programs

KCDH offers a range of academic programs:

- UG Minor program in Healthcare informatics (2021)
- UG Inter-disciplinary Dual Degree Program in Healthcare Informatics (2021)
- PhD Program in Digital Health (2022)
- MS Program in Health Informatics (2024)



R&D Programs

KCDH spearheads research programs, including short-term R&D projects and internships, with a focus on applied digital healthcare in collaboration with clinical partners:

- Faculty Research Projects
- IDDP / Internship Projects
- Grand Challenge programs



Outreach Programs

KCDH provides digital health training for professionals and supports national efforts through impactful outreach programs.

KCDH: Courses Being Offered

- Introduction to Public Health Informatics
- Introduction to computational multi-omics
- Wearable Health Technologies
- Basic Epidemiology
- Healthcare Performance Metrics
- Clinical Data Management
- Biostatistics in Healthcare
- Economics of Health Care
- Service Operations and Quality Management in Healthcare
- Communication Skills

KCDH Course Highlights

KCDH courses are very popular.
Over 450+ student enrollments
across KCDH courses this year!

Popular course include:

- *Introduction to Public Health Informatics (226)*
- *Basic Epidemiology (183)*
- *ML in Healthcare (118*)*
- *R&D Course (147)*
- *Economics of Healthcare (101)*

*Full Capacity

44+ additional courses related to Healthcare offered to by other departments like Biosciences & Bioengineering, Computer Science & Engineering, and Electrical Engineering etc

KCDH: Key Focus Areas

Healthcare Applications

- EHR, EMR and clinical applications
- Medical imaging
- Medical devices software
- Payers and life sciences applications

Healthcare Data Management

- Data interoperability and standards
- Data Privacy and Security
- Healthcare data warehousing & management
- Federated data management

Healthcare Analytics & AI/ML

- Healthcare AI/ML
- Medical image analytics
- Clinical decision support
- Preventive & prescriptive analytics
- Data Efficient ML

Consumer Health & Tele-medicine

- Consumer health devices
- Mobile Health applications
- Tele-medicine applications
- Remote patient monitoring

Computational Biology & Bioinformatics

- Genomics
- Transcriptomics
- Metabolomics
- Proteomics
- Pathway analysis
- Disease diagnosis

Population Health & Public Health Policy

- Disease surveillance & analytics
- Population health analytics
- Epidemiology & disease management
- Public health policy

Large Language Modeling

- Diagnosis assistance
- Improved patient care
- AI enabled emergency management
- Data driven policy changes

KCDH: Strong Partnership Focus

KCDH partners with healthcare organizations - **Digital Health Partners (DHP)** - to get access to clinical domain expertise and healthcare data. These partnerships are critical to create rich research and academic opportunities in Digital Health.



Hospitals & Healthcare Providers

Establish partnership with leading hospitals across therapeutic areas to:

- Drive joint research and academic programs
- Get access to clinical and patient information



Academic & Health Tech Organizations

Collaborate with academic, medical devices/software cos. and NGOs to:

- Drive joint research programs
- Support internships and placements
- Conduct consortiums / lectures



Government & NGO organisations

Collaborate with government organizations

- Support public health initiatives e.g., Niti Aayog, ICMR
- Support national digital health initiatives e.g., ABDM, NABH

KCDH: Engagement with Prominent Digital Health Partners

Hospitals Partners



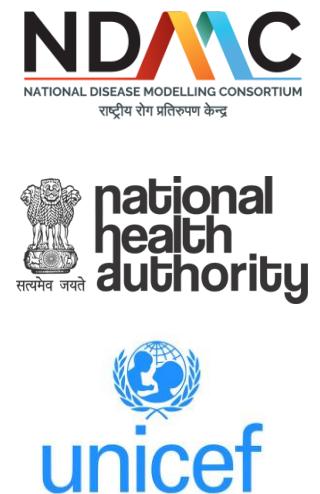
Academic Partners



Corporate Partners



Government & NGO Partners



KCDH has received a total funding of over Rs. 25 crores in the past year - the highest for any centre at IIT Bombay!

KCDH: Driving Research with Leading Hospital Systems

<p>Data Science Algorithms for Radiation Reduction in Computed Tomography (DHP: Tata Memorial Hospital)</p>	<p>HMIS Analyser: Visualization Dashboard for Health data (DHP: UNICEF)</p>	<p>Designing predictive model for Childhood Congenital Glaucoma using Clinical and Genetic data (DHP: Sankara Nethralaya, Vision Research Foundation)</p>	<p>A complete OCR framework for historical medical records digitization (DHP: Narayana Health)</p>	<p>Assessing Quality of Cancer Care in India using Electronic Medical Records: A Pilot Study (DHP: Tata Memorial Hospital)</p>
<p>An NMR-AI based Hybrid Approach for Modelling the Progression of Type 2 Diabetes Mellitus (DHP: KEM Hospital)</p>	<p>Discovery of novel biomarkers for the prediabetic stage with untargeted metabolomics and AI/ML guided data analysis (DHP: Osmania Med. College)</p>	<p>Use of Wearable sensors and Pranayama-based interventions for improving mental-wellbeing of Undergraduate Students at IITB (Sensorama)</p>	<p>A machine learning based approach to identify proteomic networks and biomarkers driving Triple Negative Breast Cancer (DHP: Tata Memorial Hospital)</p>	<p>Semi automatic segmentation and classification of CT/MR images: through ischemic stroke and sarcopenia as case studies. (DHP: AIIMS - Delhi)</p>
<p>A novel Artificial Intelligence-based prognostic approach using PET-CT images and pathology images for advanced-stage Hodgkin Lymphoma (DHP: Tata Memorial Hospital)</p>	<p>Machine learning based models and web based tools to predict the mild, moderate and severe cases of Covid 19 based on routine laboratory biomarkers (DHP: Kokilaben Dhirubhai Ambani Hospital)</p>	<p>Harmonized One-health Trans-Species Transmission of Antibiotics Resistance and levers for action using System Dynamics Modelling (HOTSTAR-SDM) (DHP: AIIMS – Bhubaneshwar, Kalinga Institute of Medical Sci</p>	<p>A study to develop an artificial intelligence algorithm for predicting the outcomes of febrile neutropenia (FN) in adolescent and adults with haematological malignancies (DHP: Tata Memorial Hospital)</p>	<p>Implementation of Electronic Alert System for Acute Kidney Injury and Development of Web Based Tools for National Public Health Advisory. (DHP: Kokilaben Dhirubhai Ambani Hospital)</p>

KCDH has established active research partnerships with some of the best hospitals in India

KCDH: Student Achievements

- Five PhD Students awarded the prestigious Prime Minister's Research Fellows (PMRF)
- 25 PHD Students
- 25 Interdisciplinary Dual Degree
- 35+ Minor students in 2023 – 24
- 4 MS by Research students in 2023-24
- 450 + enrollments in the DH courses in Spring 2023 - 24
- 21 students graduated
- 9 students landed internship in Healthcare sector
- 5 students landed Job placements in Healthcare sector
- 1 student start ups in Healthcare sector

KCDH: Key Focus Areas for 2024/25

- **KCDH Faculty Team** - continue to hire top full-time and visiting faculty
- **KCDH Academic Program** - build on the success of KCDH programs already being offered. Introduce MS Program in Digital Health.
- **Hospital / Research Partnership** - strengthen partnerships established with leading hospitals and drive research and co-development of new solutions
- **Government Initiatives** - enhance work done at NMDC and engage with government on large transformational initiatives (including AI/ML/LLMs)
- **Corporate / Industry Engagement** - continue to work closely with corporates on joint research programs and for driving student internships and placements

Digital Health will play a key role in driving innovation, accessibility and affordability of healthcare in India.

IITB-KCDH team is truly excited about supporting India's Digital Health transformation!

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https://www.youtube.com/channel/UCLjcVs6-1holqMB_8N8VEbA

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Emerging shifts in the Healthcare Landscape



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Introduction to Healthcare ecosystem

Impact of COVID-19



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Conclusion



Section 2

Emerging shifts in healthcare



2.1
Acceleration



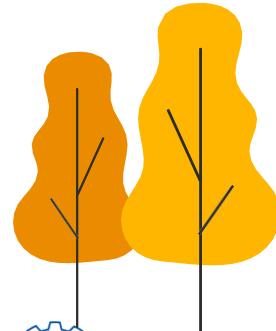
2.2
Convergence of purpose



2.3
Deepening minimalism

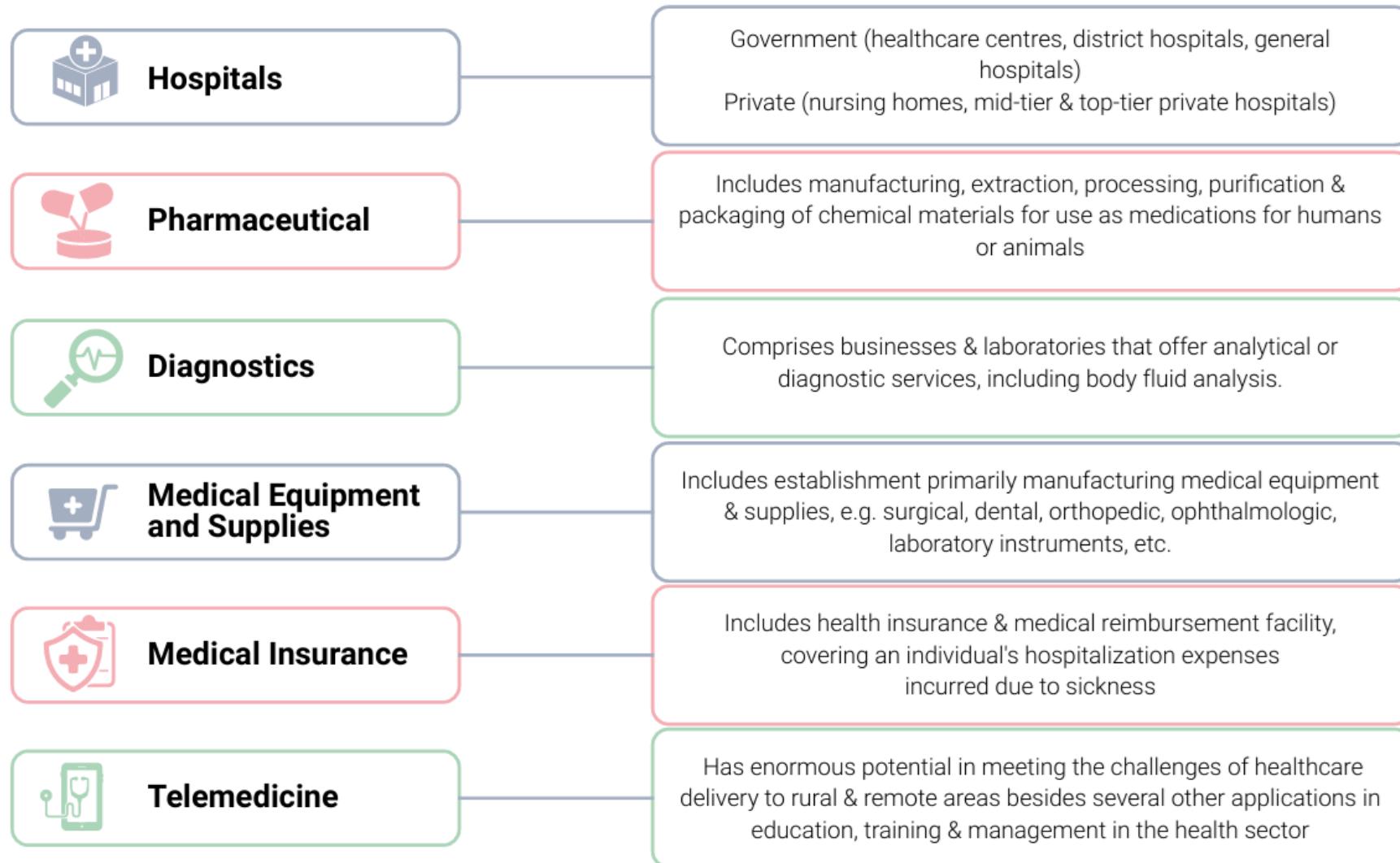


2.4
Diverging focus



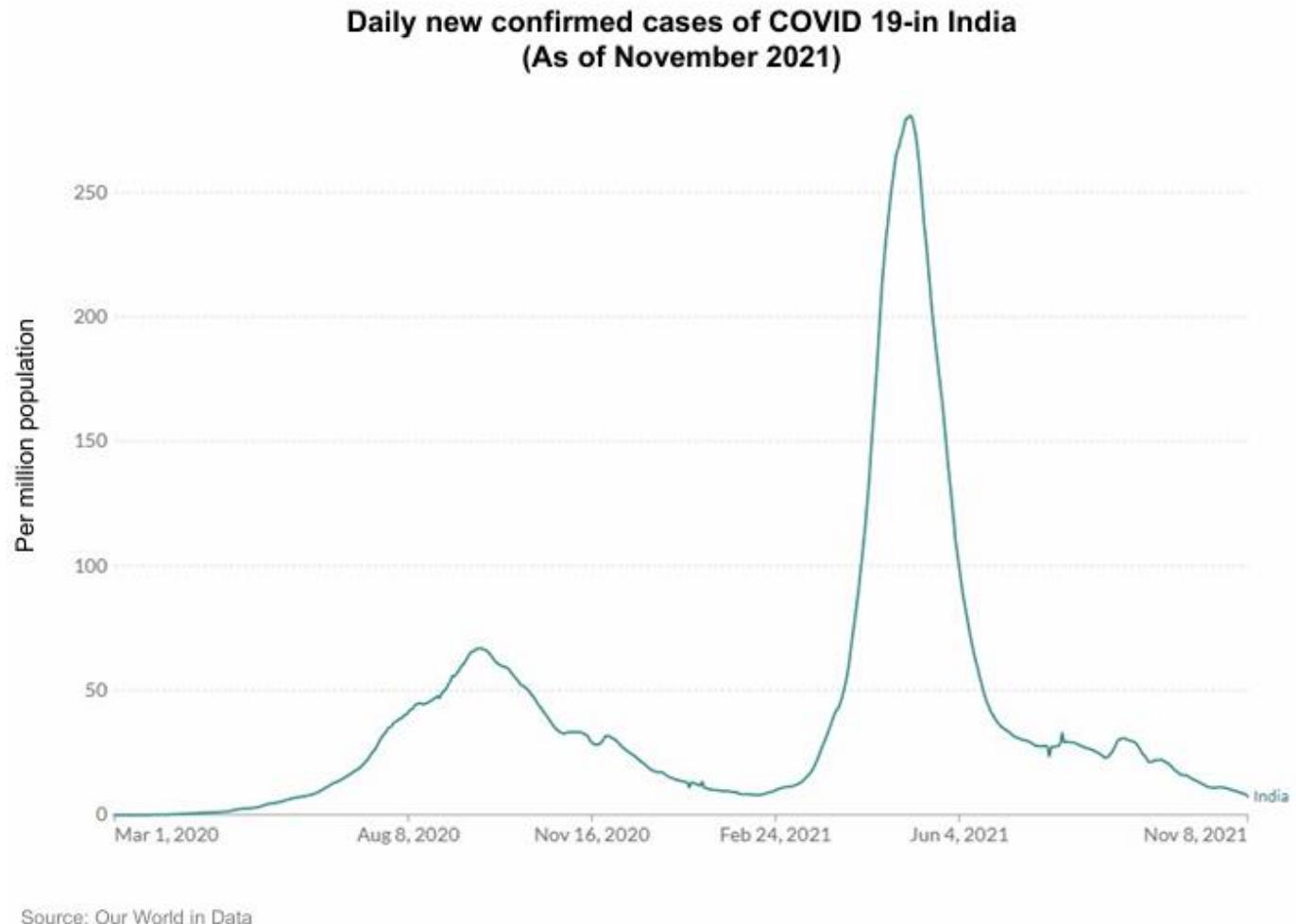
Introduction to Healthcare

The healthcare market functions through five segments



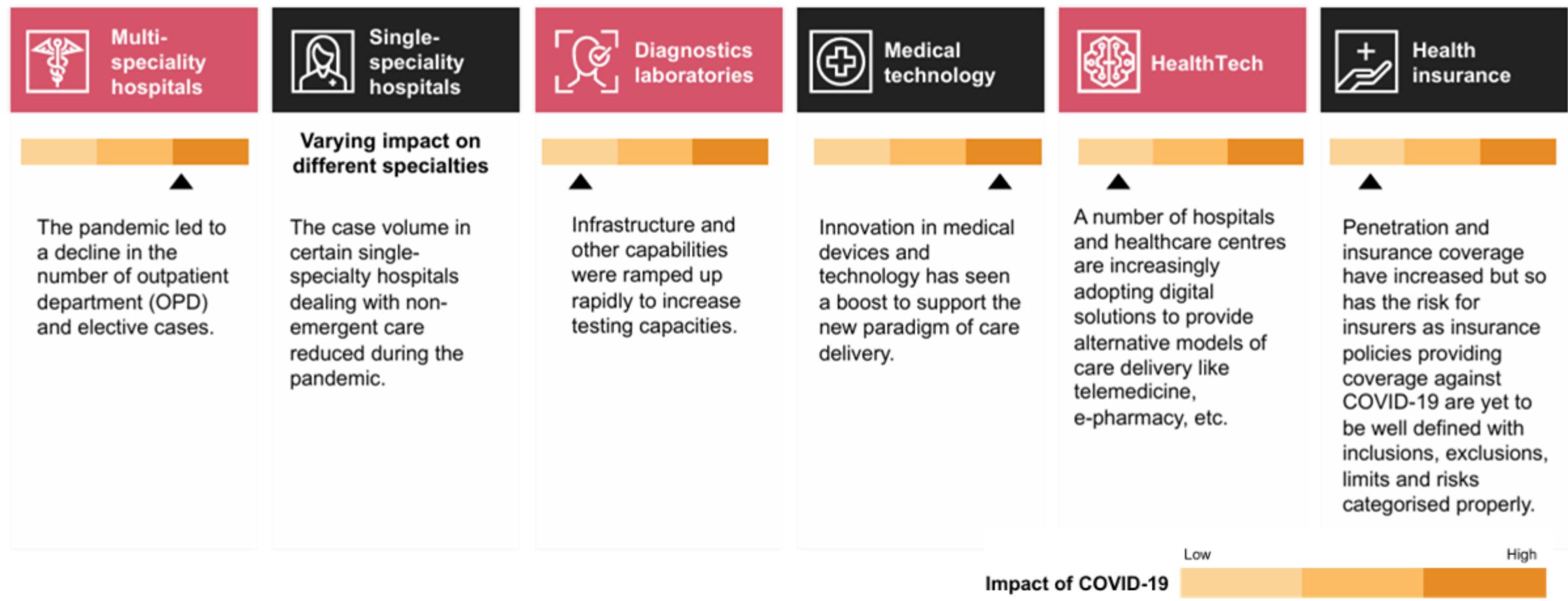
Covid-19: Indian health ecosystem under pressure

- **Timeline of COVID-19 in India:**
 - **January 2020:** First cases of COVID-19 reported in India.
 - **March 2020:** National lockdown imposed to curb virus spread.
 - **April 2021:** Second wave of infections, daily cases reached 400,000, straining healthcare.
 - **November 2021:** Daily new confirmed cases significantly reduced (10,107), but uncertainty remains.
- **Impact on Healthcare Systems:**
 - The pandemic prompted significant changes in India's healthcare infrastructure, some of which are likely to be permanent.

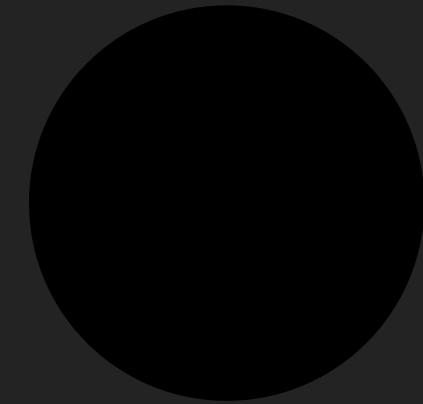
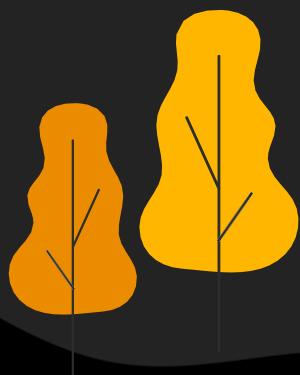


Impact of Covid-19 in Indian Healthcare Ecosystem

The impact of COVID-19 across the various sub-sectors of India's healthcare landscape is uneven



Emerging shifts in healthcare



Emerging shifts in healthcare



Acceleration

As we gradually returned to normalcy post-pandemic, hospitals and healthcare centres are realising how digital as a lever has helped in **accelerating contactless treatments and just-in-time decision making.**



The convergence of purpose

Along with the shift in consumer needs, healthcare delivery has also undergone a concurrent shift. The pandemic has **highlighted the need for partnerships driving ownership of the consumer across the care spectrum** to ensure the best outcomes.



Deepening minimalism

With contactless care gaining ample gravitas this pandemic, the focus has moved towards reducing and optimising the number of interaction touchpoints between the health system and health seeker without losing the quality of care. This new need to optimise such steps has resulted in deep minimalism – a concept closely associated with the ability of a system to simplify steps without losing quality.



The diverging focus

The pandemic has resulted in the **development of more holistic models of healthcare delivery**. At the same time, there has been a **preparatory shift across the healthcare value chain that is aimed at improving not only business but also health outcomes.**



Acceleration

The increased focus on digitalisation has helped in accelerating contactless healthcare and faster decision making. Technological innovations have further helped patients and consumers to understand diseases better and subsequently, demand higher-quality healthcare services. The following changes have been identified across the healthcare framework during the pandemic.

1 Hockey stick shaped recovery
Converting pent-up demand into accelerated recovery

2 Virtual-first health
Shifting from brick-and-mortar healthcare centres to virtual-first care

3 Disrupting traditional pharma practices
Transitioning from medication to holistic addressal of adjacencies

4 Delivering live insights
Delivering post facto data insights to business insights at scale

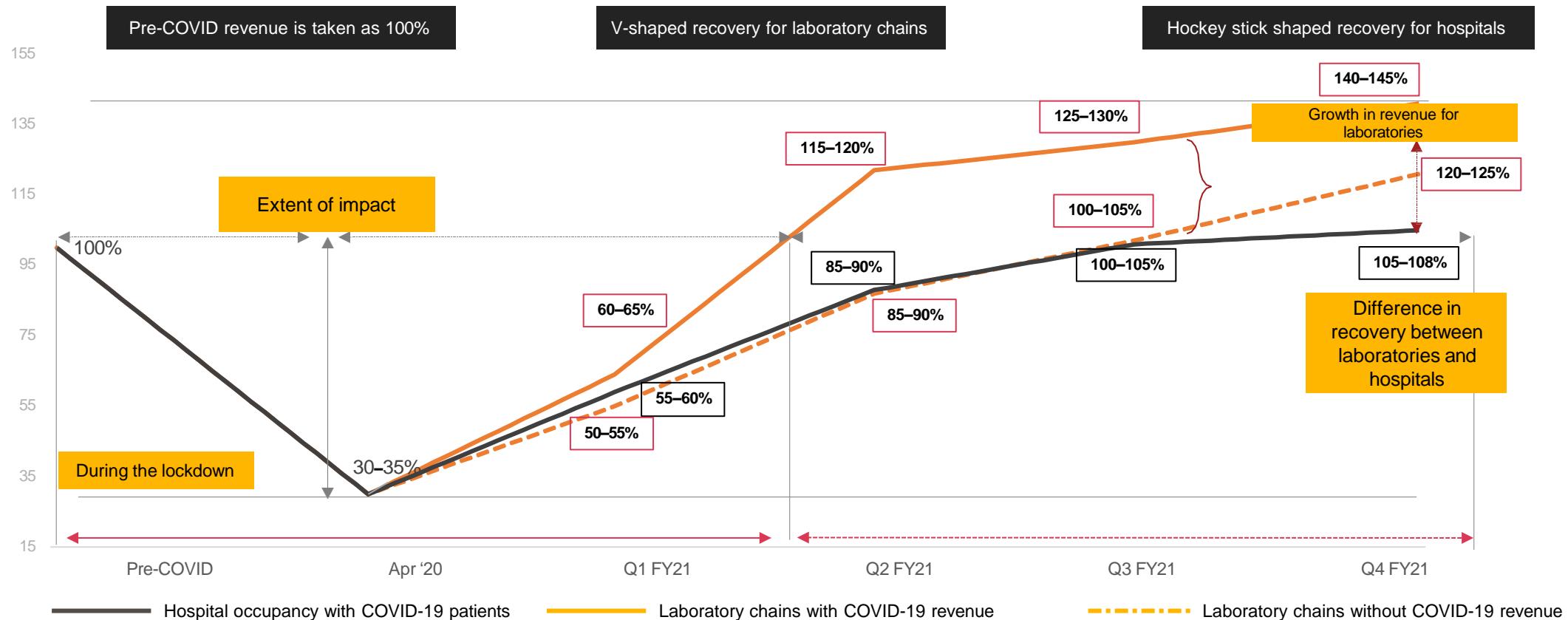


The accelerators

Hockey stick shaped recovery Pent-up demand to accelerated recovery

The country's leading hospital chains have witnessed a hockey stick shaped recovery in FY20–21 whereas diagnostics players recorded a steeper growth on account of additional revenue earned from COVID-19 testing.

Recovery comparison between hospitals and diagnostics laboratories



Source: External database (screener.in) and consolidated FY20 financial statement from company annual reports (listed hospitals and diagnostic centres)



The accelerators

1 Enabling virtual connect



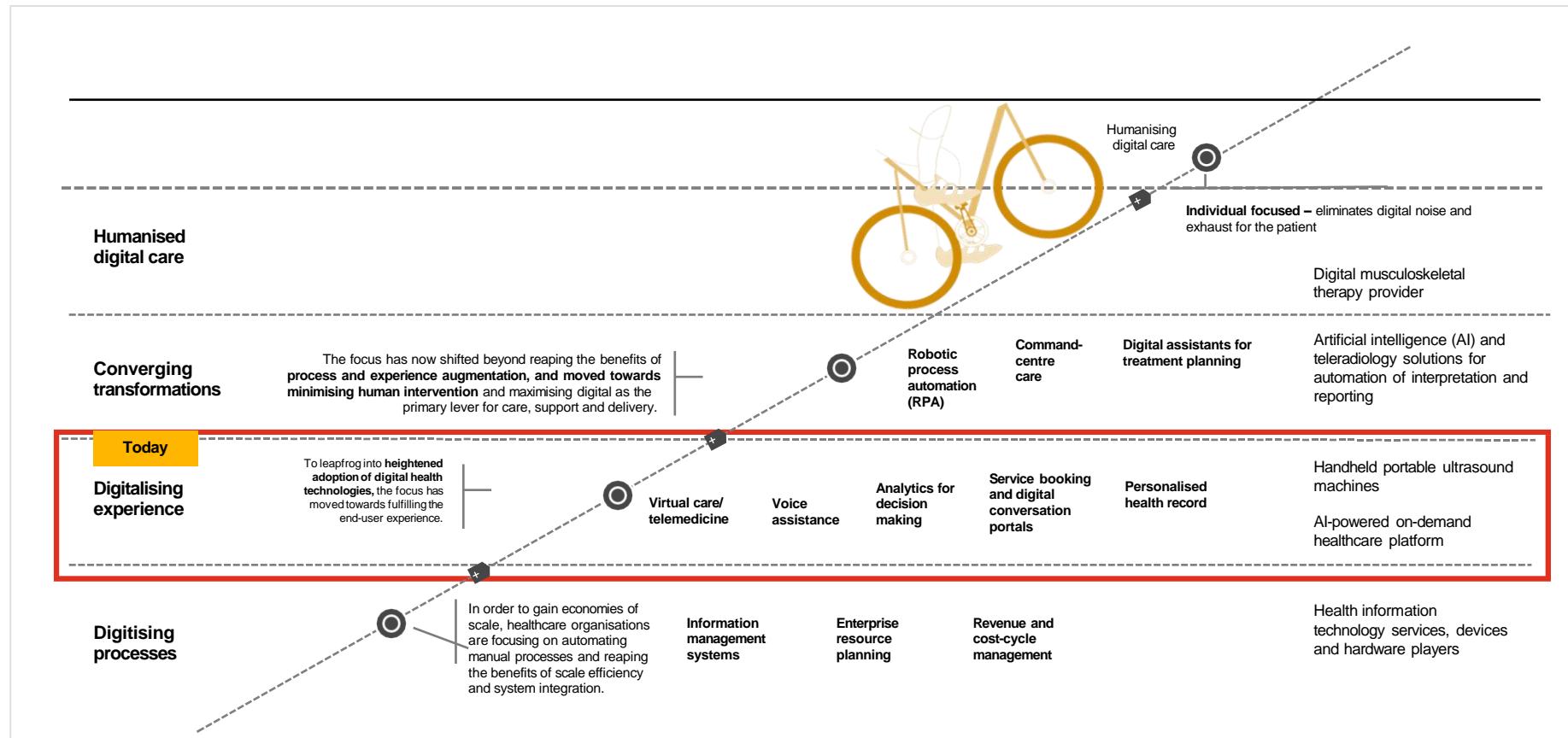
2 Integrating medical devices/technologies that aid in decision making



3 Developing capabilities to provide end-to-end virtual treatment

Virtual-first health Brick-and-mortar to virtual-first care

Digital services have played a critical role in aiding healthcare organisations transition into hyper-scalable and contextually sustainable businesses.





The accelerators

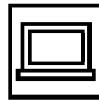
Disrupting traditional pharma practices Medication to holistic addressal of adjacencies

The pandemic has resulted in the emergence of unmet needs such as brand awareness, product differentiation, development of multiple delivery models, cost efficiency, detailed customer data and management systems, and forming deep and lasting customer relationships. These requirements could be efficiently addressed by leveraging digital solutions. Pharma companies are increasingly using digitisation to enhance patient engagement and improve internal operations.

Major changes in the pharma industry on the account of COVID-19



Limited availability of healthcare professionals (HCPs) due to a steep rise in workloads (increased patient per HCP), social distancing norms, increased risk of infections, etc.



Shift towards online modes of communication among HCPs and between HCPs and patients



Increase in demand for comprehensive disease management

Implications across the pharma value chain



Disruption in the traditional value chain

Pharma companies are leveraging large datasets to analyse the market and associated patterns, and using those insights to cater to their customers (HCPs, patients, etc.). They are gradually shifting the distribution model from the traditional wholesaler-retailer routes to direct delivery by e-pharmacies.

Evolving sales and marketing channels

Sales models driven by on-ground resources and physical access to manufacturers/suppliers are gradually moving to online platforms/forums like websites and webinars on the account of social distancing norms.

Entry of tech players providing end-to-end digital solutions

The need for social distancing has accelerated the creation of digital solutions that address gaps in patient life cycles, speed up research and development (R&D) through data analytics, etc.

Increasing stakeholder collaboration

Pharma companies are now directly collaborating with brick-and-mortar/e- pharmacies to receive medicine orders, refill stocks, and adhere and comply with rules and regulations through knowledge platforms in the form of portals/ apps, etc., and communicating with HCPs for treatment pathways.



The accelerators

Disrupting traditional pharma practices Medication to holistic addressal of adjacencies

The pandemic has accelerated the usefulness of digital solutions across patient life cycles, decision-making abilities of HCPs and the pharma value chain. The various roles played by digital solutions across each of these stages are mentioned below.

Across the patient lifecycle	
Stage	Digital solutions
Awareness	Online info, forums, mobile apps and social media
Prevention	Online info, media campaigns and social media
Diagnostics	Portable devices, companion diagnostic test for drugs and e-lab results
Treatment	Online resources and mobile apps
Drug provision	Online pharmacies, financing and loyalty programmes
Treatment	Digital tools, home care services and mobile apps
Monitoring	Monitoring devices, adherence services and forums

Education, promotion, networking and supporting decision making of HCPs	
Stage	Digital solutions
Decision	Dosage, calculator, treatment planner and risk assessment tools
Education	E-detailing, appointment booking, online information and apps
Promotional activities	Social media, cloud-based customer relationship management (CRM), webinars and tele-calling
Networking and seeking opinions	Social media, websites and apps incorporating feedback/reviews, websites and promoting events

Across the pharma value chain	
Stage	Digital solutions
R&D	Increased aggregation and data in digital format can potentially improve speed and effectiveness
Confirmatory development	Analytical and monitoring tools may make this process more effective
Ops and manufacturing	Digitisation may help in increasing operational excellence as well as reducing quality and compliance risks
Market access and pricing	Provide evidence based on real world clinical effectiveness rather than clinical trial efficacy
Marketing and sales	Support correct diagnosis by healthcare professionals and increase patient adherence



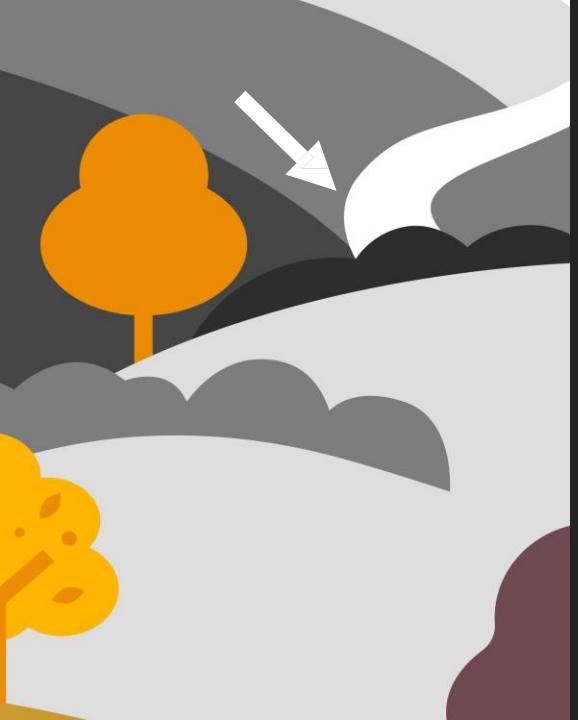
The accelerators

Delivering live insights

Delivering post facto data insights to business insights at scale

Healthcare organisations are using electronic medical records (EMRs) to improve patient health outcomes, identify better practices for doctors, generate better insights for pharma and medical device companies, and provide superior underwriting capabilities for insurers.

	EMR deployment	Disease management insights	Digital twin data ingestion
Stakeholder of focus			
Nature of live /near-live insight delivered	<p>For a hypertension case, the HCP is prompted to check for diabetes</p> <p>For a diabetes case, once the Hba1c test has been carried out, the HCP is prompted to check for insulin</p>	<p>Providing a longitudinal view of the patient's medical history and treatment</p>	<p>Annotating data and creating longitudinal datasets for ingesting into AI/machine learning (ML) and creating the patient's digital avatar</p>



Deepening minimalism

With contactless care gaining ample momentum this pandemic, the focus moved towards reducing and optimising the number of touchpoints between the health system and health seeker, without losing the quality of care. This new need to optimise steps, has resulted in deep minimalism – a concept closely associated with the ability of a system to simplify steps without compromising with quality.

1 Platform care

Decision support to virtual treatment enablement

4 Pill-data-device in one continuum

Multiple players with limited touchpoints to single-engagement with multiple touchpoints

2 Enabling care

Telemedicine to teletherapy

5 Universal health interface

Multiple access points to a single point of access

3 Emergence of voice AI

Graphical user interface (GUI) to voice user interface (VUI)

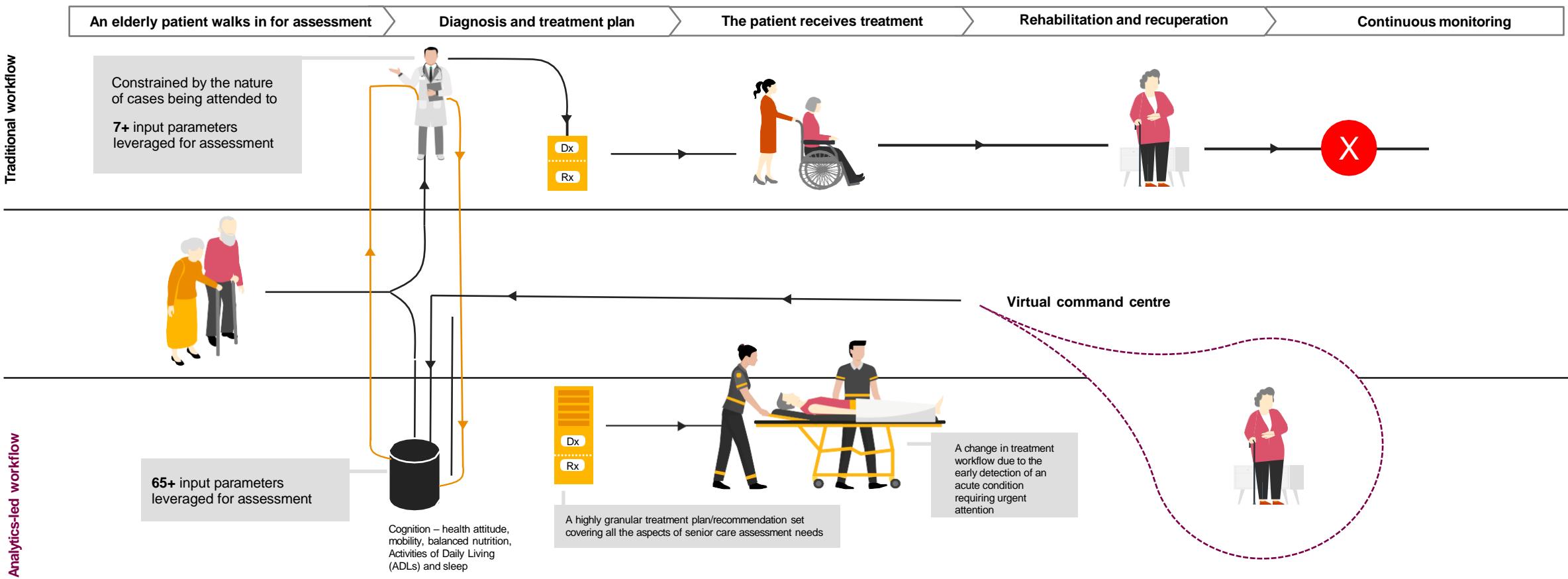


Deepening minimalism

Platform care

Decision support to virtual treatment enablement

Organisations are working towards building a virtual healthcare ecosystem in addition to the existing telemedicine base that will eventually support virtual treatment. The figure below describes the difference in diagnosis, treatment and recovery under the traditional and analytics-led workflows of patient care.

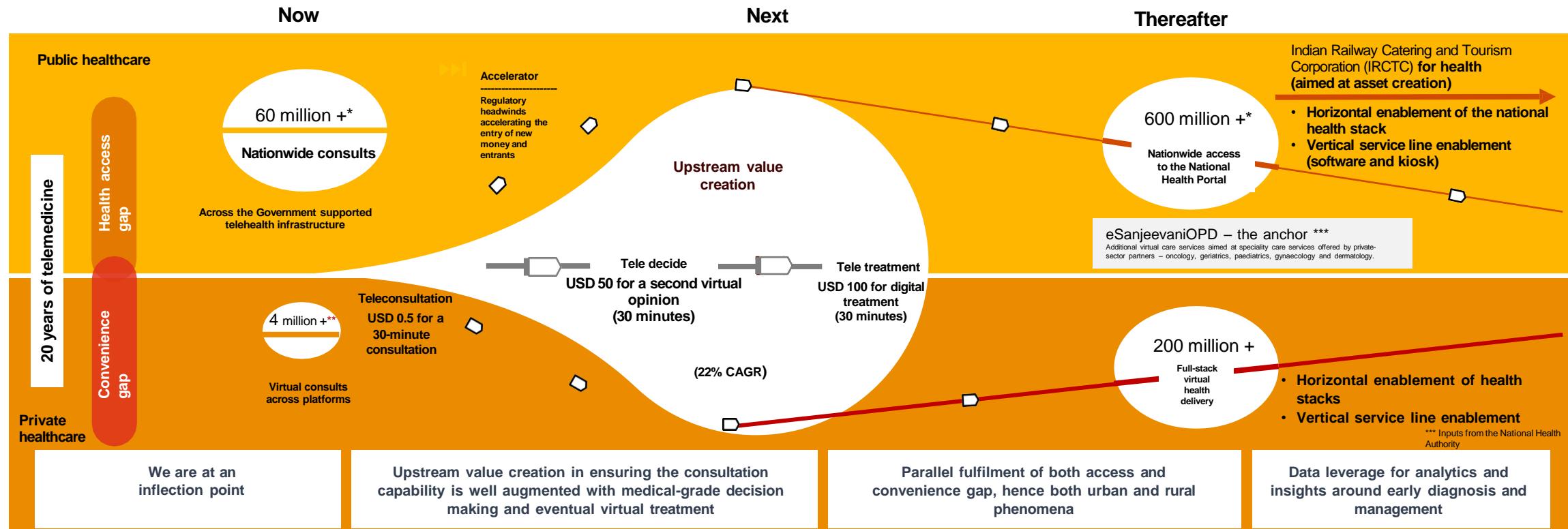




Deepening minimalism

Enabling care Telemedicine to teletherapy

The telemedicine model of the past is catching up with the virtual consult + framework of today and both are moving towards becoming a full-stack virtual care model. Opportunities exist across both public and private sectors with the infrastructure in the public sector telemedicine business undergoing major improvement and the private sector focusing on building a robust platform ecosystem. The figure below details India's telemedicine journey in the last 20 years.



* Consolidated volume of pan-India teleconsultations across the 35,000+ nationwide telemonitoring outposts set up remotely by both the Government and private sector, powered by the Indian Space Research Organisation (ISRO) and telecom operators as part of state budgets and corporate social responsibility (CSR) initiatives.

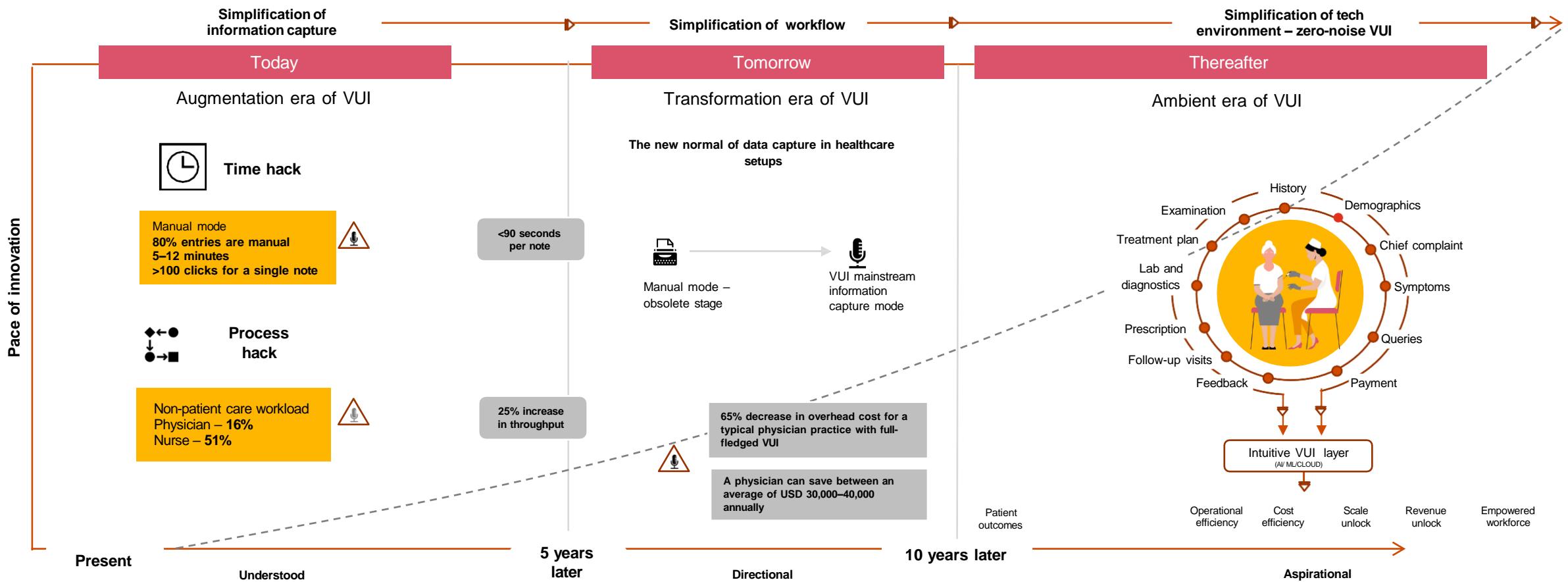
** Virtual consult volume serviced by private healthcare service providers.



Deepening minimalism

Emergence of voice AI GUI to VUI

Voice-based AI is expected to bring in the next big transformation in healthcare. Such a technological advancement would enhance the upstream value of the healthcare framework and further usher in the ambient era of VUI. The figure below shows the gradual emergence of voice AI and its journey from the augmentation to ambient era.





Deepening minimalism

Digitalisation has enabled healthcare providers to develop models that will give them relevant data and insights about patients. For example, a non-exclusive partnership that integrates insulin dose data from pre-filled, durable and connected smart insulin pens from pharma providers directly into digital health tools.

Such integration enables both caregivers and patients with diabetes to view glucose and insulin data together and helps them take more informed treatment decisions as well as have more meaningful and productive conversations about health outcomes.

Pill-data-device in one continuum

Multiple players with limited touchpoints to single-engagement multiple touchpoints

Healthcare providers are working towards developing seamlessly engaged pill-to-disease management models.

An app-based healthcare solutions provider delivers comprehensive services on awareness, monitoring, drugs and food supplements. It has also tied up with one of India's leading e-pharmacy players to provide a continuum of care solutions.

Diabetes solution portfolio for a leading continuum care player



Monitoring devices



Guilt-free food



Ayurveda



Detox drinks



Medicines



Lab tests

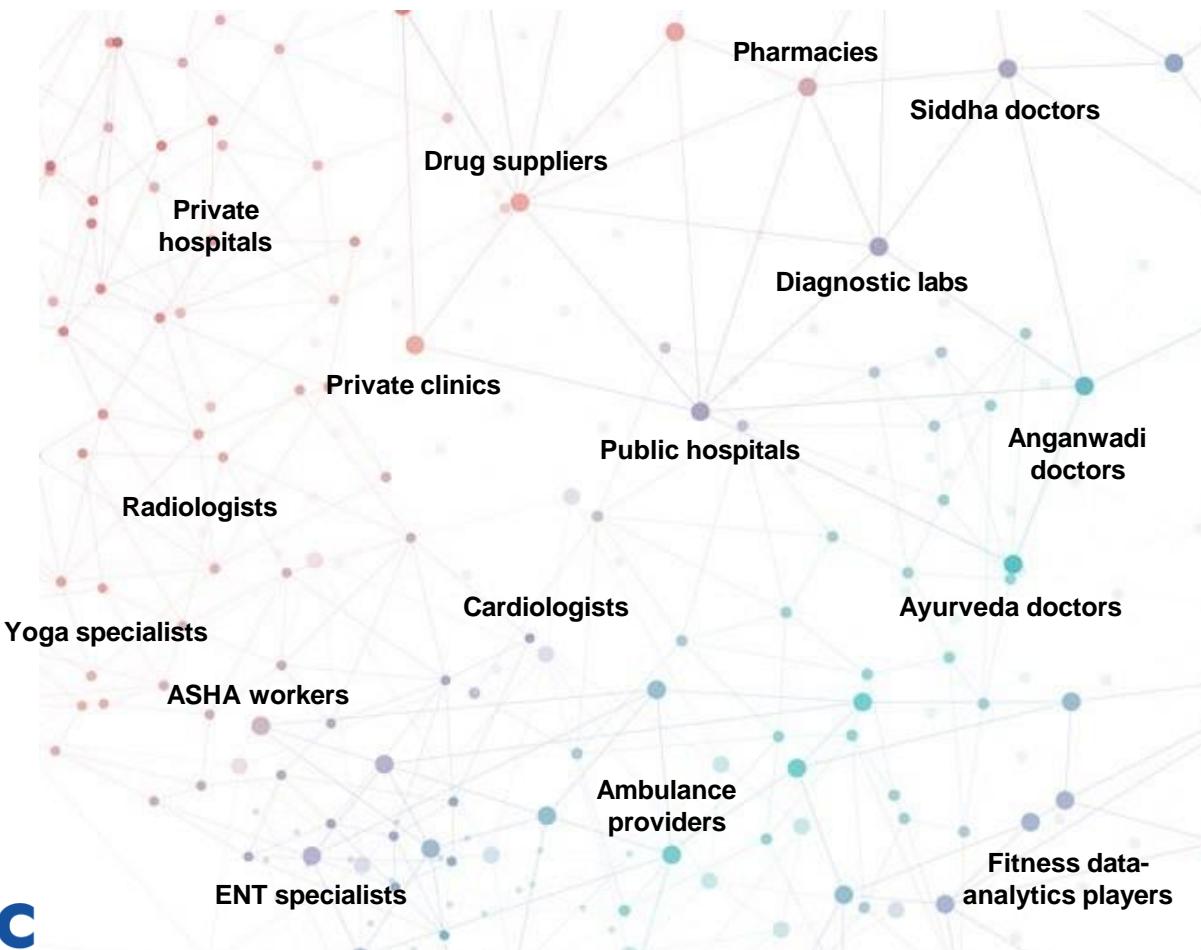


Deepening minimalism

Universal health interface

Multiple access points to a single point of access

The emergence of a single point of access for patients across the value chain which leverages digital technologies to create a universal health interface enables ease of access as well as data sharing, and a transformed ecosystem of care. The figure below depicts the number of players present in a connected healthcare value chain.



Enabling access to quality healthcare through digital health, open network and open protocols

What digital health will enable

Discovery

- Accessing hospitals and primary care clinics
- Finding nearest laboratories or pharmacies
- Tracking/finding a drug across pharmacies

Seamless consultations

- Booking for physical appointments
- Booking for teleconsultation
- Finding and booking the nearest emergency care provider/ambulance service
- Collecting samples from homes

Track and check

- Checking for the availability of specific medicines
- Checking for the facilities and number of beds available at a hospital/clinic
- Checking for service offerings at specific laboratories/hospitals



Convergence of purpose

The way healthcare is delivered in the post-COVID era has shifted along with changing consumer preferences. The traditional means of healthcare delivery are undergoing an evolution with the aim of serving the end consumer while creating added value for all the players in the ecosystem.

The pandemic has highlighted the need for partnerships driving consumer ownership across the spectrum of care to ensure the best possible outcomes.

1 Reengineering business models
Care delivery to continuum of care

2 Monetising data
Data capture to use of insights engines and advanced analytics

3 Untapped diagnostic potential
Active marketing to provider push for testing

4 Shifting influence of stakeholders
Independent purposes to one unified purpose

5 Proactive Government role
Regulator to active participant and driver



Convergence of purpose

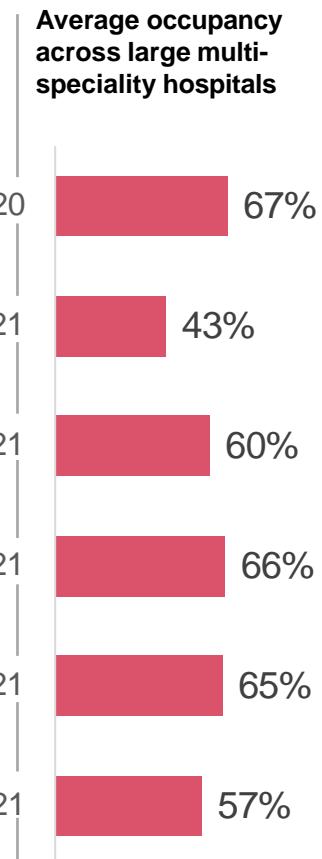
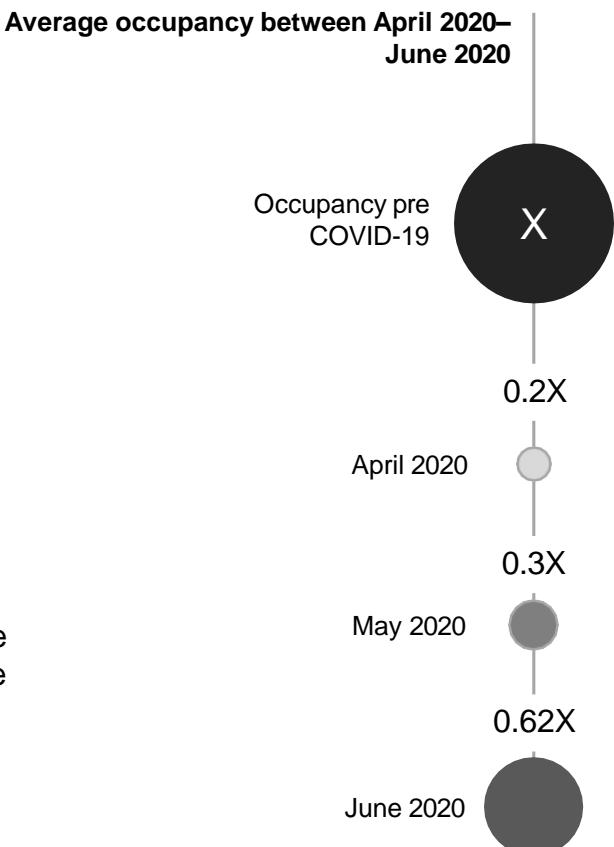
Reengineering business models

Care delivery to continuum of care

The COVID-19 pandemic has adversely impacted the healthcare delivery industry, resulting in decreased revenue and increased costs. Footfalls across healthcare centres dropped due to the pandemic as many people shifted to online consultations. Increased expenditures on personal protective equipment (PPE) and adherence to infection protocols have increased the overall cost of care.

Impact of COVID-19 on occupancy

- While the **dip in occupancy was quite significant during the lockdown in 2020**, hospitals gradually recovered, **with occupancy levels reaching to 60% of the pre-COVID era** by the end of June 2020.
- While the **extent of recovery varies**, there was a **significant impact on the volumes of OPD consultations, resulting in a dip in revenue from diagnostics and pharmacy**, and subsequent reduction of operating profits (40% of the pre-COVID period).
- Average revenue per patient (ARPP) is lower** as compared to the pre-COVID period on the account of a drop in the volume of elective cases.



Source: Redseer, Businesswise report, AIOCD, online pharmacy discussions and PwC analysis



Convergence of purpose

Reengineering business models

The need of the hour

The pandemic's impact has compelled healthcare organisations to rethink, reprioritise and reengineer the business models addressing the emerging challenges for the entire healthcare delivery ecosystem. Doing so will allow them to create a more efficient, sustainable, technology-enabled and scale-ready healthcare ecosystem.

The need

- Reduced EBITDA due to increased operational costs during the pandemic, especially in the cost of care delivery.
- Increased cost of procurement for hospitals caused by manufacturers trying to offset their losses and high demand for a few consumables.
- Hospitals offering huge discounts to attract patients in the markets, leading to pressure on pricing.
- Decrease in revenue due to lower occupancy, altered patient mix and postponement of elective surgeries.
- Government regulations for pharmaceutical and MedTech companies have impacted their profit margins.

Implications for the future

-  **Improve operational efficiency by focusing on cost optimisation**
Strategically identifying compressible cost heads – manpower, supply chain and other direct/indirect cost heads
-  **New avenue of revenue generation**
Adopting technology in care delivery – ensuring continuous patient engagement and remote patient management, using secure technology solutions such as teleconsultation, teleradiology, etc., and focusing on home healthcare services
-  **Identify the right operating model**
Redefining hospital positioning, target catchment areas and patient base
-  **Innovative lean model for capex deployment**
Exploring models such as pay per use, revenue sharing and others that provide more return on capital employed (ROCE)
-  **Leverage technology**
Investing in process automation and data analytics, adopting digital transformation tools such as RPA/business process management (BPM) to bring efficiencies and reduce costs



Convergence of purpose

Reengineering business models

Connecting the care-continuum dots

The model that focused only on treating core illnesses underwent reengineering and has been integrated into the continuum of care blocks in addition to embracing retail health components.

Reengineered business model

Scalability



Models opted

Home healthcare services

Hospitals have entered the home healthcare segment or are tying up with specialised home healthcare providers.

Renting operating theatres (OTs)

Healthcare players have rented out spare capacities to provide surgical treatment and improve the utilisation of OTs.

Teleconsultation services

Most corporate hospitals have launched teleconsultation services by themselves or have tied up with digital health players in the telehealth space.

E-pharmacy

Many hospitals have started home delivery of medicines for both outpatients and discharged patients, thereby increasing patient retention and satisfaction.

E-diagnostics/home sample collection

Hospitals have ventured into home sample collection with a team of dedicated phlebotomists to drive conversion and increase stickiness.

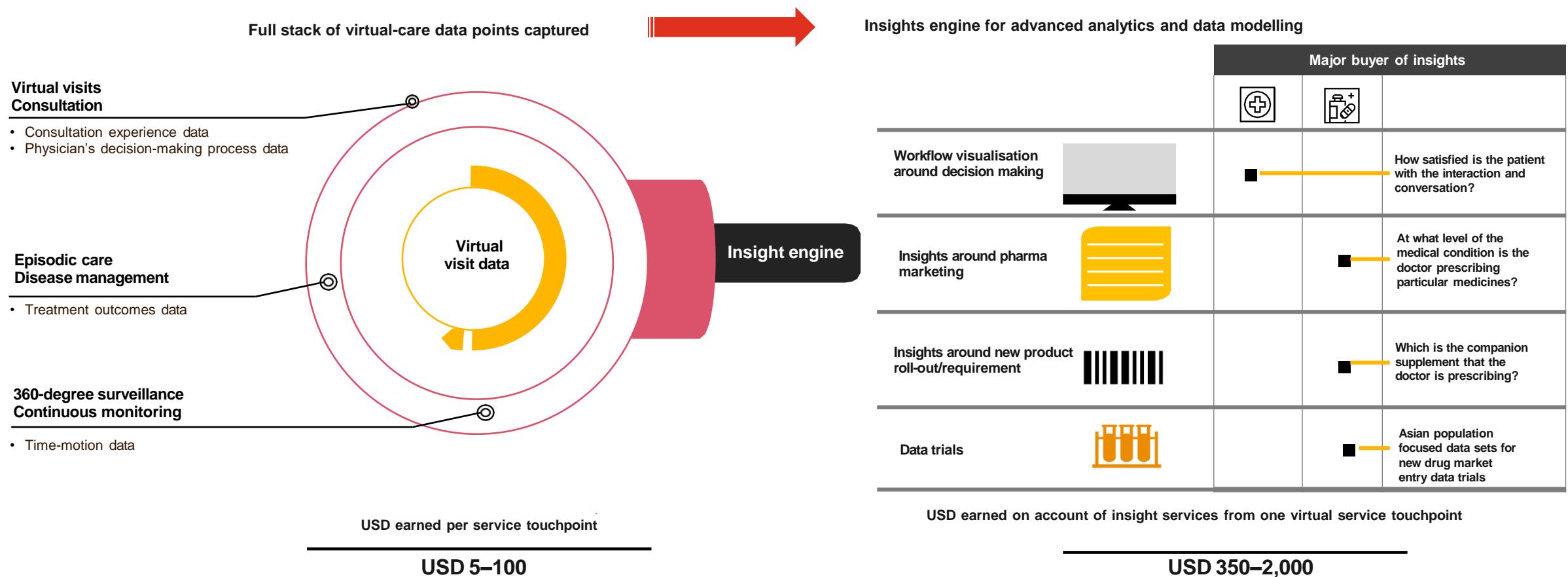


Convergence of purpose

Monetising data

Data capture to use insights engines and advanced analytics

A whole range of data points is expected to become accessible as virtual-first healthcare delivery models are adopted on a larger scale. Parallelly, the data insights could also help in generating revenue for players in the space.





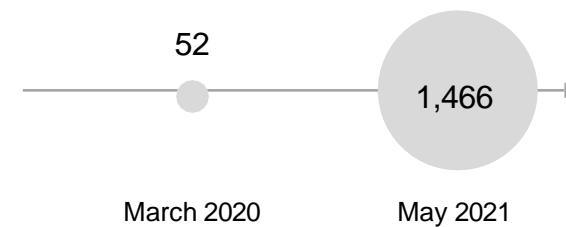
Convergence of purpose

Untapped diagnostic potential

Active marketing to provider push for testing

COVID-19 has created a window of opportunity for molecular diagnostics which is expected to grow post the pandemic to find out further about both infectious and non-infectious diseases.

Indian Council of Medical Research (ICMR)
approved COVID-19 testing laboratories
(RT-PCR capability)



The on-ground shift

- **Infrastructural upgrade** for molecular diagnostics in the form of:
 - **structural modifications** for unidirectional sample flow
 - **biosafety room and cabinet**
 - **automated sample extraction systems** and **upskilling of manpower** – technicians and other laboratory staff
- **Recruitment of qualified molecular biologists** (full-time/part-time)

The future landscape

Additional revenue streams at improved margins for laboratories



Increased volumes of molecular tests



Increased affordability



Overall market growth

Source: Indian Council of Medical Research



Convergence of purpose

Shifting influence of stakeholders

Independent purposes to one unified purpose

Stakeholder influence in the healthcare sector has shifted speedily in the last couple of years – from physicians and retailers to non-traditional partners like payers, technology players and governments. These transitions also translate into on-ground changes in how care is accessed and delivered, and will eventually bring about improved penetration of ‘healthcare for all.’

Stakeholder	Power	Role	Change in stakeholder influence
Patient	↑	Patient consumerism	Influencers in their treatment decisions due to higher awareness
Physicians/pharmacists	↓	Diagnosis and prescription	Higher influence of consumers, payers, chain hospitals, etc., to diminish HCPs' Rx discretion
Wholesaler /distributor	↓	Channel disruption	Fall in influence owing to growth of e-pharmacies and Jan Aushadhi stores
Technology players	↑	Technology influx	Offering innovative digital platforms that improve patient experience
Care provider	↓	Corporate hospital accounts	Higher influence of consumers and digital health platforms to diminish the role and influence of a care provider
Payers	↑	Government as a payer	Gaining relevance as public insurance penetration and cover increase through the Ayushman Bharat programme
Government	↑	Government pushing for self reliance	Promoting local manufacturing for key active pharmaceutical ingredients and raw materials for pharma companies
Regulatory authorities	↑	Shaping the Indian pharmaceutical market (IPM)	Shaping the IPM with definitive guidelines for sustainable ecosystems



Proactive Government role

Regulator to active participant and driver

Government interventions in healthcare have undergone significant transformations. From being a regulator, the Government's role has shifted to actively delivering care in the form of incentives for private providers, encouraging foreign direct investment (FDI), stimulating local manufacturing, innovation and digital-first healthcare.



COVID-19 monitoring

The Indian SARS-CoV-2 Genomics Consortium (INSACOG) is a **national multi-agency consortium of genome sequencing laboratories (RGSLs)**.

The agency has been established for sequencing and analysing genome data to **identify COVID-19 variants of concern, variants of interest, potential variants of interest and other mutations**.



Driving universal health coverage

The Government of India (GoI) launched the National Digital Health Mission in August 2020 as the **first step towards driving universal health coverage (UHC)**.

The mission aims to **develop the framework necessary to support the integrated digital health infrastructure in the country**.

It will bridge the existing gap amongst different stakeholders of the healthcare ecosystem through digital highways.



Driving local manufacturing and innovation

The Government extended the Production-Linked Incentive (PLI) Scheme – initially covering the manufacturing of medical devices – to include pharmaceutical products.

The scheme provides cashbacks between 1–4% of additional sales of locally made goods over a certain time period.



Diverging focus

The impact of the pandemic on the healthcare sector as a whole and its various sub-sectors has compelled them to explore more holistic models of care delivery.

The demand-driven shift that we are experiencing today is only the beginning. The preparatory shift across the healthcare value chain aims at improving both business and health outcomes.

1 Differing models different objectives
Service rendering to service-model sophistication

2 Expansion of health coverage
Coverage for a few to universal coverage

3 Blurring of boundaries
Disparate care delivery to holistic models

4 Diversification in digital
Standalone offerings to partnering for value-added services

5 Data impacting health outcomes
Early detection to continuum of care to data insights

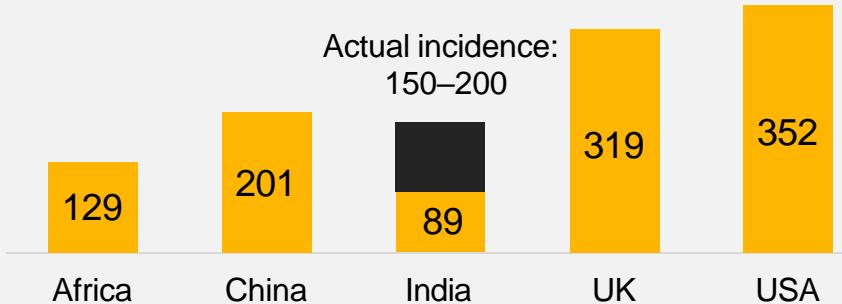


Diverging focus

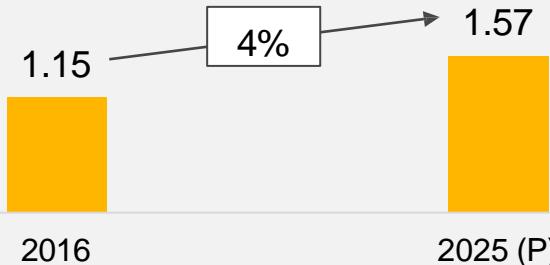
Differing models different objectives Service rendering to service-model sophistication

The oncology space has undergone a major transformation with the emergence of more distributed models driving penetration of care along with the increasing demand for personalised and advanced therapy.

Cancer incidence per 100,000 (2016)



Cancer Incidence in India (in million)



Source: World Cancer Research Fund International



Distributed model (hub-and-spoke model)

- Oncology is being developed based on population distribution and demand to ensure the availability of speciality treatment.



Personalised therapy – next-generation sequencing (NGS)/molecular diagnostic tests for:

- lowering the cost of testing
- ensuring more accurate diagnosis and improved treatment.



Focus on establishing **high-end radiation** centres for proton/carbon therapy



Corporate chains expanding their footprint

- Oncology-focused corporate chains targeting tier-2 cities for growth.
- An oncology focused hospital chain headquartered in Bangalore has grown to 25 centres (from three centers in 2005) with a presence in 18 cities.



Diverging focus

Expansion of health coverage Coverage for a few to universal coverage

Both the Government and the private sector are taking various initiatives to increase health insurance penetration, coverage and innovation. While the pandemic has affected most of the healthcare industry, the health insurance sector has witnessed growth.

Gol's initiatives driving UHC

Announcement in Union Budget 2021 to increase FDI in insurance up to 74%

Health insurance regulations announced by the IRDAI in 2013, 2016 and 2019

Launch of PMJAY-Ayushman Bharat in 2018, aiming to cover 500 million people

Revision of deduction limits under Section 80D of the Income-tax Act in 2018

New players expected to enter the growing health insurance market in India.

Mergers and acquisitions are likely to provide a boost to the sector.

The number of people covered will increase due to the incentives provided for buying health insurance.

Building technological capabilities

InsurTech is disrupting the market and making the customer journey an easier experience through paperless and contactless digital processes.

Industry shifts driving innovation and expansion

Expansion of coverage to include the 'missing middle'

The GoI is actively working towards covering 500 million people who are without any health insurance coverage. A pilot is being run by the National Health Authority (NHA) to meet the target.

Innovative products

Standardised health insurance products, COVID-specific coverage, specific disease coverage, etc., are a few of the products that are making health insurance more accessible.



Diverging focus

Growth of digital in insurance Coverage for a few to universal coverage

Digital exponential technologies, while transforming the health insurance landscape, are also enabling the larger digital transformation of the healthcare ecosystem along with digital health delivery and platform play.

Emerging trends in the post-COVID scenario

Product standardisation

Arogya Sanjeevani Health Insurance launched from 1 April 2020 with standardised terms and to be offered by all general and standalone health insurance companies in India.

Creation of disease-specific products

COVID-specific coverage through Corona Kavach and Corona Rakshak with standardised terms and to be offered by all general and standalone health insurance companies in India.

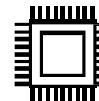
Improving customer experience through technology

Payers are providing virtual consultation as a part of insurance coverage.

Focus on the ‘missing middle’

The GoI is focusing on covering over 500 million people without any health insurance coverage.

Implications for the future



Digital exponential technologies

Technologies such as RPA, ML and AI are catalysing the insurance model to provide better customer experience and improved operations.



Product innovation

Health insurance companies are shifting from only covering illnesses to providing digital and hybrid care-delivery models.



Simplification of health insurance

Standardisation of products and terminology are driving consumer awareness and adoption.



Adoption of virtual service models

Insurance companies are overcoming geographical barriers and expanding the coverage of health insurance across the country.



Geographic expansion

Insurers are overcoming the challenge of operating in a geographically diverse country through expanding into non-urban markets.



Diverging focus

Zone of play



The premise of **fusing fitness and beauty** started to take shape when a fitness club partnered with a US-based cosmetics brand retailer to offer its products in locker rooms.

Zone of play



A lifestyle website partnered with a wellness company and a nutrition company to launch drinkable collagen.

Blurring of boundaries Disparate care delivery to holistic models

The beauty and wellness industry is transitioning towards sustainable well-being. Digital as a lever is unlocking agility and helping players move up the value chain and across the sustainable well-being spectrum faster than before.

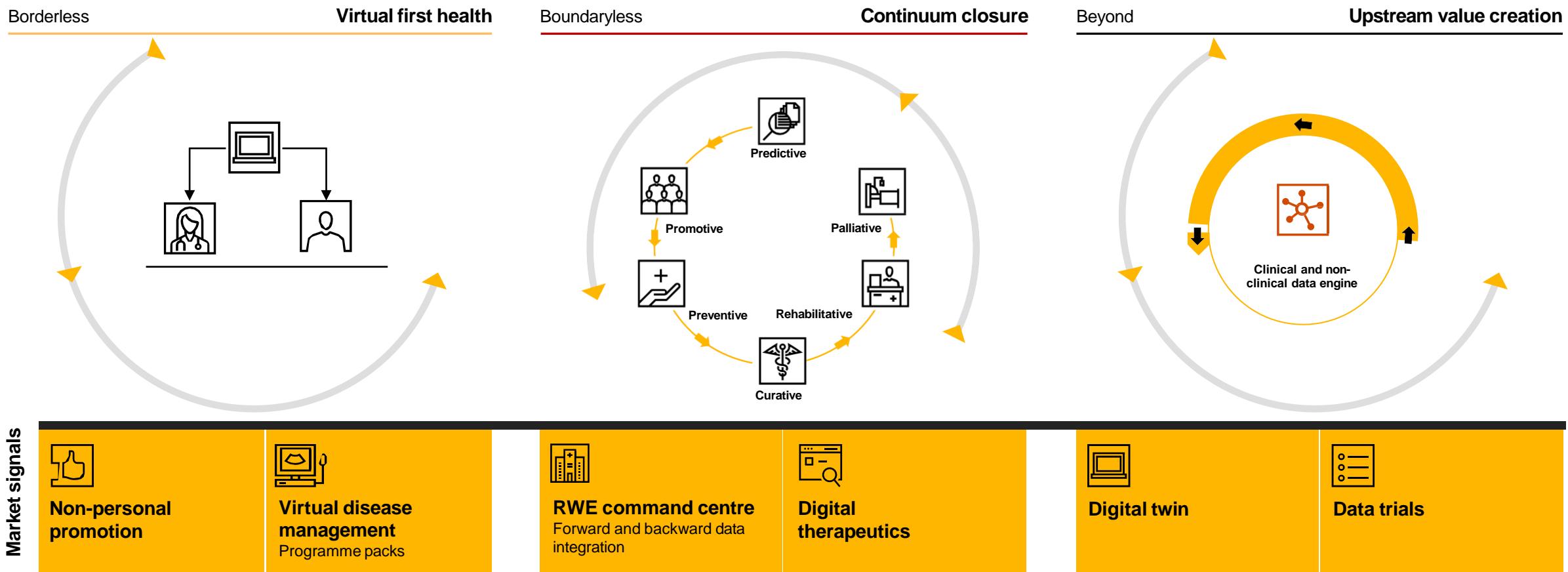




Diverging focus

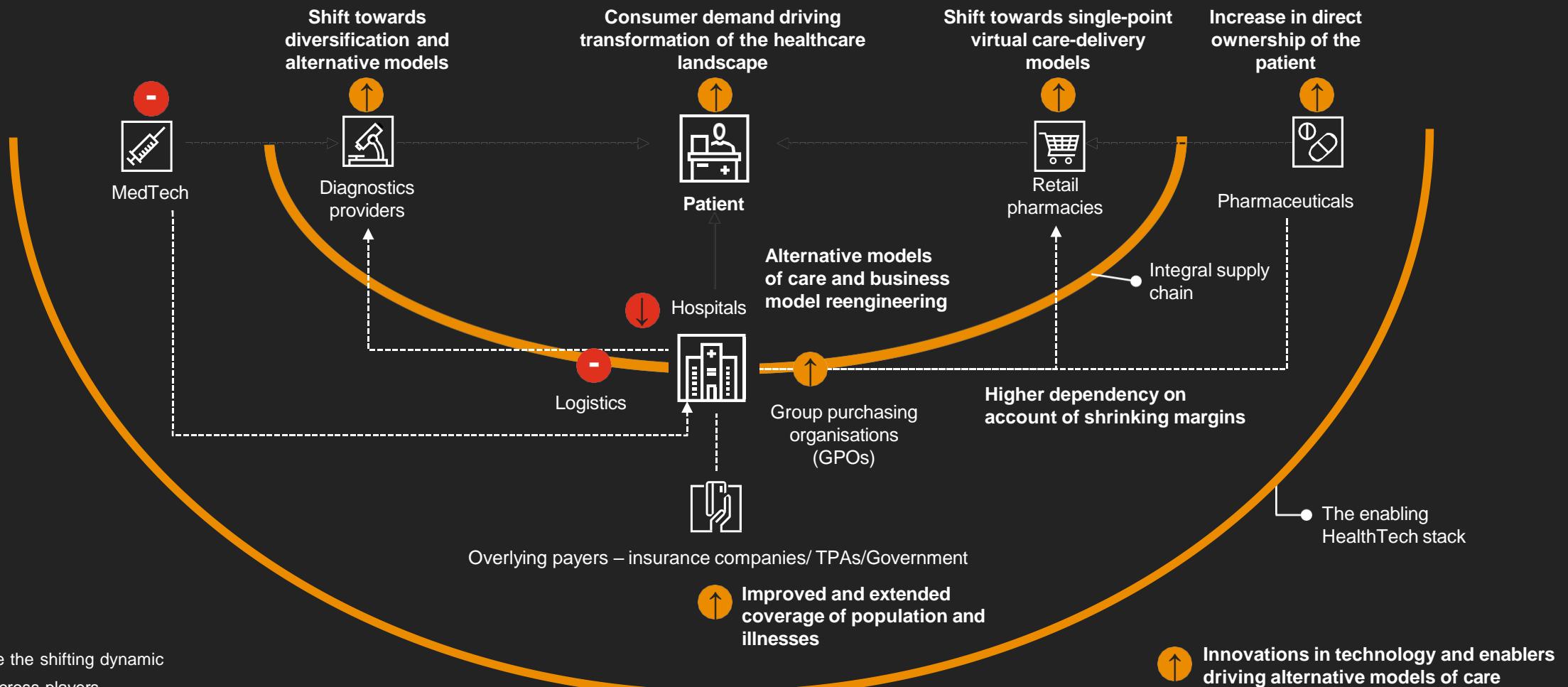
Data impacting health outcomes Early detection to continuum of care to data insights

The concept of care is moving beyond defined boundaries through virtual care and continuum of closure. The data generated is being utilised throughout the value chain to power health outcomes for patients and business outcomes through analytics for various key stakeholders.

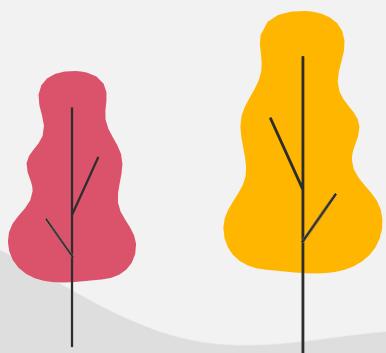


Conclusion

Both traditional and new players in the healthcare ecosystem are using digital technologies to transform the healthcare landscape, resulting in the creation of a new value proposition across the value chain.



Thank you



Appendix: State of Healthcare in India: PWC Survey results

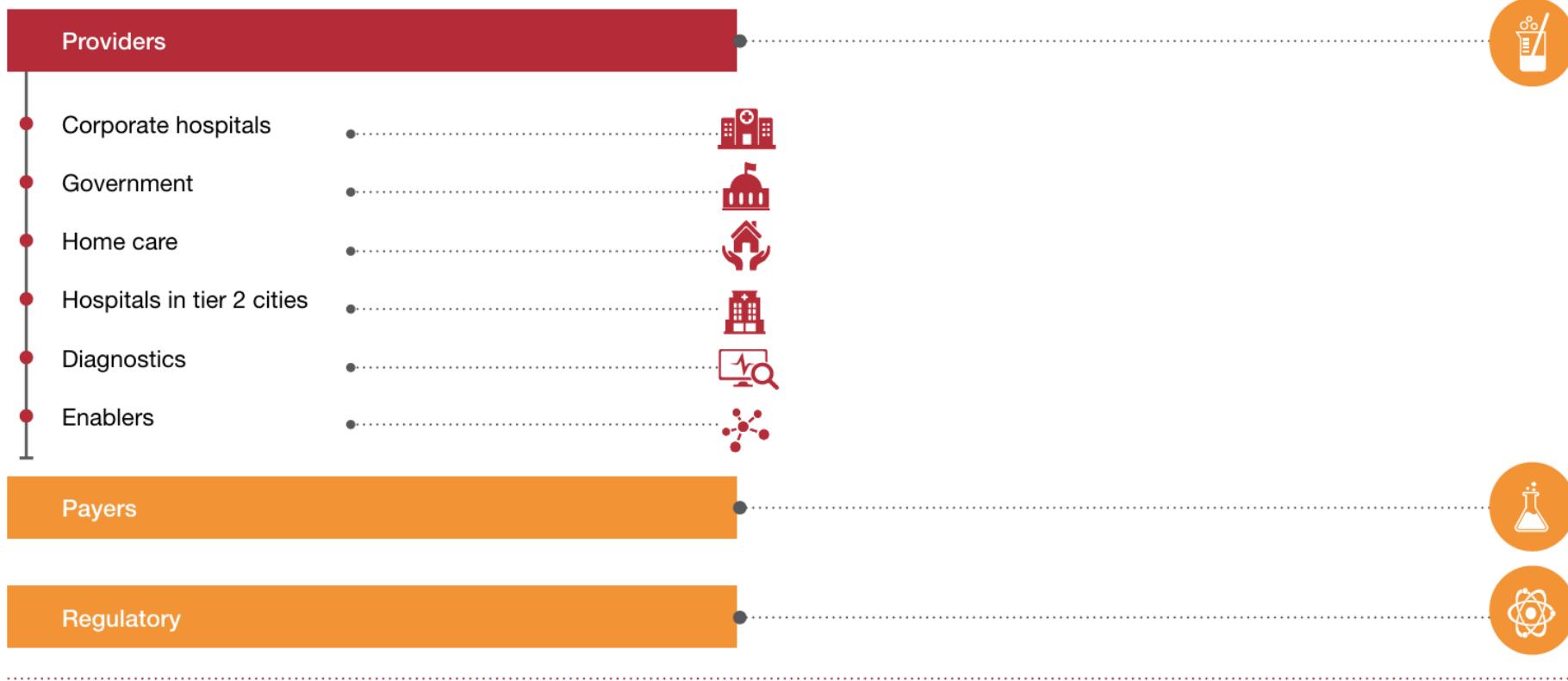


State of healthcare in India



Healthcare in India is complex due to the multi-layered architecture of health system administration. There are various considerations for this multi-layered hospital administration architecture.

These include whether it gets **public** (Central or state government) or **private funding**, what **location** it covers (rural or urban), and what **demography** and **prevalent diseases** it covers.



→ Figure 1: Healthcare provider ecosystem in India

State of healthcare in India



Also, there is great disparity in the availability of skilled resources between rural areas and urban areas, and more treatments are taking place in private facilities as compared to public facilities in both urban and rural areas.

Split of population and doctors

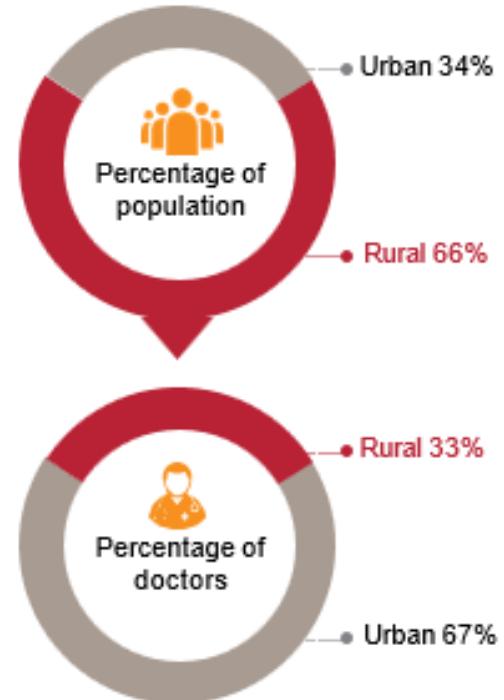


Figure 2: Split of population and doctors in India

→ Source: PwC analysis, World Bank data (2017)

Share of cases treated

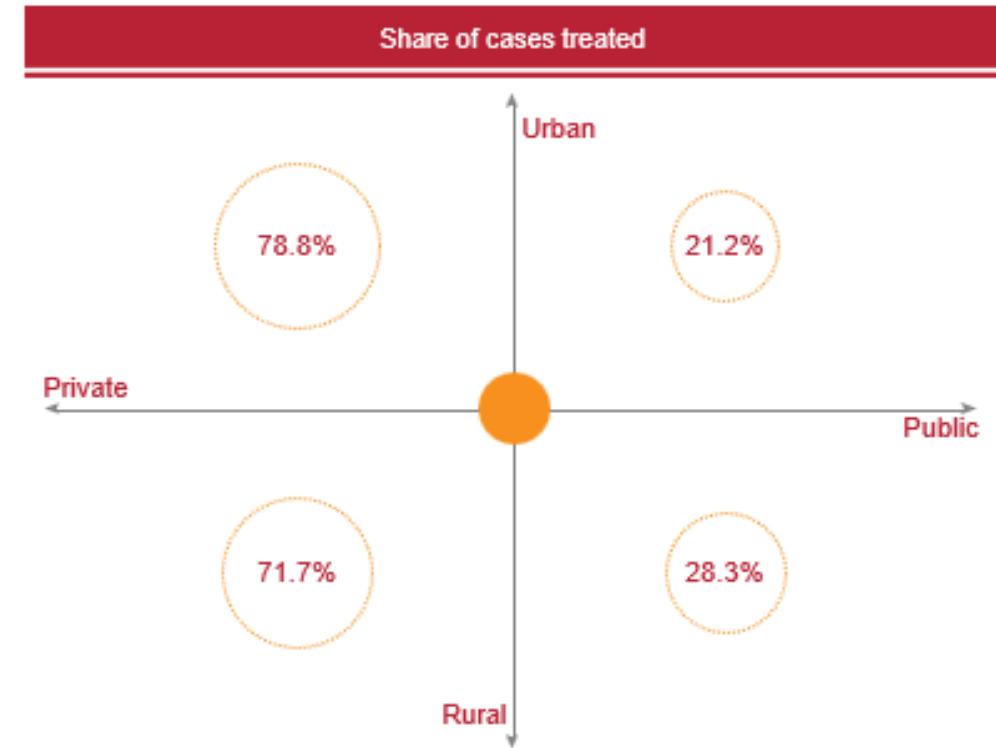


Figure 3: Share of cases treated in India

Govt. of India Initiatives

e-Health initiatives by the MoHFW, Government of India

- National eHealth Authority (NeHA)



Envisioned as a regulatory and promotional organisation to strategise eHealth adoption and set the standards, policies and legal framework for the health sector. Additionally, NeHA is responsible for setting up electronic health exchanges for interoperability and devising a certification framework for EHR products.

- Integrated Health Information Program (IHIP)



This programme intends to provide EHR to all the citizens of India and provide interoperability to existing EHR/EMRs on the Integrated Health Information Platform.

- Electronic Health Record Standards for India

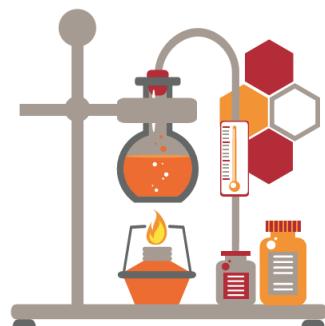


EHR standards were first notified in September 2013 by the MoHFW and a revised version was later released on 31 December 2016 after taking feedback. The MoHFW has also made standards like Systematized Nomenclature of Medicine – Clinical Terms (SNOMED CT) available free for use in the country.

- mHealth



The government is working with organisations, both government and private, to provide intuitive and interactive modes of communication, treatment, data transmission, and retrieval to doctors/hospitals and patients using mobile apps and websites.



Despite the various initiatives undertaken by the government and private players, the Indian healthcare ecosystem faces numerous challenges:

- There is a **shortage of qualified doctors and nurses**. On the infrastructure front as well, there is a need for exponential growth.

World Health Organization (WHO) recommendations

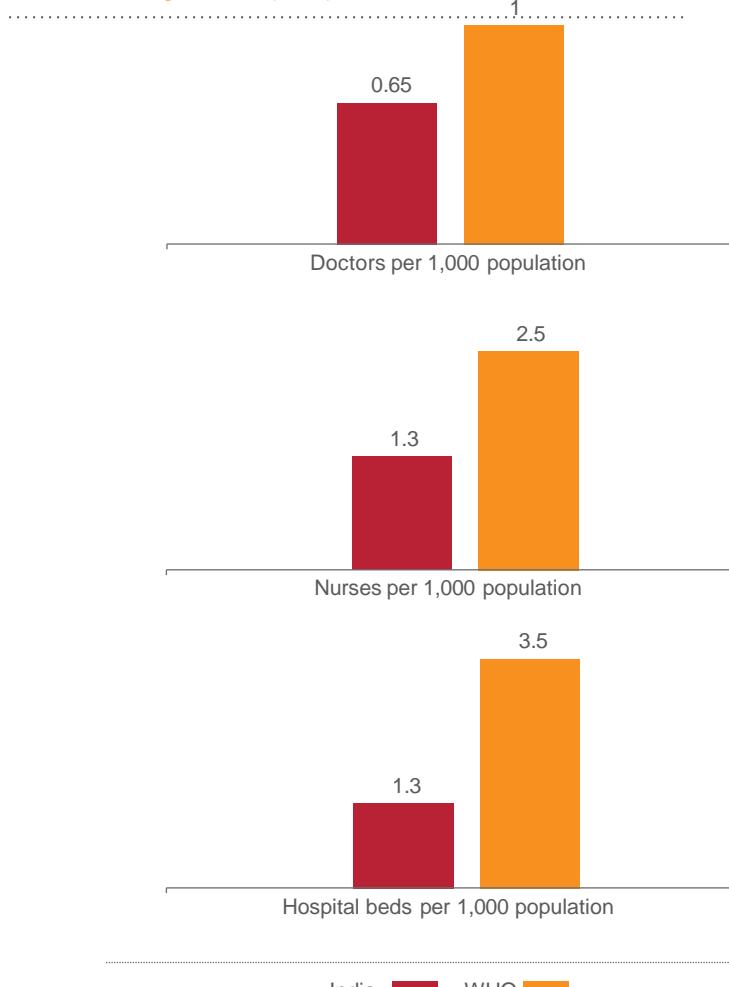
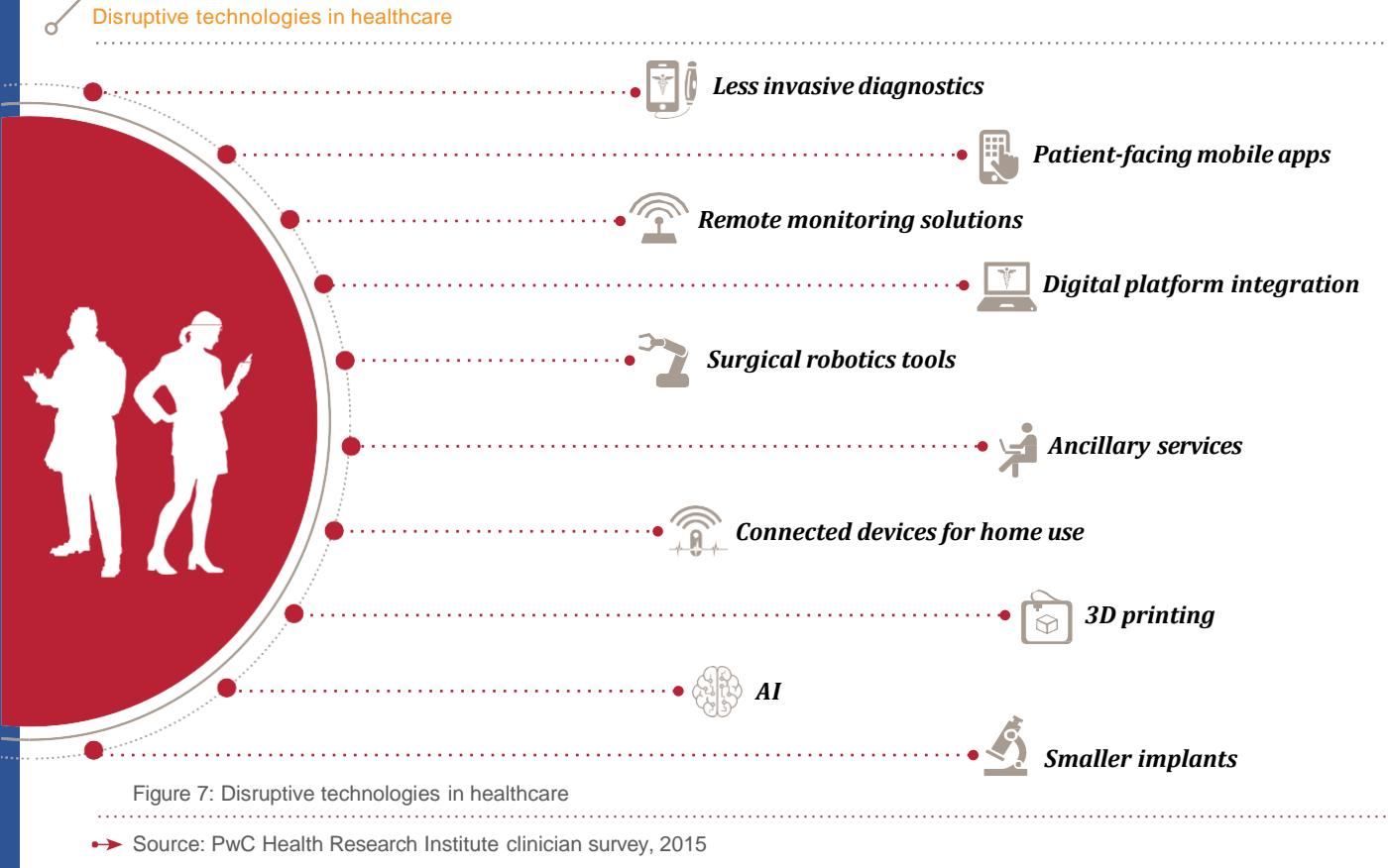


Figure 5: Comparison of key healthcare resources in India vis-a-vis WHO recommendations

Disruptive technologies are shaping the future of healthcare



Relevant emerging technologies for the Indian healthcare ecosystem

As per PwC's 2017 Global Digital IQ Survey, the Indian organisations surveyed seem to be making significant investments in AI, IoT and robotics. The investment focus is likely to shift to blockchain in the coming years.

PwC's Global Digital IQ Survey

In India, investments are happening in IoT and AI:

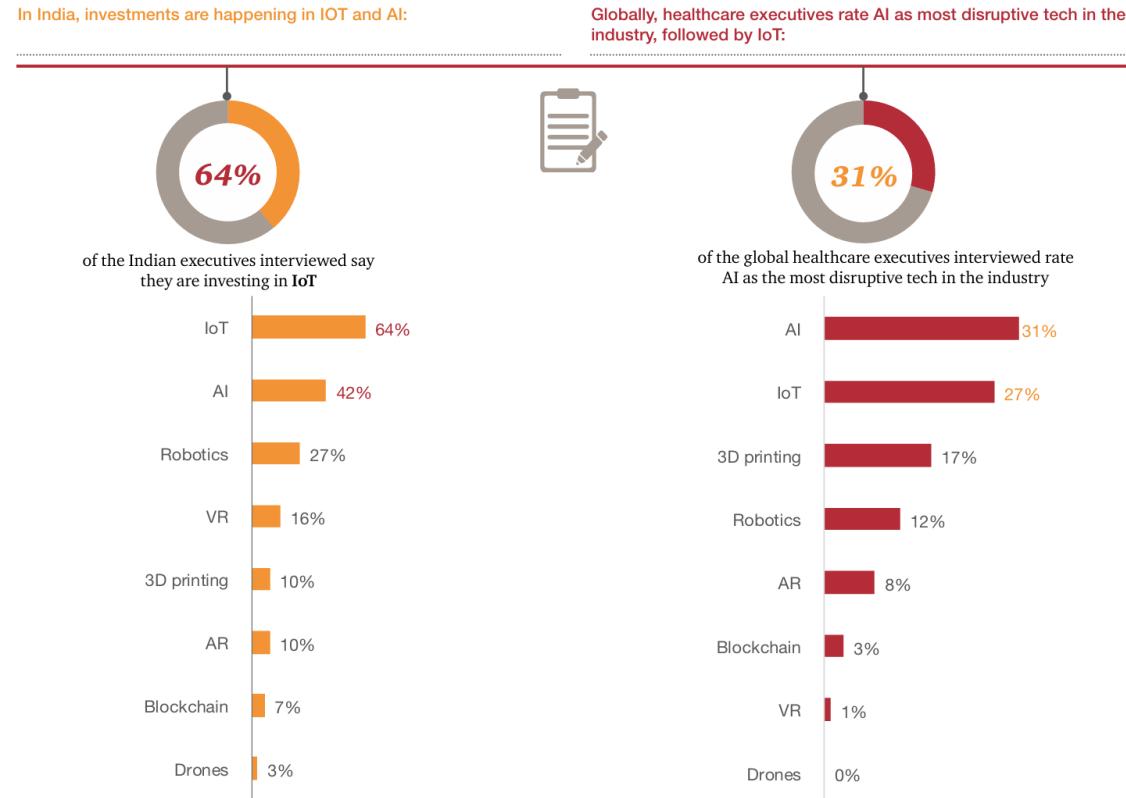


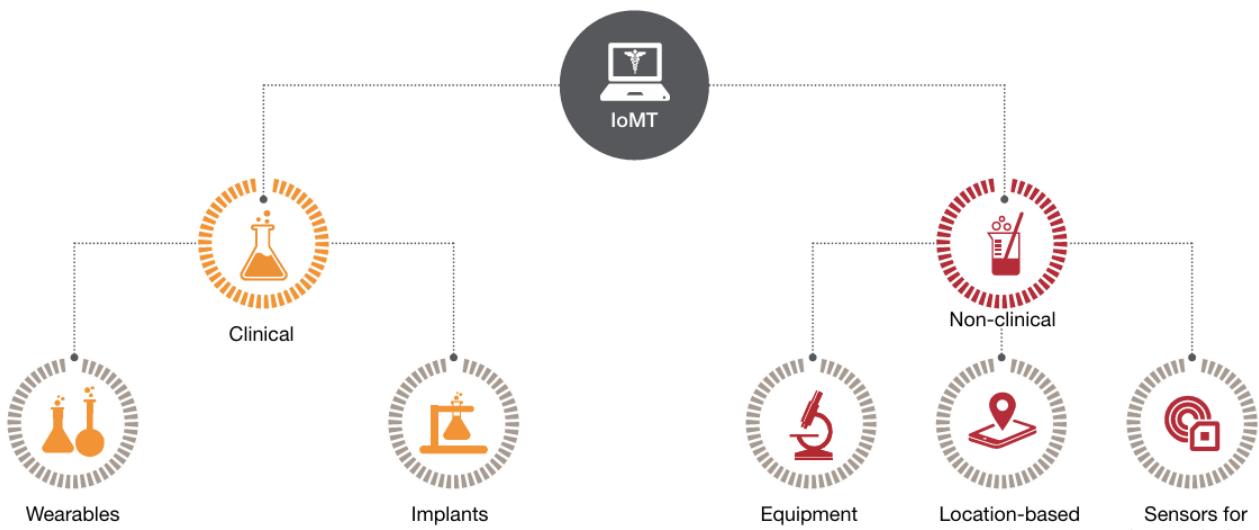
Figure 8: PwC's Global Digital IQ Survey

Source: PwC's Global Digital IQ Survey, February 2017



Internet of Medical Things (IoMT)

IoMT device categories



On the basis of their applications, IoMT devices can be split into two major types—clinical and non-clinical—which can be further classified into five device types.

•Definition of IoMT:

- IoMT refers to a global network of interconnected medical devices and applications.

•Applications of IoMT:

- **Clinical Scenarios:**
 - IoMT is used for monitoring patient vitals (e.g., temperature, blood oxygen saturation, blood pressure, respiration, ECG/EEG/EMG).
 - It raises timely alarms based on vitals data.
 - Continuous monitoring assists physicians through intuitive dashboards, reducing manual checks on ICU devices and patient monitors.
 - Nurses no longer need to rely solely on manual notes for vital information.
- **Non-Clinical Scenarios:**
 - IoMT has broader applications beyond clinical settings.

•Potential Impact:

- IoMT, combined with AI, can enhance clinical decision-making.
- It shifts healthcare delivery from a reactive to a proactive approach.

Clinical

1. Wearables

They include biosensors for monitoring blood pressure, heart rhythm, respiratory rate, blood oxygen saturation, temperature, eye pressure, glucose level, brain waves, sleep metrics, etc. These can be used for monitoring inpatients and for remotely monitoring patients after they are discharged from hospitals or under home care.

2. Implants

They include ingestible or implantable sensors used for tumour detection, tracking genomic signals, drug tailoring and inflammation detection.

Non-clinical

1. Equipment

It includes bedside monitors, smart beds, community kiosks, medication dispensers and medicine adherence trackers. These can be used in a hospital or for home care.

2. Location-based trackers

They include sensors or RFID tags used for tracking patient movement. The data is used to improve operational efficiency, track critical equipment and identify whether a patient has fallen and not recovered, etc.

3. Sensors for legacy devices

They include sensors that are used to simply transmit the data captured by legacy biomedical devices. These devices are costly and sometimes do not offer connectivity options. The sensors thus enhance their utilisation by connecting them to the enterprise applications.





Adoption of AI and IoMT Use Case

Summary of currently implemented use cases of AI and IoMT in India

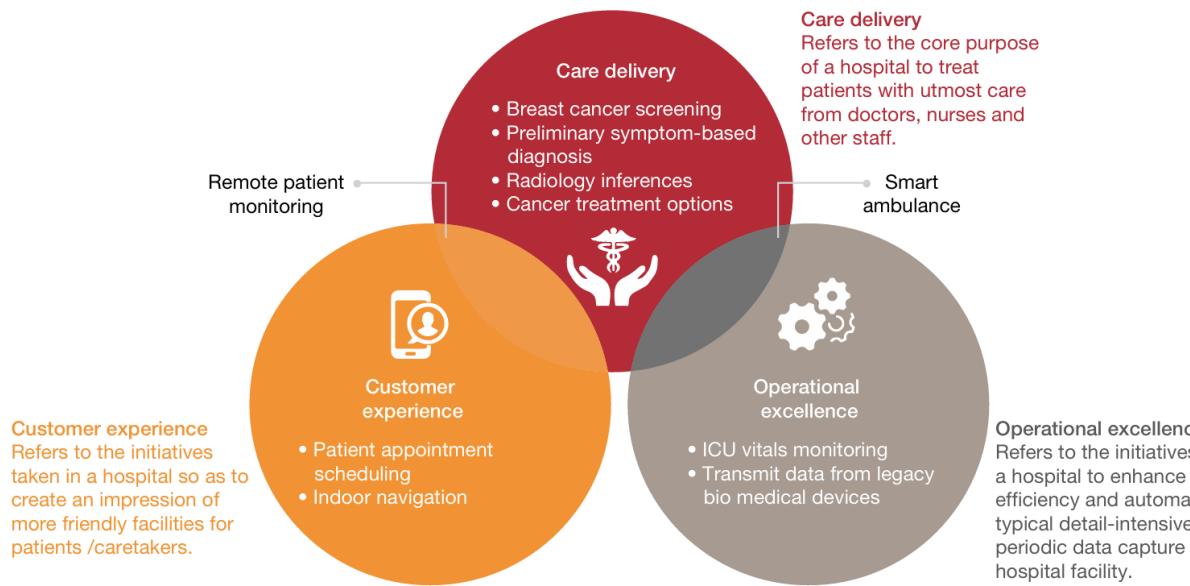
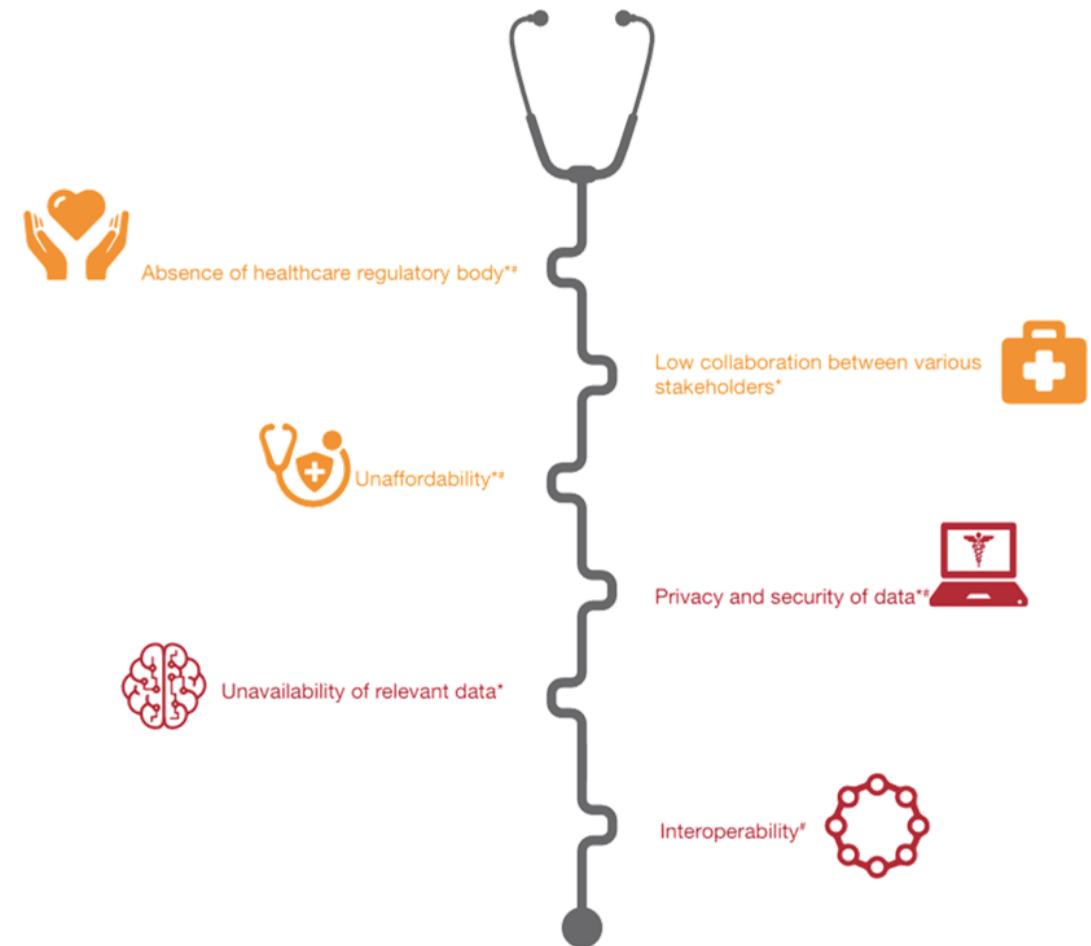


Figure 9: Summary of currently implemented use cases of AI and IoMT in India

Source: PwC's Healthcare IT Survey 2018

Challenges for AI and IoMT adoption



* Challenge for AI adoption

Challenge for IoMT adoption

■ Technological challenges

Appendix

Healthcare Scenario in Govt. of India



Figure 2.1 Health in India, roles and functions of key players at the national level

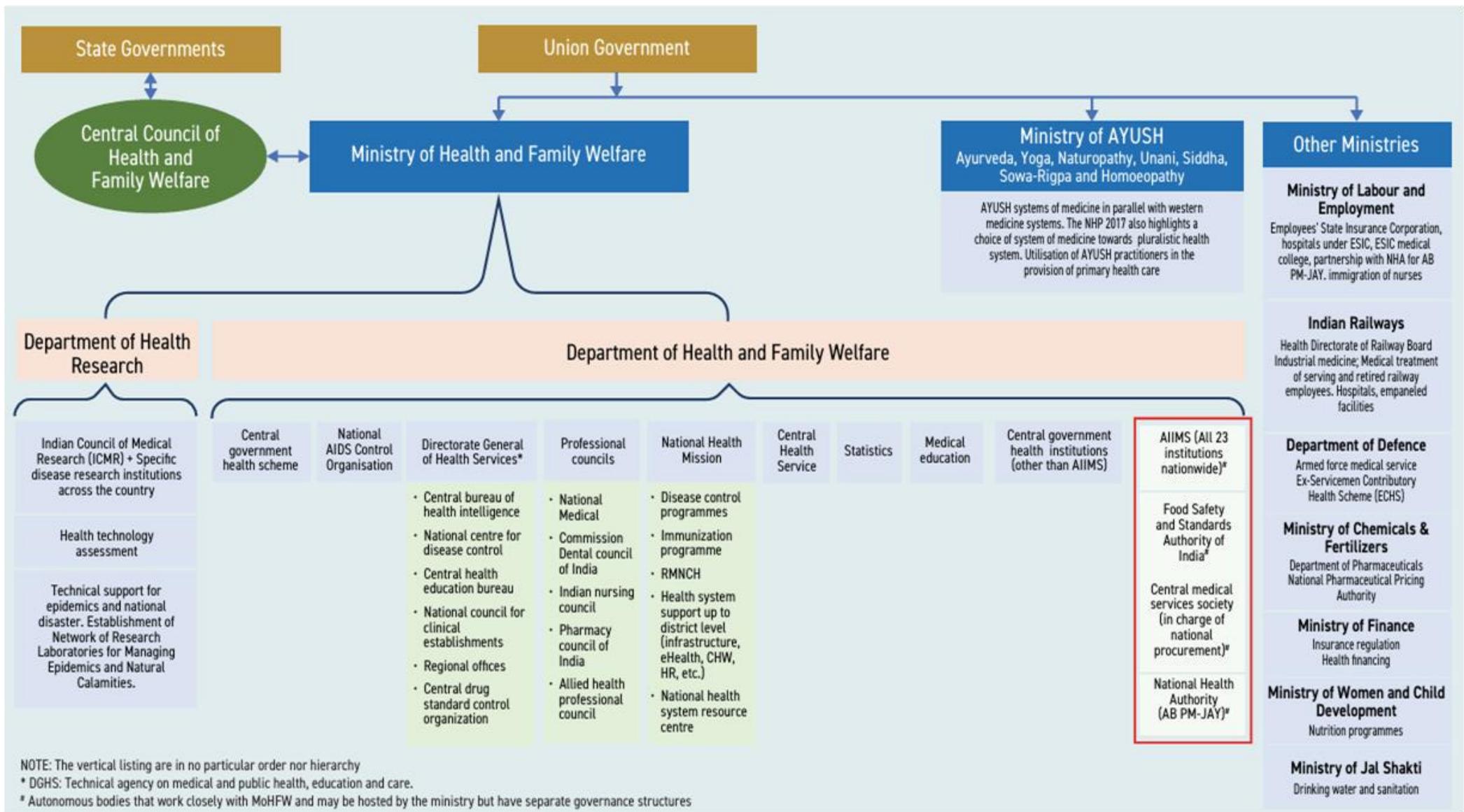


Figure 2.2 Organization of health: relationships between the Union, state and district levels

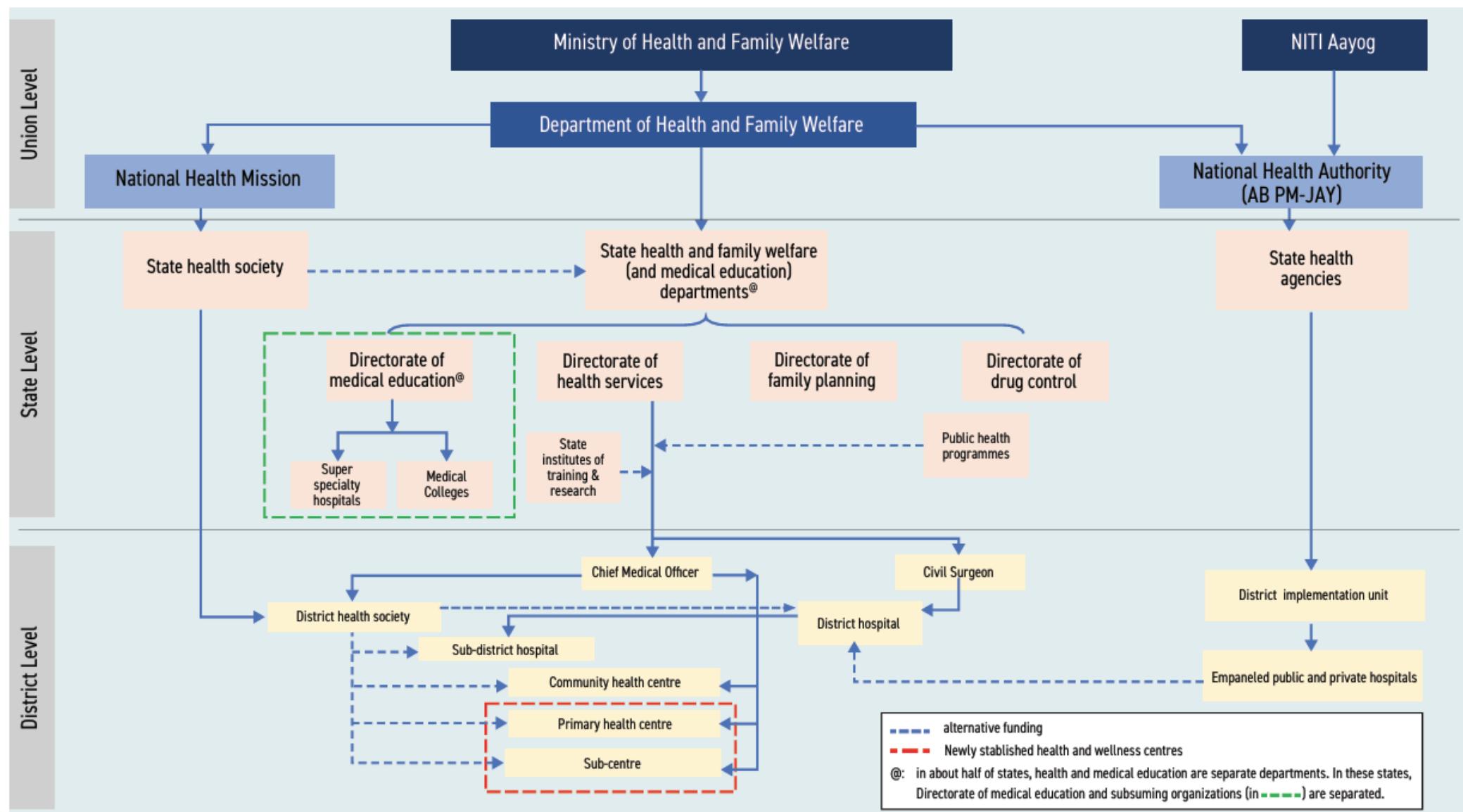


Figure 3.5 Financial flows of all health funds in India

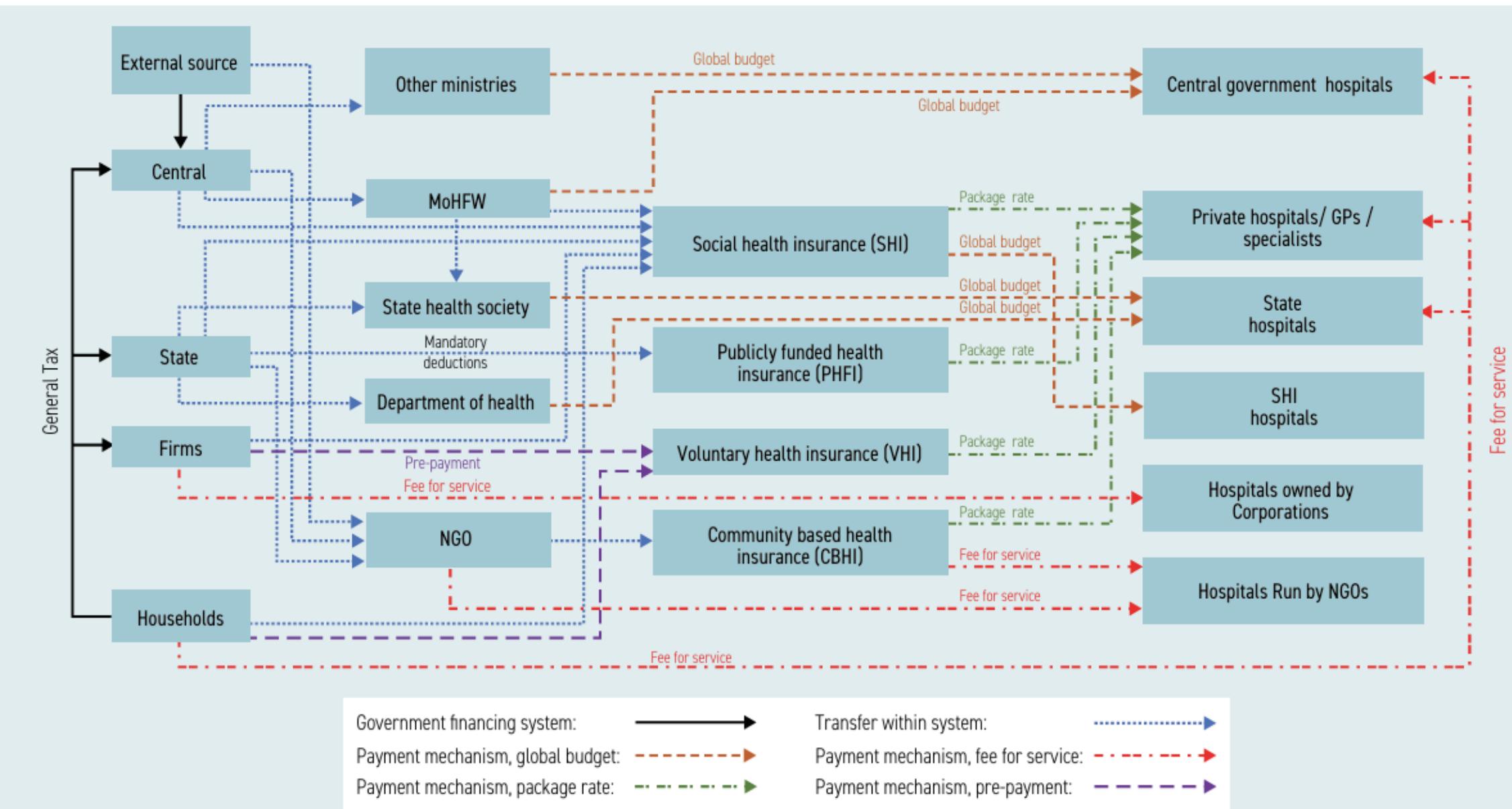


Figure 4.1 Schematic representation of service delivery in public sector
(dash line indicates possible but less common)

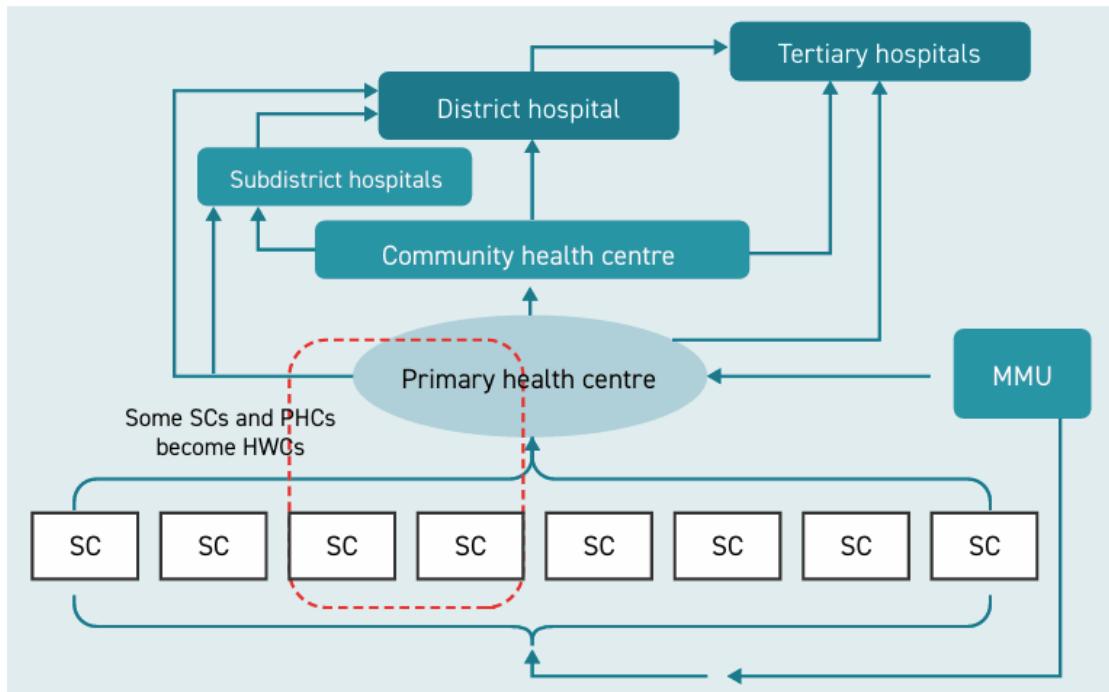


Figure 5.1 Organization of health at the national level (simplified)

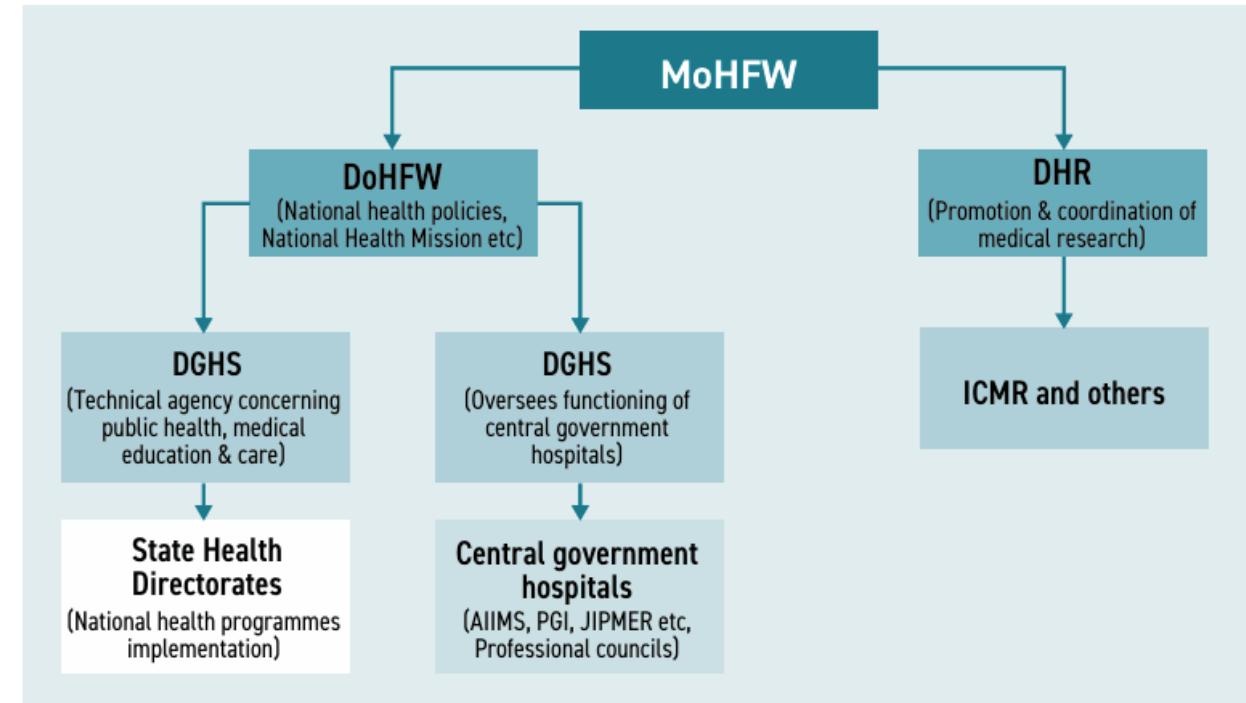


Figure 5.2 Structure of the National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke, India

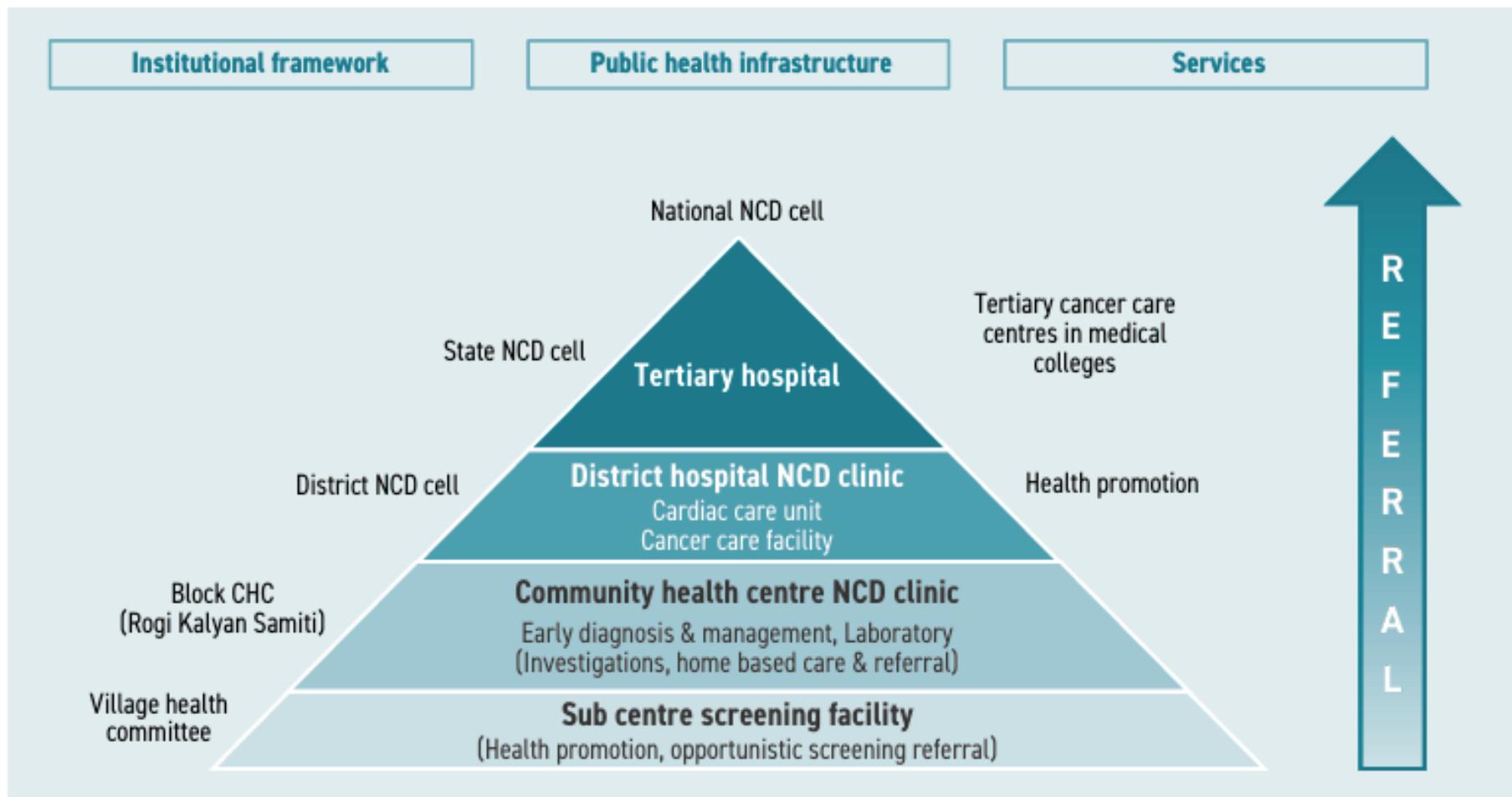


Figure 5.4 Sales break-up across different channels

