

Study to Analyze the Trends Disrupting the Healthcare Horizon

By

Ayushi Sahastrabudhe

*Dissertation submitted in partial fulfillment of the requirements of the degree
MBA Hospital and Health Management*

Academic year, 2018-2020



The IIHMR University, Jaipur

1, Prabhu Dayal Marg, Sanganer, Airport
Jaipur 302029, Rajasthan
Ph: 0141 3924700, Fax: 3924738
Website: www.iihmr.edu.in

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Jaipur 302029, Rajasthan
Ph: 0141 3924700, Fax: 3924738
Website: www.iihmr.edu.in

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The candidate has successfully carried out the study designated to her during internship training and her approach to the study has been sincere, scientific and analytical. The internship is in fulfillment of the course requirements.

I wish her all success in all her future endeavors.

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Office Managing Principal

ZS Associates India Private Limited

A Subsidiary of ZS Associates International, Inc. CIN - U72200PN2004FTC020841

Registered Office:

World Trade Center, Tower 3, Kharadi,
Pune - 411014, Maharashtra, India

T | +91 20 6739 5000 F | +91 20 6739 5001

www.zsassociates.com

Branch Office:

Block-A4, IT/ITES SEZ of DLF Limited
Village - Siskhera, Sec-30, Gurgaon (Haryana) 122002 India

T | +91 124 679 7000 F | +91 124 679 7001

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This is to certify that the dissertation titled A Study to Analyze the Trends Disrupting the Healthcare Horizon submitted by Ayushi Sahastrabudhe, Enrollment No. IIHMR-U/01/2018-20/0728 under the supervision of Dr. P. R. Sodani, Pro-President and Dean Institute of Health Management Research, for award of MBA in Hospital and Health Management carried out during the period from 3rd February 2020 to 29th May 2020 embodies my original work and has not formed the basis for the award of any degree, diploma associate ship, fellowship, titles in this or any other institute or other similar institution of higher learning.



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ABSTRACT

Background: The Global healthcare and life sciences industries are entering a transformative phase over the next five years with several forces like new technologies, fiscal uncertainties, demographic transformation and the recent COVID-19 pandemic are disrupting the healthcare horizon, driving some key trends to impact the businesses of healthcare stakeholders across sectors, who in turn will need to adapt to these shifts and fundamentally reimagine their businesses, operating models, and capabilities to remain relevant and competitive and build the most sustainable business model in the next 3-5 years by efficiently pairing differentiated technology with the right value proposition.

Methodology: A descriptive study conducted through secondary research or desk review using publically available data sources, to identify the key trends and their enablers and analyze their impact on various healthcare stakeholders and derive implications for the stakeholders over the next 3-5 years considering the opportunities and challenges posed by the trends for their sector. The qualitative data was collected by structured and targeted secondary research to gather market evidence to support the disruption caused by the trends over Q3'19, Q4'19 and Q1'20, along with tracking the COVID updates across the news flashes and study reports to understand its impact on the trends. PEST framework was used to analyze the macroenvironment for the trends, the adaptive strategies were studied for key market players in different healthcare sectors in response to the trends under the scope of study while the implications for the healthcare stakeholders were derived through primary research by brainstorming sessions and discussions with industry experts, principals, managers and gathering their PoVs.

Conclusion: With the beginning of a new decade facing several disruptions including COVID-19, acting as a catalyst for the much-awaited transformative change across the healthcare value chain, has also catalyzed more flexible regulations to emerge especially encouraging digital health mediums thereby accerelating the remote care trend. The captured evidence, macro-environmental analysis and use cases in the study suggests that the next five to seven years are likely to require a sustained upshift in strategic investments and cross industry collaborations by the stakeholders to unlock the potential of the market opportunities and overcoming the challenges adopting innovative approach through strengthening internal capabilities, reinventing digital strategies, modernizing infrastructure especially technology infrastructure and implement effective business transformation and change management strategies by investing in team's adaptability.

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Sincerely

Ayushi Sahastrabudhe

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List of Abbreviations

AI	Artificial Intelligence
AR	Augmented Reality
AWS	Amazon Web Services
B2B	Business to Business
C2B	Consumer to Business
CAGR	Compound Annual Growth Rate
CDC	Centers for Disease Control and Prevention
CFOs	Chief Financial Officer
CGM	Continuous Glucose Monitoring
COVID	Corona Virus Disease
Cx	Consumer Experience
D2C	Direct to Consumer
DL	Deep Learning
DTx	Digital Therapeutics
EHR	Electronic Health Records
FDA	Food and Drug Administration
Gen Z	Generation Z
GTM	Go to Market
HC	Healthcare
HHS	Health and Human Services
HPP	Health Plans and Providers
IDNs	Integrated Delivery Networks
IoT	Internet of Things
M&A	Mergers and Acquisitions
ML	Machine Learning
NCDs	Non-Communicable Diseases
PBMs	Pharmacy Benefit Managers
PEST/PESTE	Political, Economic, Social, Technological, Environmental
R&D	Research and Development
US	United States
VR	Virtual Reality

1. Introduction

The Global healthcare and life sciences industries are entering a transformative phase over the next five years (1). Amid rising global trade tensions and sluggish global economic outlook for 2020, the global healthcare market is expected to cross the \$2 trillion mark in 2020 (2). McKinsey (3) expects the promising new technologies such as biotechnology (genomics, biosensors), digital (AI, blockchain, Internet of Things, robotics, automation) and treatments to see much wider adoption making the environment ripe for the disruption of businesses, operating models and markets. At the same time the changing demographics, such as growing middle class and an aging population, coupled with the epidemiological transition to increased prevalence of NCDs and the novel risk created due to the global pandemic, meaning that the demand for innovation to drive simultaneous improvement in health outcomes, affordability, quality, and access will continue to be high (3). This disruption, in turn, will affect a fundamental shift in the healthcare ecosystem, driven by digital health applications across the healthcare horizon by traditional players coupled with a push from the non-traditional entrants in the healthcare industry, towards a preventive care strategy. An article published in Euro Health (4), commissioned by the European Observatory on Health Systems and Policies states that with unparalleled technological disruption, fiscal uncertainty, and the demographic transition into a grey continent, the health system needs to be more responsive to outside knowledge and pressure with largely data-driven and digital tools. But for this to be incorporated in a system of health innovation would require a positive and pervasive change in the health community's mindset (4). Pratap and Sahay describe in a chapter published in Global Innovation Index 2019 that "the picture for global health care is not consistent across all countries, the challenges and unmet needs vary widely between the developed and developing worlds" owing to variations across the regulatory environment, economic conditions, income levels, urbanization, and climatic conditions, thereby, having varied implications of a trend for the healthcare stakeholders across the globe (5).

Healthcare ecosystem undergoing innovation-driven transformation

The healthcare value chain continues to be influenced by the information revolution and technological advancements, so as the stakeholders (Pharma companies, Health providers, IDNs, Payers, PBMs, Tech companies). By 2025, US healthcare spending is expected to top \$5.34 trillion. A \$284-billion to \$550-billion opportunity is identified for value creation from the application of best practices to improve healthcare productivity and market function (6). Big healthcare data, open and secure platform lays the foundation for digital transformation to play a major part in new care delivery models; shaping a predictive, preventive, and personalized future; promoting closer collaboration among industry stakeholders; and driving cheaper, more precise, and less invasive treatments and therapies (7).

Data powers value: Healthcare data is now seen as the ‘new goldmine’. The healthcare industry is generating a humongous (2,314 exabyte) amount of data; “The global big data in healthcare market amounted to \$11.45 billion in 2016 and is expected to reach \$134 billion in 2025 growing at a CAGR of 36%” (8). Government regulations are playing a key role in promoting big data; For example, Health Data Initiative’s Department of Health and Human Service (HHS) has started to release data from agencies like FDA and the CDC to access public data of patients for clinical trials and other research activities.

New data-driven technologies like tele- and self-monitoring, wearables, artificial intelligence, and several connected devices, etc. are spurring digitization and automation across the board with nonhealthcare (tech startups, consumer tech companies, big tech giants) players leveraging their tech capabilities and large rich consumer data to establish a strong foothold in the healthcare industry. However, Prof. Christian Lovis (9) states that the actual adoption of these technology is ambiguous as there are many determinants, like education, legal and regulatory frameworks, and interoperability, affecting its real impact on patient autonomy and care processes. Though the technology is set to disrupt but the culture, the care processes, and the environment will have to change accordingly to match the pace of disruption (9). Technology giants are investing billions of R&D dollars trying to win a share in the public cloud and to retain consumer mindshare and engagement. Start-ups are disrupting many areas, from the natural language processing of clinical notes to the enrolment of patients in trials and the creation of virtual clinical trials. Additionally, institutional investors have pumped more than \$80 billion into health tech in the last five years (3). The regulators are pushing interoperability and freeing up data to be aggregated around the patient, manufacturers are investing in digital health as well as building contracts directly with providers for expensive drugs (10). Combined, these digital advances create fertile ground for the development of consumer-centric personalized, intuitive, and integrated health and social care ecosystems. Ownership of the consumer relationship, and therefore the ability to add and derive value, has the potential to shift. Leading players will need a clear view of their intended role in these ecosystems of the future; investigate partnerships, alliances, and acquisitions; and find how they want to organize their programmatic M&A and innovation capabilities (3).

COVID-19 is set to impact the healthcare horizon

The COVID-19 pandemic is a transformative event in world history. Healthcare systems and pharmaceutical markets will not see a rapid return to normal. In fact, COVID-19 could act as a catalyst for substantial and lasting change for some fundamental aspects of healthcare systems and pharmaceutical businesses. Whilst there are huge challenges ahead, the fact is that the crisis is sparking more innovation across the healthcare value chain (Discovery, Development, and

Delivery) acting as an opportunity for healthcare stakeholders to transform and evolve more rapidly giving a technological push to the discovery, development, and delivery of care to the consumers

Impact on Discovery and Development

- An upsurge in the use of AI and computing technologies to accelerate drug discovery and development
- Boost for COVID -19 related trials; encouraging innovative trial models to make trials more adaptive to the current situation; halt on ongoing trials by FDA as well as company's individual decisions
- Pharma supply chain is adversely affected
- Delayed launch and slow adoption of recently launched products
- Accelerated approval of COVID-19 treatment

Impact on Delivery

- Healthcare delivery sees an accelerated shift to digital.
- The rise of remote engagement is a strong driver to technology companies who were already very active in putting into place telemedicine and remote
- Customer engagement over digital channels preferred largely
- A shift in provider landscape to increased consolidations across the value chain (vertical integrations to spike)
- Elective treatments hampered
- More online medicine delivery preferred along with an increased rate of refill
- Payers waiving off co-pays for telemedicine visits and remote diagnostics

1.1 Rationale

In a marketplace characterized by heavy disruption, the healthcare and life sciences sector will be at a crossroads. The companies in the various sectors of the healthcare industry will need to pair differentiated technology with the right value proposition and adapt to these shifts to fundamentally reimagine their businesses, operating models, and capabilities to remain relevant and competitive and build the most sustainable business model.

In an endeavor to help the stakeholders understand the urgency to react to and navigate these upcoming challenges, this study aims to prepare a comprehensive landscape of the trends and their driving forces which prove to be critical to addressing the challenges and will require the industry clients to make some bold decisions to power the future of healthcare. These trends hold an **evidence-based** view, which decision-makers can leverage to develop their growth strategies and scenario planning considering the impact of these trends over the entire healthcare system over the

next 3-5 years and stay ahead in the competitive market by making themselves prepared for such upcoming advances.

2. Literature Review

S.L. Ondra in the chapter, **Macro Trends in Healthcare Delivery** explored three broad areas where macro trends are driving change in US healthcare system: cost, consolidation, and new technology to understand where things are moving and how to create a strategy and plan for success, concluding that the business and care models are set to be disrupted with transitioning to models that align incentives across the stakeholders in the healthcare space to deliver higher value-creating winners and losers in a sector that earlier almost had only winners (11).

Deloitte's 2020 Global health care outlook takes a detailed look at the factors driving change in the sector, key issues shaping 2020 (Financial operations and performance improvement, Care model innovation, Digital transformation and interoperability, Future of work) and outline suggestions that stakeholders (health care providers, governments and other payers, disruptive entrants, and even consumers) can consider responding to the trends, as they lay a solid foundation for the envisioned future (7).

Sadiku M. et al. in the research paper titled '**Emerging Technologies in Healthcare: A Tutorial**' explored the concept of emerging technologies and described the emerging technologies in healthcare and their applications along with their benefits and challenges concluding that the future technological innovations (new drugs, new treatments, new devices, etc.) will keep transforming healthcare and the stakeholders need to be aware of the drivers, align with them, and work with them to ensure the best outcomes for society (12).

Edmunds M. et.al. explored the consumer health informatics ecosystem in '**Back to the Future: Emerging Technology, Social, and Cultural Trends Affecting Consumer Informatics**' and found some cross-cutting themes across settings and stakeholder groups, like recognizing the importance of patient autonomy and the value of the consumer's voice, understanding and building systems of care that support personalized care, paying for new models of care, navigating the management of electronic records to encompass a broader view of health and described some strategies to promote technology adoption in health care and consumer empowerment (13).

3. Objectives and Methodology

3.1 Research question: What are the disruptive trends and how will they revolutionize the current status quo impacting the future growth of stakeholders in the healthcare industry?

3.2 Objectives:

General objective: To assess the evolution of trends and their implications over the next 3-5 years for the stakeholders across the healthcare horizon

Specific objectives:

1. To identify the underlying enablers driving the change in the healthcare ecosystem
2. To understand how the trends are becoming disruptors
3. To scan and analyze the macroenvironment factors driving the trends
4. To identify and assess the opportunities and challenges posed by the trends
5. To derive the implications of the trends for the healthcare stakeholders

3.3 Study design: Descriptive study (desk review)

3.4 Source of data: Market research reports, whitepapers, consulting reports, industry expert's comments, and interviews, news flashes, company websites, Forbes, Government websites, Fierce pharma, HealthITConsultant, Modern Healthcare, HealthAnalytics

3.5 Data collection and analysis:

- Some underlying technological and structural forces driving change across several industries were scanned to identify the underlying enablers for the healthcare trends.
- The qualitative data was collected by structured and targeted secondary research using 'Advanced search' on Google, to gather market evidence to support the disruption caused by the trends over Q3'19, Q4'19 and Q1'20, along with tracking the COVID updates across the news flashes and study reports to understand its impact on the trends.
- The adaptive strategies were studied for key market players in different healthcare sectors as a reflection of the impact of the key trends under the scope of study on their businesses for which the data on key M&A activity was collected through news flashes and company websites to describe the strategic intent of the healthcare stakeholders.
- PEST framework was used to analyze the macroenvironment for the trends

- The implications for the healthcare stakeholders were derived through primary research by brainstorming sessions and discussions with industry experts, principals, managers and gathering their PoVs.

3.6 Operational definitions

- **Trend:** A general direction in which something is developing or changing.
- **Disruption of the healthcare industry:** A vital catalyst for a change that sheds a unique light on difficult issues, giving a fresh urgency and perspective to the challenges and drive innovations in the healthcare industry.
- **Healthcare ecosystem:** A complex and interconnected system of healthcare organizations like Providers – primary and specialty physicians, nurses, and other clinical staff, as well as different hospitals, clinics, and labs that deliver care; Payers- that reimburse providers for covered healthcare services; organizations that don't deal directly with patients, but whose contributions indirectly influence patient outcomes including Pharmaceutical companies who make and develop our medications; Biotechnology companies; Medical device companies; Distributors whose products and services are used to prevent, diagnose, treat and even cure diseases; Health information technology providers who manage the all-important patient records and data
- **Healthcare stakeholder:** A person with an interest or concern in something, especially a business.
- **Emerging technology:** An emerging technology is the one that holds the promise of creating a new economic engine and is trans-industrial.
- **Disruptive innovation:** In business theory, a disruptive innovation is an innovation that creates a new market and value network and eventually disrupts an existing market and value network, displacing established market-leading firms, products, and alliances.

4. Results and Discussion

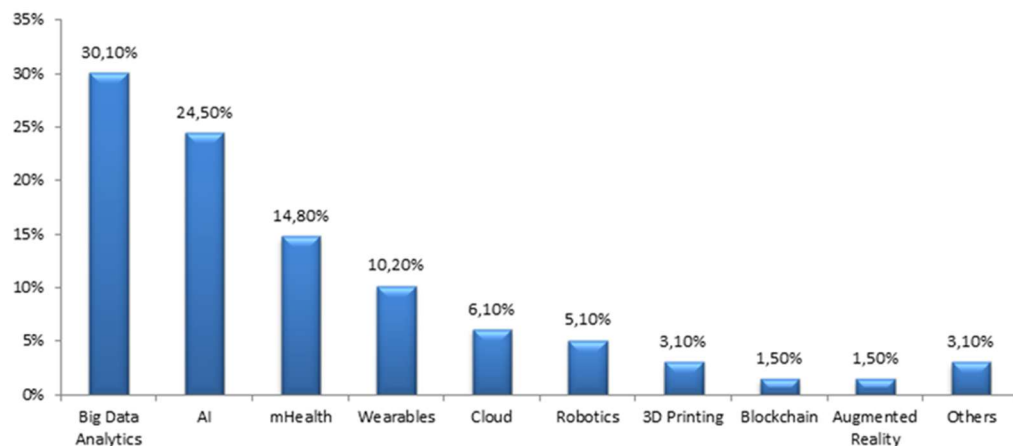
4.1 Identifying the enablers

Enablers are the underlying technological and structural forces driving the change across different sectors of the healthcare industry. These were identified by reading through whitepapers, industry expert's comments and interviews, reviews, market research reports, studying the competitive landscape and the findings are consistent with Emerging Technologies in Healthcare: A Tutorial (12)

Identified enablers are:

Tech enablers	Others
•Artificial intelligence(Predictive algorithms, virtual assistants and chatbots,robotics) •Internet of Things(IoT) •Blockchain •Genomics •Biosensors •AR/VR	•Consumerism •Declining ROI •Increased competition

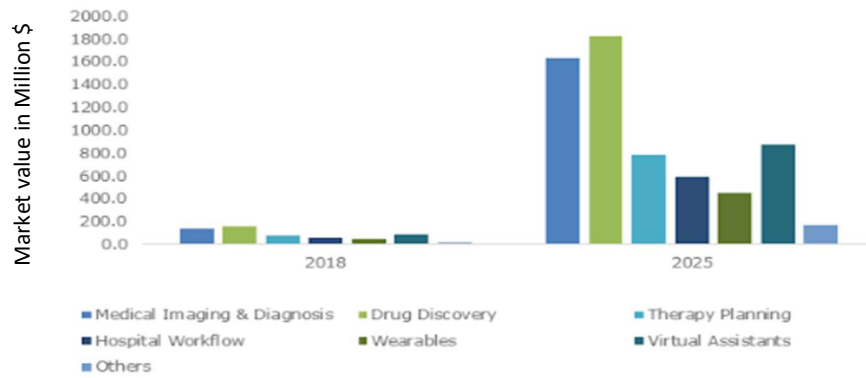
Fig.4.1 Underlying Enablers Driving Change Across the Healthcare Horizon



Source: [Forbes](#)

Fig.4.2 Key Technologies Impacting the Healthcare Industry

Interpretation: Big data analytics followed by AI forms the top two technologies enabling transformation across the healthcare horizon. This shows there is a huge market opportunity for traditional and non-traditional players in the healthcare industry to leverage these technologies and derive the value from a vast amount of healthcare data, radically transforming the value generation and delivery across the healthcare value chain.



Source: [globalmarketinginsights.com](https://www.globalmarketinginsights.com)

Fig.4.3 AI in Healthcare Market Size by Application in USD Million

Interpretation: Increasing interest and adoption of AI in various sectors of healthcare is set to disrupt the healthcare horizon. Drug discovery followed by Medical imaging and diagnosis proves to be the key areas for AI of application, where the market is expected to see exponential growth with AI in the drug discovery market reaching ~\$2B and Medical imaging and diagnosis market reaching ~1.5B by 2025.

The key trends identified across the healthcare value chain driven by these underlying forces impacting the entire healthcare system over the next 3-5 years are as follows:

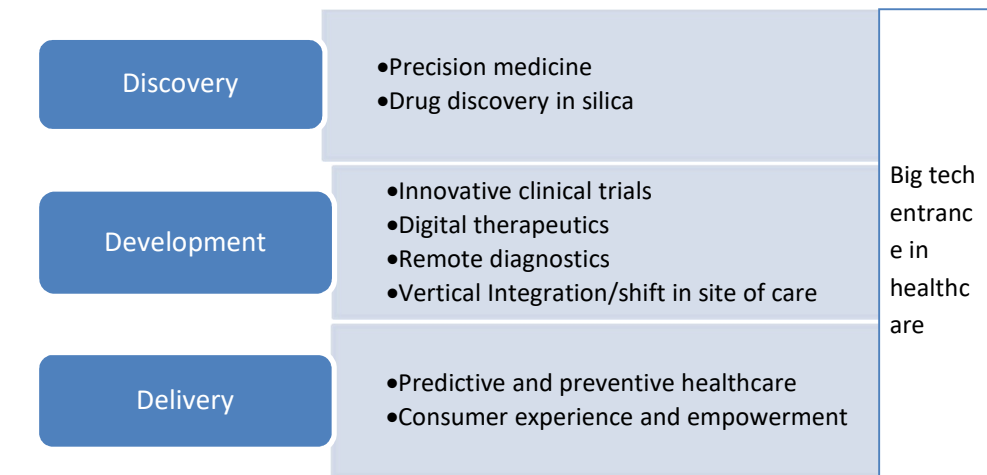


Fig.4.4 Emerging Trends Across the Healthcare Value Chain

Scope of the study: I will be taking up 5 trends in detail for the analysis which seems to be rapidly picking up the most compared to others considering the increased investments, demand, adoption,

regulatory support in each vertical of the value chain, opening up new opportunities for growth of the industry players:

1. Drug discovery in silica
2. Remote diagnostics
3. Vertical integration/shift in site of care
4. Consumer experience and empowerment
5. Big tech entrance in healthcare

4.2 Trend1: Drug Discovery in Silica

About the trend: Drug discovery is the first step of the biopharma value chain that identifies new candidate therapeutics for treating or curing human diseases (14). The declining efficiency of pharma R&D has pressed drug makers to innovate in order to improve efficiency of developing medicines. Biopharma's commitment to digital transformation is increasing and the applications of AI in drug discovery are picking momentum, largely driven by the need to control costs and speed up drug discovery, minimize failure rates of trials and ultimately create better medicines.

4.2.1 Macroenvironmental factors driving the trend:

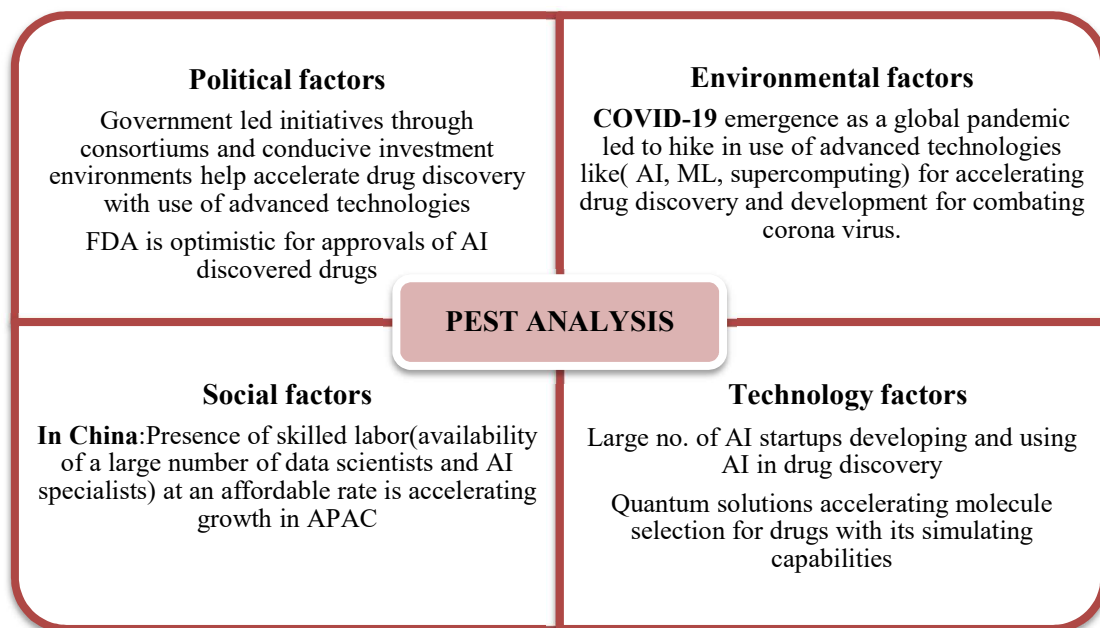


Fig.4.5 PEST Analysis: Drug Discovery in Silica

Why AI? Why now?

AI solutions have the potential to accelerate scientific research using quick and accurate in silico testing by using DL algorithms to identify new potential drugs faster and cheaper (14). Evidence suggests that Big pharma companies are exploring ways to leverage the power of AI to fasten the most cost incurring part of drug manufacturing, these findings are consistent with those of Deloitte which states that in the past few years, the number of AI companies focused on discovering new drugs have surged rapidly posing as a **competitive threat to the Big pharma companies** leading them to now make a variety of deals (acquiring the intellectual property rights, royalties, sale of drugs created under the collaboration, etc.) with these companies to access their technological capabilities (14).

4.2.2 How the trend is disrupting?

Drug discovery forms the largest application segment for AI in healthcare. With a growing number of cross-industry collaborations and partnerships coupled with advances on regulatory front the AI adoption in the drug discovery space is estimated to be a ~\$2B worth market growing at a CAGR of ~40% by 2025 (15). Tech giants are also leveraging their tech capabilities (AI/ML, cloud, quantum computing) and investing in drug discovery by providing platform-based services or even collaborating with biopharma companies and AI startups to develop innovation labs or even successfully developing predictive algorithms. In the current times of global health crisis emerging due to the COVID-19 pandemic, AI/ ML has become a major focus to accelerate drug discovery.

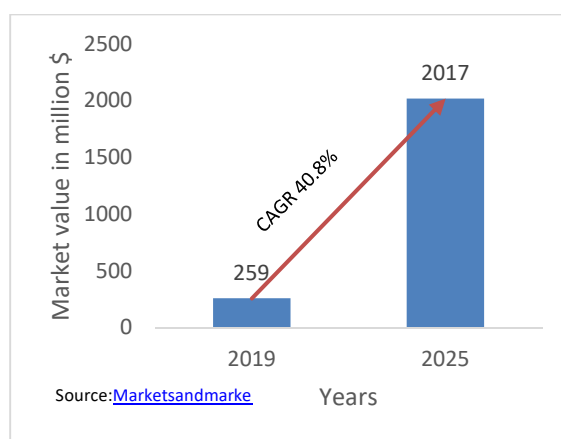


Fig.4.6 AI in Drug Discovery Market Value in Million Dollars

Big Pharma companies across US and UK are working in harmony in a public-private collaborations and consortium to harness large data sets with AI whilst maintaining privacy by using blockchain to improve access to robust and reliable data to gain competitive advantage:

MELLODDY project, ATOM consortium, Medicines Discovery Catapult, Machine Learning for Pharmaceutical Discovery and Synthesis Consortium (15). These consortiums aim to reduce drug development time drastically (to ~2 yrs.) in the next 3-5 years. **Breakthroughs:**

- AI-designed OCD drug is set to enter a human clinical trial for the first time (developed by Exscientia in collaboration with Sumitomo Dainippon) (16)
- IBM's Supercomputer identified 77 potential drug compounds against COVID-19 by simulating ~8,000 compounds (17)
- Google DeepMind's AI technology has developed a groundbreaking DL algorithm that predicts the 3D structure of proteins from primary sequences (18)

Geographically:

Table 4.1. Global Landscape of Activities in AI in Drug Discovery

US	UK/EU	Asia Pacific (APAC)
US leads the AI in drug discovery sector in both investment (63.5%) and the number of AI for drug discovery companies (60% of start-ups) (15)	Level of activity in the UK and EU has increased by 10.8% and 10.3% respectively, due largely to government initiatives (15)	China has been a major investor with \$1.4 B investments in US-based biotech and drug firms The Asia Pacific is the fastest-growing region in global drug discovery.

Adoption surge:

“170 AI companies, 50 corporations and 35 major R&D centers using AI in drug discovery as of Q2 2019” (20). In the past three years, most biopharma companies have been adopting a variety of strategies to actively integrate AI into the discovery process, such as:

- Building internal capabilities, investing in start-ups and creating collaborations with tech giants and/or research centers. The following deals show **Biopharma companies are actively and consistently adopting** more than one AI solution at different stages of the drug discovery process and across the disease spectrum:

Table 4.2 AI in Drug Discovery deals of Biopharma companies

AI startups/Big tech	Big pharma	Purpose
BenevolentAI	AstraZeneca, Novartis	To identify treatments for kidney disease and lung fibrosis
Exscientia	Roche, Celgene, GSK	- Roche: designing preclinical drug candidates - Celgene: Speed up the discovery of drug candidates for cancer and autoimmune diseases - GSK: In vivo active lead molecule targeting novel pathway for the treatment of COPD (15)
Insitro	Gilead	To find ways to treat liver disease
Atomwise	Hansoh Pharma	Largest china-US collaboration for AI drug discovery
Benevolent AI	Insilico	Identifying potential treatments for Coronavirus via AI (16)
Microsoft	AstraZeneca, Novartis	- To form AI Factory for Health -- an accelerating program for healthcare startups (15) - To bring microsoft's advanced data analytics and AI capabilities for its ongoing research plans (16)
Google	Sanofi	To use AI and cloud-computing tools in a new Innovation Lab to speed up drug discovery (15)

Looking ahead: AI applications in drug discovery are expected to account for over 35% of the healthcare AI market share by 2022. By 2030, drug discovery processes are likely to be mostly outsourced to external AI companies, where research will be done mostly in silico (via computer modeling or simulation) and in collaboration with academia (14). This will lead to a shift to an autonomous drug design paradigm, where the system will autonomously decide which compound to make next.

However, the lack of availability of quality data, data interoperability and transparent algorithms to meet drug development regulations remains as few major barriers, these findings are in line with previous researches as Maddox et al. also describes the necessity of appropriate quality data availability for AI algorithms to leverage its speed and scalability, also the ill-defined evidence standards for AI tasks remains a challenge and whether AI will improve quality of care at a reasonable cost still remains an unanswered but critical question (23).

4.2.3 Opportunities and challenges posed by the healthcare stakeholders to adopt and sustain the disruptive force of the trend:

Table 4.3 Opportunities and Challenges: Drug Discovery in silica

Opportunities	Challenges
• AI in drug discovery market to grow by 40.5% CAGR from 2020-2027 • Expansion of biotechnology industries • The evolving regulatory scenario requires biopharma companies to develop legal and ethical expertise to deploy advanced computational technologies for drug discovery • COVID-19 pandemic requiring fast discovery and development of drugs deploying advanced technologies	• Lack of availability of quality data, data interoperability as well as data governance which is crucial to the success of biopharma's digital transformation • Not enough stringent policies around data privacy and security • Need for transparent algorithms to meet drug development regulations

4.2.4 Implications

Advanced computational tools are aiding to create better and more effective drugs as well as make the process of drug development more affordable and less time-consuming. Drug discovery has inevitably become a major focus, with AI and supercomputing being leveraged due to its speed and scalability to accelerate drug discovery and development by recreating genome sequence of COVID-19.

Implications to healthcare stakeholders (Pharma companies)

- The future of R&D is likely to rely on data-dependent methodologies like AI for which the pharma companies need to build data handling capabilities.
- Replace wet lab work by computer simulation – combining big data + analytics.
- To remain competitive in the evolving R&D environment pharma companies will need to invest in developing their analytical capabilities and their data strategy.
- Make or buy decision to incorporate AI for understanding disease mechanisms and generating novel drug candidates.
- Invest in AI startups to leverage the technology capabilities to accelerate drug discovery and development of potential drug candidates to combat COVID-19 and leverage the huge market opportunity along with relaxed regulations in times of global health crisis.

4.3 Trend-2: Remote Diagnostics

About the trend: Remote patient monitoring (RPM) is a healthcare delivery method that uses technology to monitor patient health outside of a traditional clinical setting. Remote diagnostics refers to the use of biosensors connected to Bluetooth-enabled devices like blood pressure cuffs, weight scales, blood glucose monitors, etc. to capture patient's vitals and electronically transmit the information between patients and physicians leveraging the IoT technology; These solutions enable users to transmit the data automatically to their clinicians. It aims to improve remote access to patients in order to help enable the transition to more care outside of the hospital and shift the emphasis toward prevention and maintaining well-being (24).

4.3.1 Macroenvironmental factors driving the trend:

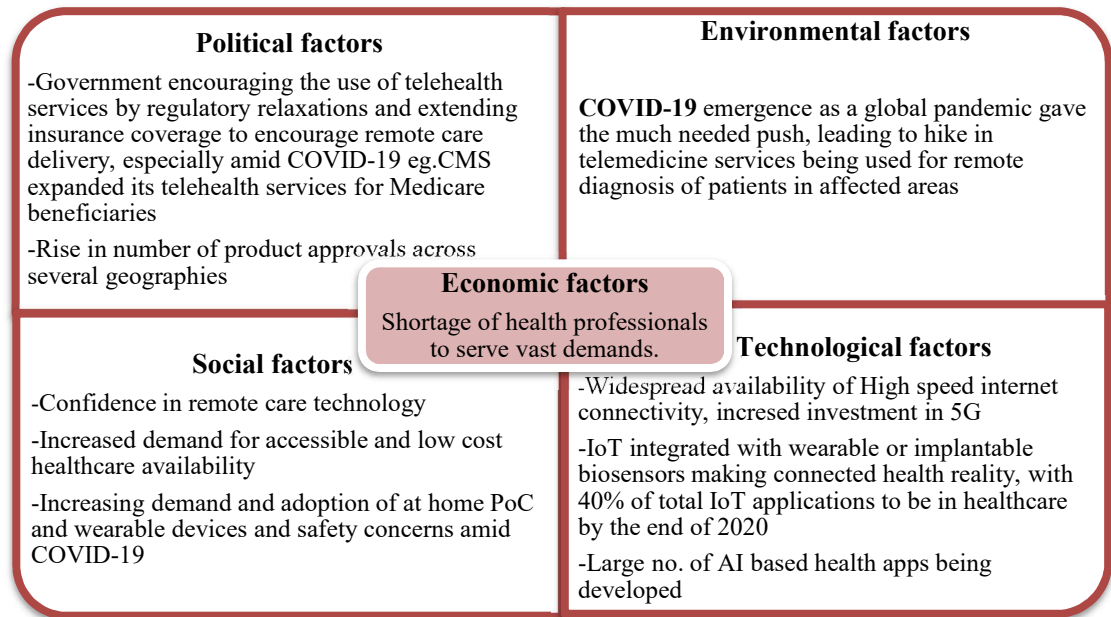


Fig.4.7 PESTE Analysis: Remote Diagnostics

4.3.2 How the Trend Is Disrupting?

Confidence in remote care technology is gaining traction amongst the various healthcare stakeholders. Also, COVID-19 outbreak has brought an opportunity for health systems and telehealth vendors to bring connected health to the forefront facilitated by regulatory support from FDA which issued a policy to facilitate greater use of remote patient monitoring technologies to cut back on hospital visits and thereby minimize the risk of exposure to COVID-19 while also reducing the burden on providers during the current crisis (25). Remote monitoring with clinical-grade sensors is being used to diagnose and contain COVID-19 (26). Underlying technological forces like Biosensors along with IoT are driving innovations in remote diagnostics making diagnosis portable and cheap and enabling the push towards preventive care with early detection. Some notable examples are:

- Bio Sticker (On-body sensor for constant monitoring of critical signs)
- Butterfly IQ (Portable ultrasound device)
- Smart contact lens (track and monitor diseases such as diabetes and glaucoma)
- Open Water's wearable light-based imaging system (scan the brain and other body parts in real-time)

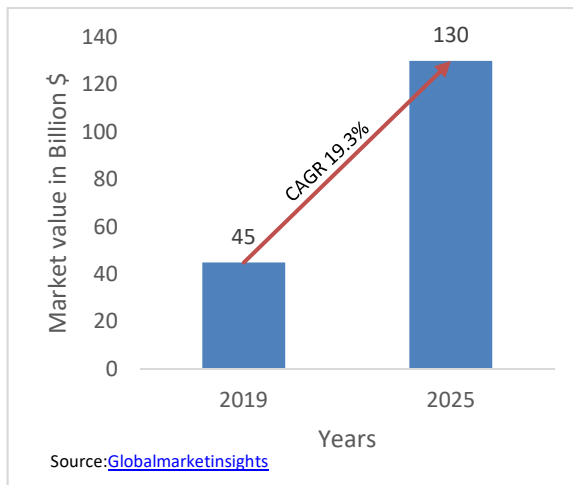


Fig.4.8 The Global Telemedicine Market Value in Billion \$

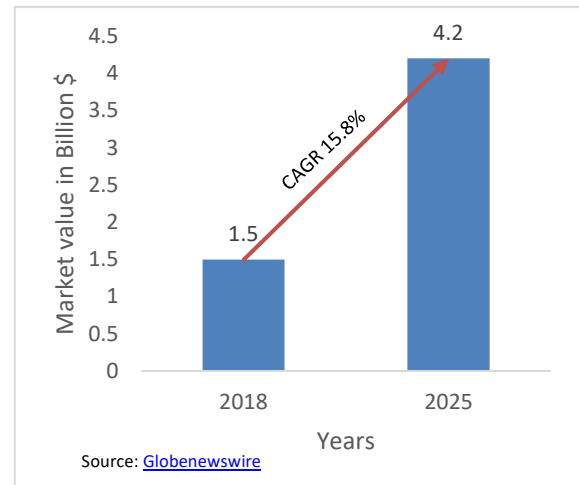


Fig.4.9 The Global Remote Patient Monitoring Devices & Equipment Market Value In Billion \$

The global telemedicine and remote patient monitoring devices market values show immense growth potential for the development and adoption of remote diagnostic devices at a scale in the near future, with COVID-19 encouraging their rapid uptake among providers and patients.

Adoption surge:

- Manufacturers are increasingly integrating IoT and wireless technology with remote patient monitoring devices to efficiently diagnose and treat medical conditions (27).
- AMA's Digital Health Study found adoption of digital health tools have risen significantly since 2016 among physicians with Tele-visits doubling from 14% in 2016 to 28% in 2019 while Remote monitoring for improved care jumped from 13% in 2016 to 22% in 2019 (28)
- The rapid adoption of remote-health services evident for screening and diagnosis of patients amid COVID-19 (11% hike in telehealth urgent care) (29)
- 88 % of health executives have invested in or plan to invest in remote patient monitoring technologies as part of their transition to a value-based care model (30)

Geographically

Table 4.4 Global Landscape of Activities in Remote Diagnostics

US	UK/EU	APAC
50% of United States hospitals engage in telemedicine (33) Confidence in remote care technology gaining traction with 56 % of Americans currently monitoring their health with at least one digital data collection tool (32) and ~70% wish to share real-time medical information with their doctor especially for chronic conditions (26)	UK's first remote diagnostic procedure demonstrated over 5G connected ambulance (35) European telemedicine providers partners with StethoMe, the first AI stethoscope (which remotely diagnose early signs of respiratory issues) to combat COVID-19 by providing at-home symptom checking and monitoring, to alleviate strain on the health services.	China is using robots to provide faster diagnostic checks, and Hangzhou city ambulances are assisted by A.I. to speed through traffic (36) Narayana Health in India offers remote diagnostics services in partnership with Cisco (37)

Stakeholder's response to the trend:

Table 4.5 MedTech and Pharma manufacturers partnering with consumer tech companies

Manufacturers	Consumer tech	Purpose	Impact
Cerner	Amazon Web Services	To build new prediction tools and a virtual medical scribe for healthcare providers (38)	Earlier health interventions offered leveraging digital diagnostic insights
Dexcom	Verily	To develop a new implantable diabetes sensor that transmits health data to monitoring devices or smartphones via Bluetooth (39)	Diagnostic sensors enabling preventive and personalized

			patient care
Dexcom	Livongo	To cross-reference data from the G6 Continuous Glucose Monitoring to give members more insights and health nudges about their behavior based on the CGM reading. (40)	Measures a range of biometrics enabling preventive care
Dexcom, Abbott	Insulet	Glucose data from Abbott and Dexcom's sensors will power Insulet's predictive algorithm for determining insulin doses (41)	Efficient-drug administration
Takeda	Enzyre	To develop an at-home diagnostic device that determines their coagulation status of hemophilia patients and share it with their care teams over a smartphone (42)	Affordable and accessible diagnosis for patients

4.3.3 Opportunities and challenges posed by the healthcare stakeholders to adopt and sustain the disruptive force of the trend:

Table 4.6 Opportunities and challenges: Remote Diagnostics

Opportunities	Challenges
• Telehealth Market is set to progress at a rate of 22.74% • Confidence in remote care technology is gaining traction • Changing consumer behavior expecting ease of access to affordable care • Growing interest and use of emerging technologies like AI, robotics, IoT • COVID-19 giving the necessary push for uptake of telehealth and remote services	• Creating a high-speed network between facilities • Data processing • Not enough stringent policies around data privacy and security • Digital user experience (device safety and user-friendliness)

4.3.4 Implications:

Remote diagnostic solutions can successfully address the 4 main elements of healthcare delivery (cost, access, outcome, and customer experience) for example Ochsner Health System saved \$300,000 through improved patient outcomes, along with 12% better satisfaction rates, providing remote monitoring service (45). Telemedicine and the transfer of diagnostics to the patient's home is the future, and the possibility of lung monitoring in patients with chronic diseases like COPD or asthma as well as in the current times of COVID-19 pandemic is a huge benefit surging the adoption of remote care solutions set to redefine healthcare.

Implications for MedTech and providers:

- The shift in consumer behavior with increased demand for personalized products and services require MedTech companies to focus on using transformative and cognitive technologies to augment their products and offerings.
- With new entrants disrupting the sector, MedTech need to decide divestitures of certain underperforming segments, develop products to adapt to new channels of care and modify GTM strategies.
- Strategically partner with consumer-focused tech and specialized digital health companies to avoid the disruptive threat from new entrants and existing competitors that have already formed alliances.
- Understand consumer needs and develop safe and user-friendly diagnostic sensors enabling preventive and personalized care for patients.
- Deploy IoT networks to expand the telehealth services to enable connected healthcare.

4.4 Trend-3: Vertical Integration/Shift in Site of Care

About the trend: As organic growth saturates, stakeholders are relying heavily on inorganic growth (horizontal and vertical integrations) to gain economies of scale and control over multiple pieces of the healthcare supply chain. **Vertical integration** is the creation of strategic combinations of alliances to change the dynamic across healthcare industry players (Hospital systems, drug manufacturers, wholesale distributors, pharmacy benefit managers (PBMs), retail pharmacy outlets, and medical insurers) as the new vertically integrated entities will have data on drugs, on insurance claims and on clinical outcomes all in one place to enhance the delivery of health care (46). **A shift in site of care** is to move care to accessible and affordable care settings, including Home Healthcare, Virtual Clinics, Retail Clinics, in line with value-based care delivery through integrated solutions in the healthcare ecosystem (47). KPMG expects the trend for decentralizing care and moving care closer to home to continue with Out of Hospital (OOH) care services globally seeking

to join up services to improve care coordination and reduce service fragmentation. Health systems around the world face unprecedented pressures that require policymakers, payers, providers, and suppliers to rethink how they work. Thus, health system leaders are expected to propagate and sustain transformation effort, is in line with KPMG's findings that the technology is disrupting traditional models of care, and is a vital component in joining up services to integrate care networks/systems (44).

4.4.1 Macroenvironmental factors driving the trend:

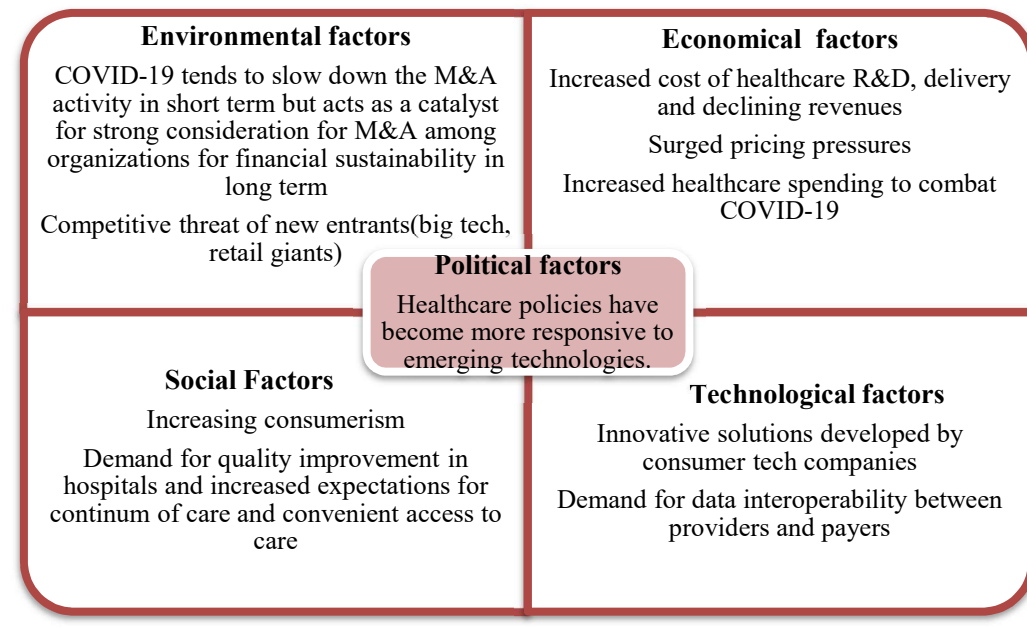


Fig.4.10 PESTE Analysis: Vertical Integration/ Shift in the site of care

4.4.2 How the trend is disrupting?

Industry consolidation was listed as the most important trend of the year 2019 according to a Definitive Healthcare Survey (48) as the year saw continued robust healthcare merger and acquisition (M&A) activity, significantly outpacing 2018 with 1,221 deals announced in the US healthcare sector in 2019. With the advent of Big Tech and Non-traditional players entering the healthcare space, Virtual care and Retail clinics are now seen as an integral part of healthcare, as opposed to an alternative as earlier by the consumers. The growth in the retail healthcare space with increasing insurance rewards for healthy lifestyles, is increasingly encouraging patients to turn to retail clinics to maintain their wellness (Walmart, Walgreens, and Rite Aid), states a recent journal article(49).

Adoption surge

- Health systems have now begun to partner with a health plan, rather than sponsoring a new plan on their own (50). About 94 % of healthcare executives now consider collaboration a key factor to success and about 70% of payers and providers are already participating in collaborative partnerships (47) which allows them to achieve improved data management that fuels population health and enables success in value-based care models.
- With Virtual Care and Telehealth receiving ~\$2.6B funding, about 40 states in the US have adopted more substantive telehealth policies (51).
- Retail clinic leaders (Target, CVS, Walgreens, Walmart) are collaborating with public health organizations and other stakeholders (e.g., health insurance companies, hospitals) to quickly coordinate public safety measures across the health care system. For example, CVS Health and MinuteClinic have taken several measures to protect its stakeholders during the COVID-19 outbreak, while Walmart is providing services in the driveways (52).

Strategic Moves of Traditional and Non-Traditional Players:

Traditional players (pharma, health providers, payers) are facing a competitive threat from the new Non-Traditional entrants (Tech companies, Retail giants) in the healthcare business. These seismic changes in the industry are forcing healthcare organizations to rethink their **strategic identities** as they struggle to compete and survive in business models that are becoming obsolete (53).

Depending upon the identities chosen companies are adopting expansion strategies by acquisition or collaboration to innovate into a new revenue stream, thereby protecting their market share.

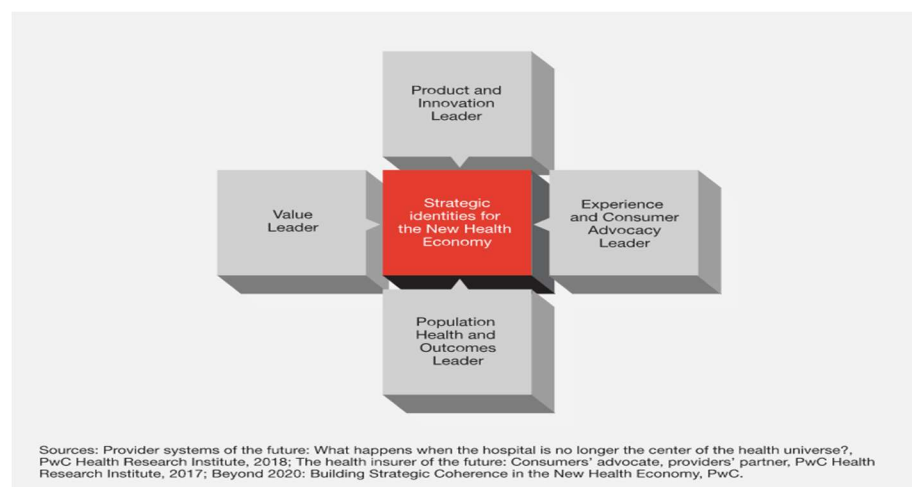


Fig.4.11 New strategic identities considered by healthcare organizations

Evidence shows that the deal priorities differ among healthcare executives: Health plan and pharma executives are most concerned with remaining competitive and accessing new markets; providers want access to new technology (53). Below mentioned are some recent key strategic deals that depict integration among various healthcare stakeholders at different levels across the healthcare value chain. These deals show how the stakeholders are coming together to lead a greater service integration to achieve a triple aim: improved patient outcomes, improved quality of care, and lower costs.

Table 4.7 Strategic deals among healthcare stakeholders

Entity 1	Entity 2	Strategic intent	Deal type	Pharma	Payer	PBM/health plan	Hospital/home	Biotech/Telehealth
Cigna	Express Scripts	Position the health plan provider (Cigna) as a product and innovation leader in financing and expanding access to high-cost care	Acquisition					
Cigna	MDlive (Telehealth)	Virtual care enables Cigna to deliver convenient access to affordable care for its customers	Partnership					
Vertex	Exonics Therapeutics	Focus product portfolios and develop patient engagement services to ensure an optimal outcome	Acquisition					
Clover health	Genetech	Product and innovation leadership developing medicines for older adults	Partnership					
Humana	Microsoft	Humana will be able to better address factors that influence health outcomes.	Partnership					
Signify health	TAVHealth	Help SignifyHealth address social determinants of health, such as food insecurity and transportation issues, for its	Acquisition					

		patients						
Optum	DaVita medical group	Optum wanted to enhance their value leadership identity	Acquisition					
BMS	Voluntis	BMS intends to position itself as population health and outcomes leader by developing self-management DTx for cancer patients	Partnership					
CVS	Aetna	An insurer comes together with a large network of primary care providers offering low-cost neighborhood healthcare	Acquisition					

Traditional players (Pharma, Payers, Providers) continue to either acquire or collaborate for new, disruptive technologies to develop an innovative public image. Payers are increasingly looking to invest and gain a foothold in the behavioral health space and increase their presence and offerings through partnerships with providers, management groups, and even healthcare technology firms. (eg. Anthem). Also, Hospital M&A activity experienced major growth among deals in the healthcare sector which hit \$533 billion in 2019, up 26% from 2018 (54).

In addition to the traditional players, there are instances of innovative solutions to help improve patient care and deliver better **out of hospital (OOH) services**, across the globe, facilitated by Non-traditional players to provide community-based care:

- **Walmart** is expanding its direct access to care through clinics and transparent D2C pricing. It recently launched two health centers in line with its aim to become “America’s Neighborhood Health Destination”. The convenience of the Walmart Health centers and their low prices (30% to 50% lower than physician offices) have successfully set the company apart from the competition (55) (56). It is also playing a vital role in expanding testing facilities for COVID-19 by “drive-thru testing” under public-private partnership to support government efforts (57) .
- **Walgreens partnered with Microsoft** for connecting people to healthcare services through their digital devices to support preventative self-care and reduce emergency room

visits (58). Also, it is advancing its healthcare strategy through a variety of health plan partnerships.

- Electronics retail giant, **Best Buy** developed smarter homes to serve senior patients by home health monitoring using predictive modeling (59).
- **Amazon** launched its healthcare program, Amazon Care, for employees in Seattle to offer virtual health clinics and in-home follow-up visits (60).

Looking ahead: The integrations among healthcare stakeholders are helping them to expand their customer base as well as cost savings and are in line with the changing consumer expectations of convenient access to care. Thus, it is expected to see a large percentage of care being delivered outside traditional hospital settings (through hospice, home health, telemedicine etc.) in the future. These findings are consistent with that of KPMG that estimates expanding OOH care to be a “must-have” over the next 3-5 years to achieve system sustainability (43). By 2025 it is expected that only 50% of current hospital systems will remain. Virtual care will become an integral component of healthcare in policy, benefits, behavioral health, consumer experience, and platform consolidation. The increased activity among the non-traditional players (tech and retail giants) will lead to healthcare providers and technology giant partnerships with a focus to create customer-focused organizations.

4.4.3 Opportunities and challenges posed by the healthcare stakeholders to adopt and sustain the disruptive force of the trend:

Table 4.8 Opportunities and Challenges: Vertical integration

Opportunities	Challenges
• Competition between health systems is heating up and costs are on the rise • The surge in financial pressures on health systems amidst COVID-19 pandemic • Increased funding to virtual care • The transition to value-based care could accelerate the shift in site of care • Growth of remote monitoring market • Increased adoption of telehealth services: with rapid growth amid COVID-19 pandemic	• Strict federal and state regulations likely to restrict the degree of linkage in a vertically integrated entity • The increasing vertical integration in the healthcare industry threatens to make the healthcare marketplace substantially less competitive • Lack of transparency hinders both partners • Aligning clinical goals between payers and providers

	• The advent of Non-Traditional players threatening the market share of traditional providers (Walmart, Amazon, Google, Microsoft, etc.)
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4.4.4 Implications:

Lines between payers, providers, and pharmaceutical firms are becoming blurred, offering synergies from a vertically integrated industry. Integration activities across the healthcare value chain offer an opportunity for stakeholders to work at scale by strategically modifying their business models, thereby improving access to limited resources, reducing cost and competitive pressures for the providers along with enhancing new care services and efficient utilization of scarce skills in the workforce and enhancing public image. Technology, data, and information flow accelerate a move towards more integrated care; thus, providers need to have foundational technological infrastructure and skilled capabilities in place. KPMG's published paper also states similar findings, describing digital transformation as central to future models of healthcare and expects health systems and organizations to have a clear digital strategy with a focus on connecting care. Providers need to build an end to end customer relationship solutions, as community-based solutions should be modeled around perpetual care rather than episodic care (44).

Implications for providers and payers:

- Find ways to legally compete, collaborate, or innovate with other HC stakeholders
- Prepare for the transition from the current care model by expanding roles and partnerships for multiple stakeholders to elevate the quality of B2B and D2C skills & processes
- Clinical goals need to be aligned between payers and providers to facilitate vertical integration to achieve a common goal to improve customer experience
- Adjust for locally specific go to market (GTM) decisions
- Prioritizing their business opportunities (telemedicine, virtual promotions etc.) considering the rapid increase in the shift in site of care owing to COVID impact.
- Providers need to have technological infrastructure in place to move service to ambulatory, community, virtual, and home settings to offer affordable and accessible care to the patients.

4.5 Trend-4: Consumer Experience and Empowerment

About the trend: The healthcare industry is now evolving from the sick-care industry to a consumer-driven industry where consumers are actively involved in their health decisions.

Consumerism in healthcare encourages and empowers patients to make informed choices to manage their own health as they approach medical treatments with great concern and look for services and tools that are aligned with their health and lifestyle. Today's consumer is accustomed to highly personalized engagement across other product and service industries and thus increasingly expect similar personalized experiences in healthcare as fostered by other industries. Unlike other industries, the healthcare and life science sector lag behind, but as digitalization and connected experiences become the norm across other industries, healthcare and life sciences industries are shifting to meet consumer demands for new capabilities and improved engagement (61). Health consumers empowered by digital technology now expect on-demand, anytime, anywhere service, better information, and transparency forcing providers to develop new models of care to compete successfully in the emerging C2B health marketplace (62).

4.5.1 Macroenvironmental factors driving the trend:

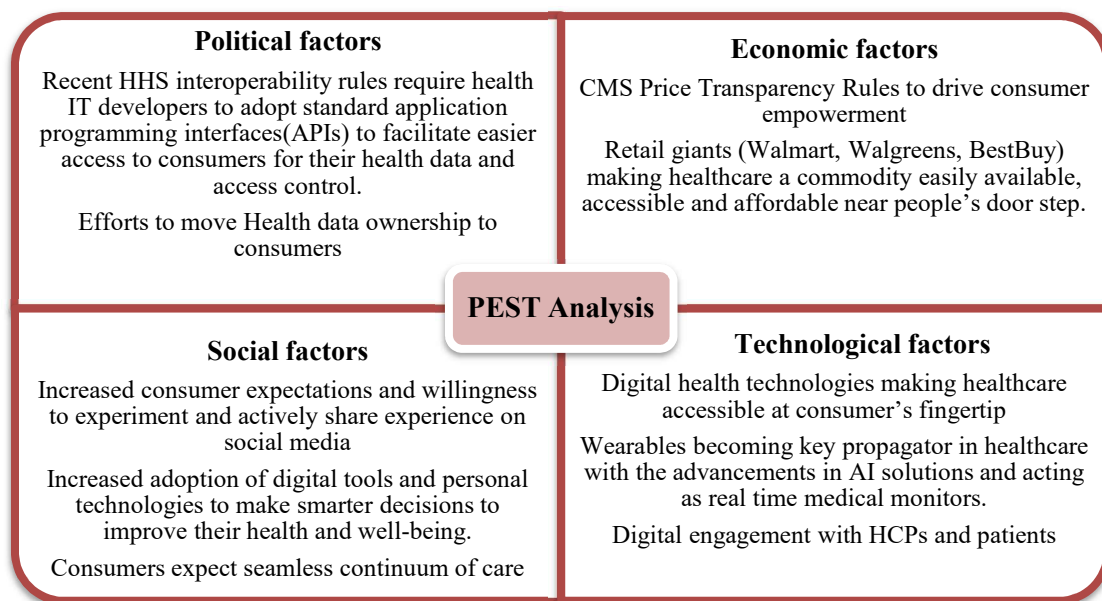


Fig.4.12 PEST Analysis: Consumer experience and empowerment

4.5.2 How the trend is disrupting?

Evolving consumer expectations: With the advent of digitization, the consumer is becoming empowered and their expectations are changing across the four prominent healthcare and life

sciences sectors (providers, insurers, pharmaceutical, and medical device companies). They are excited by emerging solutions that hold the promise for expanding access to and quality of care. A 2019 study of 6000 global healthcare consumers found 65% of consumers expect connected experiences. Their definition of great experience varies by sector where 77% expects Providers to provide good customer support; A significant number (30%) of consumers now have direct relationships with pharmaceutical companies (61) and about 84% of patients think pharma companies should work more closely with patient organizations, creating more cohesive patient experiences (63) also, 21% have initiated communication directly with medical device companies.

Consumers are now eager for healthcare innovations that reduce barriers to care: 94% are interested in walk-in clinics that accept patients with no appointment required, and 76% are interested in in-home visits. Over half of millennials and Gen Z consumers have asked a provider about a medication based on their own research. As the barrier to knowledge lowers, finding alternative sources of care becomes easier, surging pressure on providers to improve the consumer experience. 82% of consumers would switch providers as a result of a bad experience. 68% of consumers expect companies to engage with them in real-time (61), even 90% of individuals are willing to share their personal information in exchange for greater personalization and more value (64). Ultimately 78% of customers state that positive experience influences their purchasing decision.

Evidence suggests healthcare and life sciences leaders are making consumer experience a top priority, as the healthcare and pharma spending grew 3.7% globally to \$35.7 B, targeting consumers in a more personalized way(65). Stakeholders seem to have started reaping benefits from their customer-centric approach.

Pharma:

Pharma companies are adopting new technologies and rethinking internal processes to build ongoing relationships and retain customers (physicians, patients, PBM). Big pharma companies like Novartis, Lilly, Roche, Janssen are incorporating the patient's voice in clinical trial design through - social listening, patient interviews, trial simulations, surveys. Evidence shows that pharma websites are exerting greater influence on physicians along with remote self-detailing applications and chatbots provide an improvised experience to the physicians than the sales rep contact alone (66). 85% of doctors in Japan, already been contacted through different digital channels by pharma companies focusing on developing a digital engagement strategy that's increasingly focused on with the HCP (67). COVID-19 outbreak surged these demand and action for virtual promotions by pharma companies to their physician networks as significant decline is observed in face-to-face promotional activity in countries S. Korea, Japan, US and Italy followed by substantial increase in

remote interactions eg.18% increase in all virtual engagements types in the US through mid-March. “True omnichannel customer orchestration has resulted in a more than 20% increase in engagement rates and an uplift in impactable sales that can reach 30 %” (68).

Providers:

80% of hospital and health system CFOs believe digital transformation is critical for their organization's long-term survival and to continue to provide high-quality patient services. Thus, leading hospitals and health systems are reducing live touchpoints and investing in digital solutions to become more convenient hubs for care. Evidence shows 96% of hospitals in the US have switched from paper records to online portals to aid doctors to track testing, imaging, and visits, then offer patients access to their health information (69). 49% of providers now believe consumer experience (Cx) to be a strategic priority. Providers are exploring the potential of ‘Smart hospital’ to redefine Cx with the use of VR and AR technologies for real-time education and improving the collaboration and communication between doctors and patients. 50% higher net margins achieved by providers offering ‘superior’ versus ‘average’ Cx.

Payer:

Nearly 80% of health plans invest 1/3 of their health IT dollars in technology to improve Cx. Evidence suggests that the payers will continue to focus on affordability as consumers continue to struggle with high out-of-pocket costs, burdensome deductibles, rising premiums, and higher healthcare spending overall. Also empowering patients has become a priority with CMS’s Price Transparency Rules coming into play, with consumers expecting clarity from insurers and now they evaluate insurers on quick access to their records upon making contact, thus NHS in collaboration with Amazon’s Alexa now set empower patients with access to verified health information

However, **the gap remains** in meeting the multigenerational expectations:

Almost half of the consumers say the healthcare and life sciences industries are more focused on their own needs than those of patients, indicating ample room for improvement. Nearly 60% of consumers still struggle to manage their care between different parties themselves, this contradicts with the modern consumer’s expectations for seamless, connected experiences (61). However, fewer than 40% of consumers are engaging digitally with their health insurance carriers (64) and 72% of consumers say their engagement experience hasn’t improved over the past 2 years according to a study commissioned by Change Healthcare (70). Fewer than 1 in 3 respondents believe their organization is providing a best-in-class digital experience for patients. The result suggests traditional health care providers could lose ground to more tech-savvy competitors.

Looking ahead: Consumers will use the C2B platforms to create their own “customized to me” systems of care, threatening the value proposition of today’s proprietary networks. Thus, resulting in healthcare systems to increasingly take a “user-centric approach”, in both developed and lower- and middle-income countries, powered by advanced technologies (AI, IoT, AR/VR) and analytics, the healthcare systems will enhance patient experience and deliver predictive and connected care by 2030 (71). This transformation in the care delivery model will lower costs by approximately 25% to 60% (62). This new frontier of consumer engagement requires pharmaceutical companies to consider factors that were less impactful in the past. For instance, the needs of consumers and will move to new direct to consumer business models(D2C). About one-third of pharma companies are expected to spend over 50% of their marketing budget on digital channels by 2022 (72). Also, consumer’s interest to directly communicate with the medical device companies opens new sales channels for the medical device sector and expands its purview beyond product innovation and production to being valued service providers (61).

4.5.3 Opportunities and challenges posed by the healthcare stakeholders to adopt and sustain the disruptive force of the trend:

Table 4.9 Opportunities and Challenges: Consumer experience and empowerment

Opportunities	Challenges
• Consumer willingness to share their health information tracked in apps and medical devices with their health providers • Health consumers empowered by digital technology • Digital content of Pharmacos has started to influence physicians’ decision-making as they adopt online modes for informed decision making.	• Cross-functional collaboration and agility in limited delivery teams to optimize physical touchpoints and orchestrate digital content delivery • The right balance between human and digital component will be critical • Development of personalized, value-based products that address the needs of individual consumers • Training and equipping Physicians to get comfortable with conversations around cost (price transparency) • Non-traditional players (Tech and Retail giants) leveraging their customer centric experience to reap faster rewards in healthcare industry

4.5.4 Implications

Trust is critical and fundamental when it comes to sharing consumer's personal data. In fact, evidence suggests that 88% of consumers are more loyal to companies they trust. Thus, to unlock the full potential of the data-powered technologies, the healthcare and life sciences industries must work toward building consumer trust (61). There is a need to coordinate customer experience deliberately – from patient to provider to insurer to manufacturers, thus there is a need for real-time nurturing of all stakeholders with advanced automation. Tech players are outperforming 90% of health systems in providing a seamless, integrated digital experience for consumers (eg. Amazon, Apple etc.) urging the healthcare stakeholders to develop digital capabilities to enhance the consumer experience.

Implications to healthcare stakeholders (Pharma, MedTech, Providers, Payers)

- Create an organization that leverages digital health technologies to predict and react and improve execution without losing sight of strategy with more adaptive people and processes
- Engage more directly with consumers through medical support staff and nurse advisors and drive customer loyalty through a better experience
- Deploy blockchain technology to protect patient data privacy
- Transparent pricing and sharing treatment progress with the patients to aid informed decision making
- Engage with personalization with the medical practitioners via video, virtual reality, AI tools, and other technologies and shift to virtual promotions to market products to physicians (which is increasingly becoming a common practice in recent times of pandemic)
- Diversify the workforce (from industries such as tech, hospitality, and social services) to drive customer experience

4.6 Trend-5: Big Tech Entrance in Healthcare

About the trend: Big tech companies (Apple, Amazon, Google, Microsoft, Tencent etc.) have been investing in different sectors of the healthcare industry over the years. But now they are accelerating their pursuit of the healthcare market, and they're starting to hone their strategies leveraging their data prowess and tech-savviness to become attractive partners in specific corners of the ecosystem. These players are ramping up their efforts to reshape health by developing and collaborating on new tools that could be a boon to consumers, medical professionals, and insurers

(73). To these tech giants, the healthcare industry seems to be an ocean of tremendous opportunity. They are leveraging their core business strengths coupled with the **expansion strategy** of acquiring or collaborating with startups, smaller companies, established players in the healthcare industry to attain the domain-knowledge which they lack.

4.6.1 Macroenvironmental factors driving the trend:

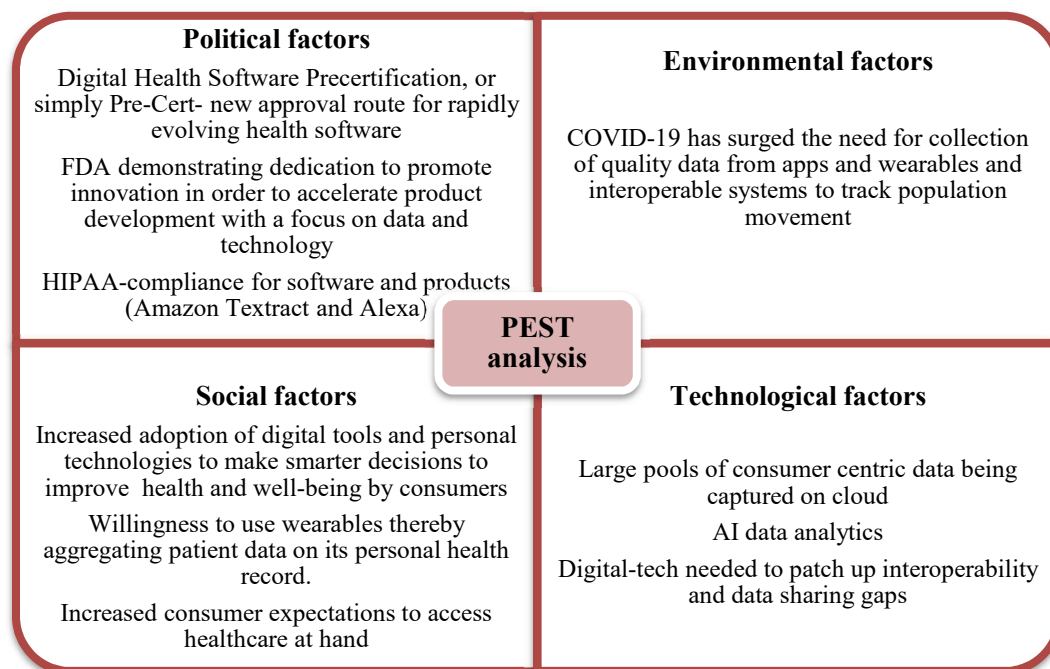


Fig.4.13 PEST analysis: Big Tech Entrance in Healthcare

4.6.2 How Big tech is disrupting the healthcare horizon?

Though their interest and activities in healthcare are not new, but with the increasingly changing consumer expectations and adoption of digital tools and personal technologies, huge volumes of data is being generated which is still not being leveraged completely by the healthcare organizations, moreover coupled with the regulatory willingness to promote innovation to accelerate product development with a focus on data and technology have accelerated and intensified the investments of these tech giants in various sectors of the healthcare industry in the recent years, to alleviate the technological gaps and make sense of vast amounts of health data. **For instance**, Google is developing a search tool that would apply artificial intelligence (AI) to patient's clinical data and make suggestions about treatment plans, prescriptions, diagnoses, and more. It is also leveraging partnerships with the health system (Ascension health system) (74) and EHR company (Meditech) (60) to get access to "tens of millions" of patient medical records.

The below mentioned heat map depicts the investment areas of Big Techs in digital health space over the years:

HEATMAP: CONCENTRATION OF BIG TECH'S DIGITAL HEALTH INVESTMENTS

Based on number of deals to digital health startups in each category

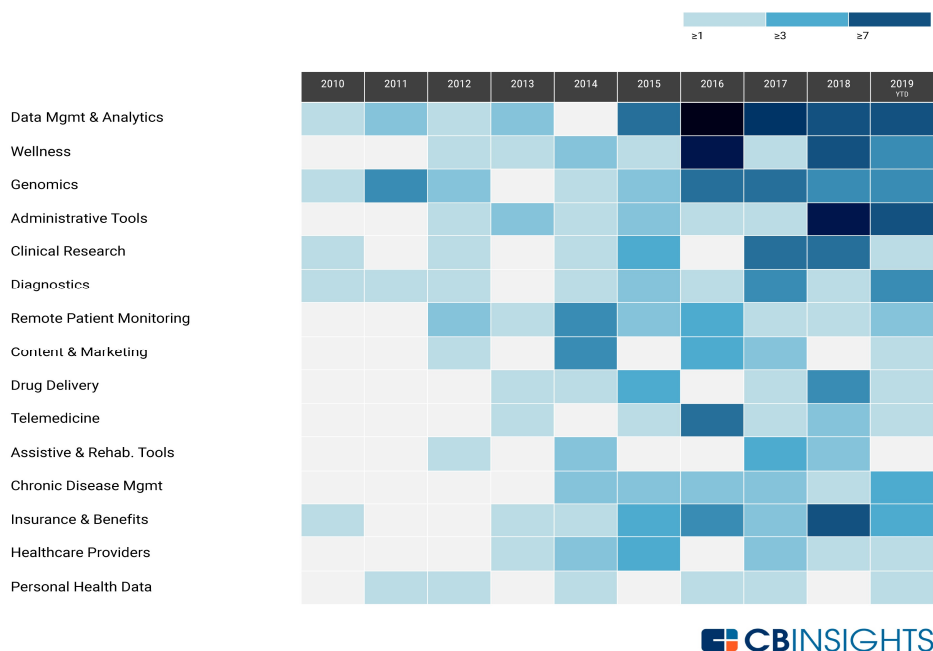


Fig.4.14 Heatmap: Concentration of Big Tech's Digital Health Investments

Tech giants' areas of focus within digital health have shifted over the years as new technologies emerge and regulations evolve. Since 2012, global tech giants have invested most heavily in digital health companies focused on Data Management & Analytics followed by Wellness, and Genomics. Google, Microsoft, and Tencent, representing over 70% of digital health deals are the most active tech giants investing in digital health startups (75).

Focus Areas:

- Microsoft is focused to lay claim on the healthcare cloud market competing ahead with Amazon and Google by launching the first industry-specific cloud offering for the healthcare industry.
- Apple is setting bets on clinical research initiatives, offering its tech solutions like wearable devices for adaptive clinical trials
- Alphabet, with its varied subsidiaries, is focusing on its AI expertise to drive precision medicine and innovative drug discovery and development
- Amazon is buckled up to disrupt the pharmacy, virtual care, and telehealth realms.

Big tech actively taking steps to combat COVID-19:

Big techs are upgrading their apps (Apple, Facebook), developing interactive binge maps (Microsoft), and putting collaborative efforts in the fight to combat COVID-19. Their efforts in these crisis times pose a true opportunity for these tech giants to leverage their advanced data handling tech capabilities by integrating with health organizations, government and, also enhance their public image among the consumers, strengthening their foothold in the healthcare industry.

Examples:

- **Collaborating with government:** Leading tech firms (Microsoft, Google, Palantir, and Faculty AI) teamed up with NHS to ensure the availability of critical medical equipment to the facilities most in need during the coronavirus outbreak leveraging their vast data resources (76). A Microsoft powered COVID-19 self-assessment bot an AI bot called 'Clara', is launched by the Centers for Disease Control and Prevention (CDC) to help people assess potential symptoms of COVID-19 (77).
- **Collating with traditional players of the healthcare industry:** Healthcare organizations, tech, and non-profits have come together to form the COVID-19 Healthcare Coalition, a collaborative private-industry response to the novel coronavirus which includes EHR vendors (Epic, Athena health), Big Tech (AWS, Microsoft), health systems (Mayo, Intermountain) and other. Its mission is to save lives by providing real-time learning using the vast resource of data, expertise, capabilities, and insights and complement government actions to preserve healthcare delivery and protect the U.S. population (78).
- **Partnering with other tech giants:** Apple and Google partnered to build system-level COVID-19 contact tracing technology, with a push towards greater health-data interoperability, providing health organizations a consistent stream of public health data (79).

How the entrance of Big-Tech is disrupting the way of doing business for traditional players of the healthcare value chain?

Pharma

Evidence suggests that Big tech is entering the research and development space of manufacturing pharmaceutical products by collaborating and entering strategic partnerships with pharma companies to radically transform drug discovery and development (i.e. clinical trials). For instance:

- **Transforming drug discovery:** Google collaborated with Sanofi to radically transform drug discovery by leveraging its technology and analytical expertise (80).

- **Transforming drug development** (Innovative clinical trials):
 - Google’s tech branch Verily entered a strategic- partnerships with Novartis, Sanofi, Otsuka, and Pfizer to reach potential clinical trial patients (81).
 - Apple, Johnson & Johnson, and Best Buy entered into a partnership to conduct one of the largest randomized digital health trials to detect atrial fibrillation among seniors, using apple watch and encourage them to seek medical help (82).

MedTech

With the increased adoption of wearable devices by the consumers, Big tech is leveraging its consumer experience and developing advanced wearables and point of care devices be it Apple’s watch now able to remotely diagnose and monitor patients capturing their vitals with advanced biosensors or Alphabet acquiring Fitbit for around \$2.1 billion to boost its wearable division or Livongo Health, a digital health startup, integrating its mobile app with Apple, Fitbit, and Samsung smartwatches. Evidence suggests that the big tech can prove to be a competitive threat to medical device manufacturers if they don’t work on developing transformative and cognitive technologies to enhance products and services offered to customers. Big tech can potentially eat up their market share by reaping huge earnings from their advanced user-friendly solutions like Apple reported record-high earnings in its wearables and services segment, which includes Apple Health Records and it is now expanding its health sensor technology to create preventative care solutions (60).

Health systems

Providing health systems with tech needed to patch up interoperability and data sharing gaps by extending their cloud platforms, data analytics, and machine learning technologies and leveraging the partnerships by having access to huge patient data to develop new tools or directly cater to patient’s needs to enhance consumer experience and also empower them with data ownership.

- Dozens of hospitals and health systems across the U.S. formed partnerships with major technology companies (Alphabet, Amazon, Apple, IBM, Facebook, and Microsoft) in 2019, for instance:
 - **Google** rolled out partnerships with **Cleveland and Mayo Clinic advancing the health system’s** digital healthcare innovation strategy using cloud computing, data analytics, and machine learning technologies (83)
 - **IBM Watson** Health invested \$50 million over 10 years to support research collaborations with Boston-based **Brigham and Women's Hospital** and Nashville, Tenn.-based **Vanderbilt University Medical Center** (83).

- AWS launched Amazon Transcribe Medical, a voice transcription service for physicians that inputs text directly into medical records (60)

4.6.3 Opportunities and challenges posed by the healthcare stakeholders to adopt and sustain the disruptive force of the trend:

Table 4.10 Opportunities and challenges: Big tech entrance in healthcare

Opportunities	Challenges
• Increasing demand for data interoperability and real-time health monitoring with disruption of EHR market • A paradigm shift towards ‘Predict and Prevent’ leading to a surge in demand for clinical decision support tools • Health system partnerships • Growth in telehealth adoption facilitated by improved internet availability and accessibility • Large testing ground and aggregated consumer demand • Growing industry focus on personalized care	• Lack of consumer trust in sharing their health data with tech companies • Rising concerns among regulators and consumers for data privacy and security • Cloud competition • Variability of the healthcare regulatory environment in different countries

4.6.4 Implications:

- The ambitious entrance of Big-Tech in the healthcare industry can prove to be competitive or collaborative for the traditional healthcare players depending upon how the stakeholders leverage the opportunities and make changes to their strategic plans
- Healthcare stakeholders can leverage the customer-centric approach of these new entrants and be in a win-win situation through a collaborative partnership with these firms to reduce the emerging threat of losing the market share
- The Big-Tech need to gain consumer trust so as to succeed in the healthcare ecosystem.

5. Conclusion

The predictions of healthcare disruptions have been made for decades. Therefore, with the beginning of a new decade facing several disruptions including COVID-19, acting as a major catalyst for the much-awaited transformative change across the healthcare value chain. The captured evidence, macro-environmental analysis and use cases in the study suggests that the next 3-5 years are likely to require a sustained gear up in strategic investments by the stakeholders to unlock the potential of the market opportunities and overcoming the challenges by strengthening internal capabilities, implement effective business transformation and change management strategies, and effective implementation. The new vision for healthcare in 2020 and beyond will not just focus on access, quality, and affordability but also on predictive, preventive, and outcome-based care models increasingly driven by advanced technologies like Artificial Intelligence (AI), Blockchain, and the Internet of Things (IoT) that will further catalyze the space of innovation adoption and related applications across the healthcare horizon ranging from drug discovery to delivering customer experience and empowering the consumers.

Though data being the oil for these technologies to function, governance and quality of available data remain major roadblocks. Thus, pharma, MedTech, providers, and payers need to invest in their data strategy, have the technological infrastructure in place, hire competent people and develop analytical capabilities either by acquisitions or collaborations or developing in house capabilities to leverage the growth trajectories of the market and overcome the increased costs, declining revenues, and competitive threats. The regulatory environment is evolving and COVID-19 has catalyzed more flexible regulations to emerge especially encouraging telehealth tools to be approved and adopted at a fast pace, posing a huge business opportunity for all healthcare stakeholders to be able to best cater to their consumer's expectations by offering consumer-centric solutions. Thus, stakeholders will need to raise stakes on their future strategic intents, capital deployment decisions, developing new capabilities, attracting the right talent, and driving transformatory business innovation to sustain the waves of disruption.

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