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The Rise in mHealth: A digital transformation in Indian Healthcare

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Abstract

M-Health has successfully transformed the traditional healthcare delivery allowing the large segment of people to access quick facility with connected mobile device globally. Mobile technology is making huge inroads in the healthcare space. Digitalization is revolutionizing our healthcare system. With the rise of M-Health apps, the future of healthcare industry looks even more expanded and the opportunities available are numerous.Recent estimates predict the global mHealth market will reach $57.57 billion by 2026, with a compound annual growth rate (CAGR) of 29.1% from 2019 to 2026.The "Global mHealth Industry Landscape Overview 2022," produced by Deep Knowledge Analytics and Big Innovation Centre, powered by Innovation Eye, gives a comprehensive view of the rapidly expanding global mHealth ecosystem that supports mobile apps and wearable technology. The mobile health revolution in India has the potential to improve the healthcare system and address many of the country's healthcare needs. Emerging information and communication technologies with the help of the Internet of Things (IoT) have been instrumental in integrating different domains of the health sector with mobile technology. To become more customer Centric in mHealth Care services, emphasis should be on the role of technology and also build a business model to ensure its scalability and outreach. The number of mHealth apps utilizing AI technologies, including advanced methods like Deep Learning and Machine Learning, is on the rise. This growth is driven by the wider accessibility of AI, as its capabilities continue to improve. It is now undeniable that mobile health technologies play a valuable role in healthcare delivery and monitoring systems worldwide. With the growing number of mobile users and affordable data plans, it is evident that mobile technology is here to stay in the healthcare sector. Healthcare in India is a prime candidate for investment, especially through digital interventions, and this trend is already picking up. mHealth can be a game-changer in India, if services are provided at subsidized rates or for free, in line with government commitments to provide healthcare for all.

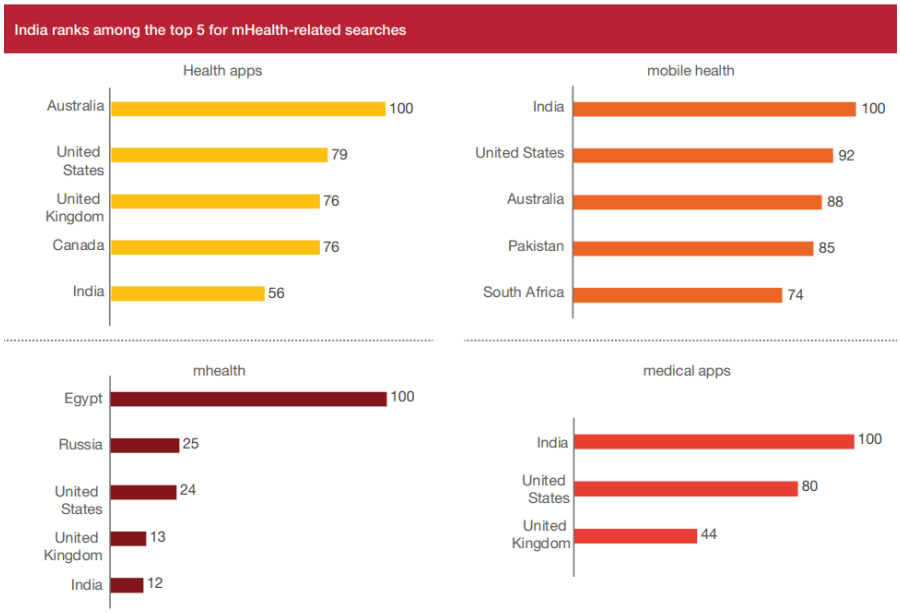
***Keywords**: M Health, Apps, Digital Health Technologies, Healthcare, Mobile Technology, AI, Machine learning.*

INTRODUCTION

Mobile applications will definitely revolutionize healthcare segment in India as opined by **Annie Mathew**, *Director, Asia Pacific Alliances and Business Development.* mHealth is/will be playing crucial role in defining the future of healthcare as it is having a huge potential and hence becoming a global reality nowadays majorly in the consumption,

delivery of care and facilitating unprecedented access to specialist clinical diagnostics and treatment advice. *According to* **Deloitte report in India** *80 per cent of population lives in rural areas, which have minimal healthcare facility whereas 60 per cent of hospitals are situated in urban areas. Hence* "**mHealth**" adoption is going to be a major drive for **more accessibility, cost reduction, faster & better** component as 70-80% of healthcare expenses are out-of-pocket in India.

Mobile technology is making huge inroads in the healthcare space. The World Health Organization (WHO) Global Observatory for eHealth (GOe) defines mHealth as medical and public health practice supported by mobile devices. mHealth is about leveraging mobile and wireless devices to improve health outcomes. 1 In total, 2.5 billion people worldwide own a mobile phone. Globally, mobile data traffic will grow 7-fold from 2016 to 2024, a compound annual growth rate of 47%. In India, mobile data traffic will grow 7-fold from 2016 to 2024, a compound annual growth rate of 49%. Fifty -two percent of physicians believe that the widespread adoption of mHealth in India is inevitable and 92% expected a noticeable effect of mHealth within 3 years. India ranks among the top five countries for search terms like ‘mHealth’ , ‘medical apps’ ,‘health apps’, and ‘mobile health’ according to a data gathered from Google Trends confirming Indian population interest in mHealth.



Source: Google Trends (June 2017)[3]

Shaping India’s Mobile Health Ecosystem

Mobile technology in India is providing efficient and cost-effective mobile healthcare services and has [illegible] tial to impact every aspect of our lives, including health and

wellness especially by reaching out to the bottom of the pyramid. According to European Commission's green paper mHealth solutions empowers the patients with self-assessment

tools and remote diagnosis and also helps in timely intervention by sharing the data with the care provider. mHealth will be revolutionized in coming years according to Boston Consulting Group's report on 'The Socio-Economic Impact of Mobile Health', as more and more health services are enabled by mobile communications by disseminating of information on healthy lifestyle in simple text messages and enabled smartphones with medical devices capable of monitoring and diagnosis playing a significant role in healthcare delivery. To become more customer Centric in mHealth Care services, emphasis should be on the role of technology and also build a business model to ensure its scalability and outreach. It should be customized to the needs especially in the regional language of the State. Collective action of all the relevant stakeholders is needed in the process. A transparent and symbiotic relationship to be played by the public and private players. Government also intervenes towards a new proactive paradigm of healthcare provision (Moerenhout et al. 2018), focused on delivering 'P4' (preventative, predictive, personalized and participatory) medicine (van Roessel et al. 2017). The arrival of mHealth technologies (self-tracking software, health apps and wearables,) and amount of health information available on the Internet was a paradigm shift leading to the emergence of a new generation of 'expert patients' empowering them and increasing their self-esteem resulting a better quality of life.

mHealth platforms are bringing healthcare to doctors and patients in consultations to treatments, transforming the healthcare segment completely the way it has never been experienced before. But like all industries it does face some hurdles and challenges:

To Engage patients

Creating an efficient ecosystem for doctors and patients, platforms that are user-friendly and add tangible benefits is recommended for engaging patients.

Interactive and Usable

It's crucial that extremely user- friendly apps having all the necessary elements should be designed and provided to doctors making it convenient to use.

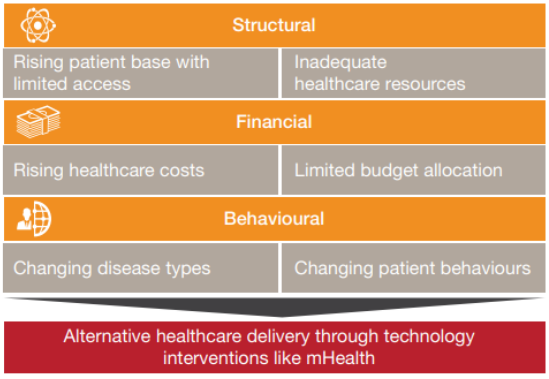
Trust

For the long-term penetration of mHealth, Healthcare data and privacy of doctors and patients need to be guaranteed as early adopters are giving more preference to digital record-keeping and needs to gain the trust of the broader market and key stakeholders to unlock the true potential of mHealth.

Structural, financial and behavioral factors

The Indian patient base is rising and distributed and the supporting infrastructure and resources are inadequate making it a structural challenge to access even basic healthcare.

further constraints in the healthcare ecosystem in India is the financial burden like rising healthcare costs and limited budget allocation for healthcare by the government. The population is getting more tech-savvy and demanding convenient and easier means to receive care, change in lifestyle are some of the behavioral factors leading to newer types of diseases which require access to specialists who are few in number.



Source: PwC analysis

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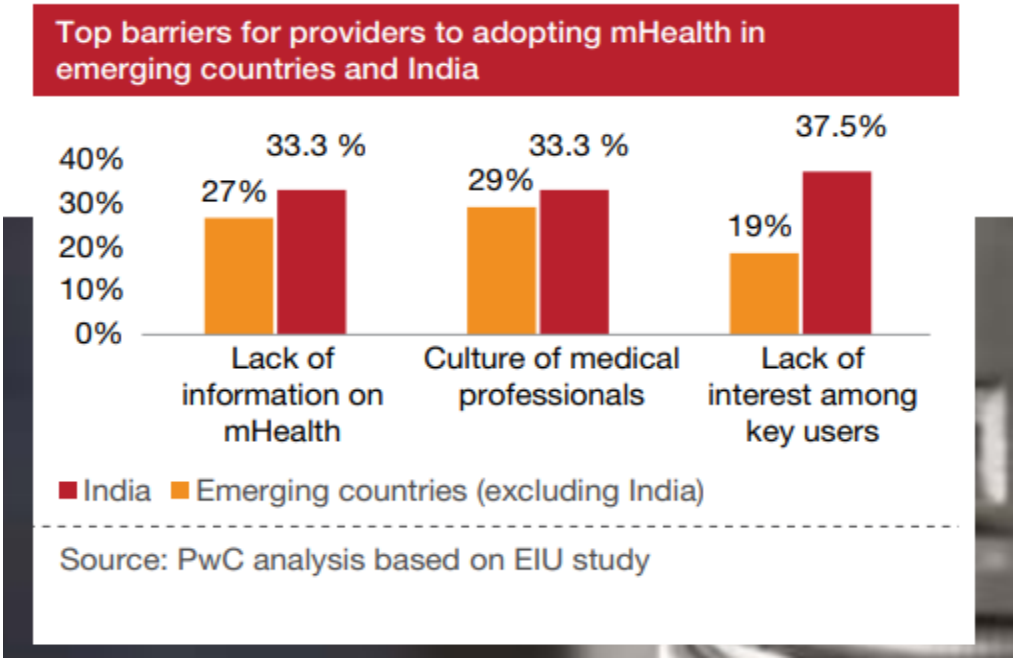
India's current challenges for mHealth adoption

Though mHealth technology can help in improving accessibility, decreasing healthcare costs and increasing the medical fraternity in India can yield positive results as it has impacted the emerging countries in healthcare ecosystem. Despite In Indian Health care sector, a number of barriers are limiting the impact of mHealth.



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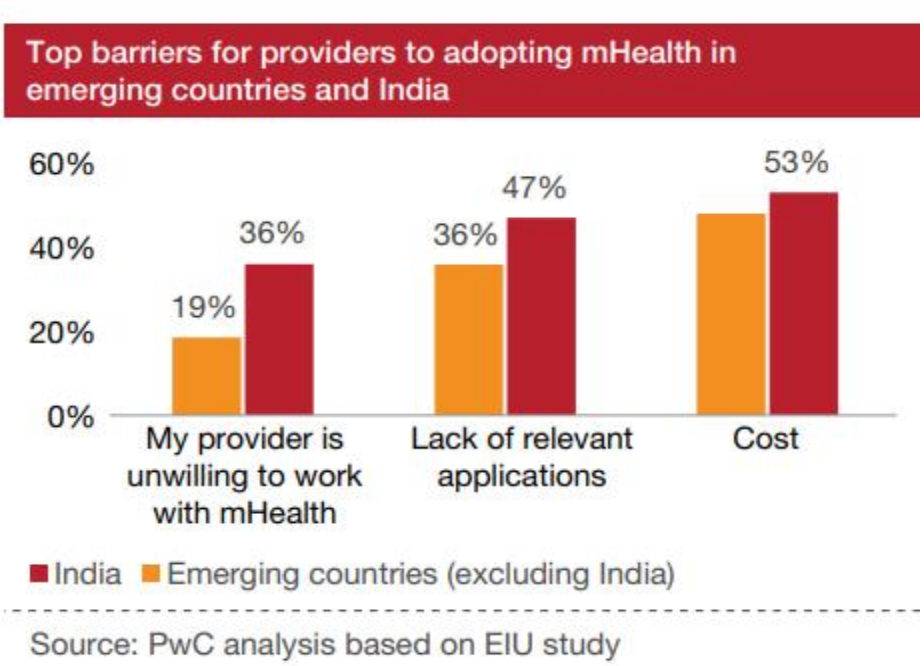
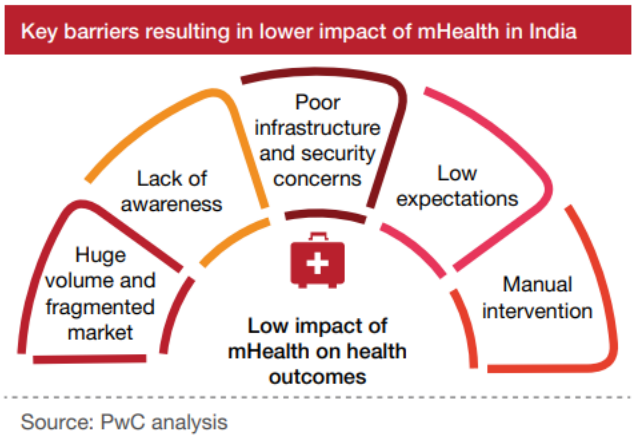


Huge volume and fragmented market

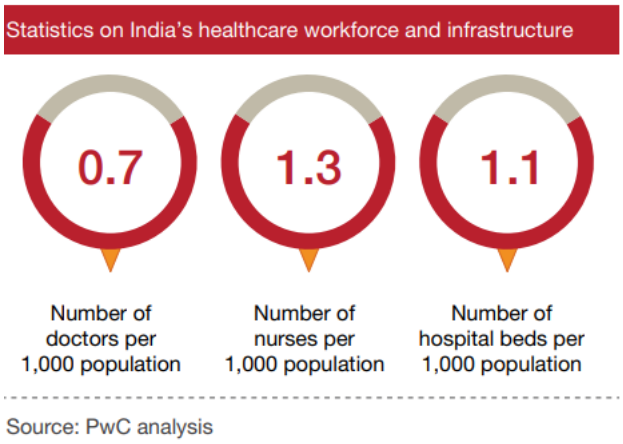
In mHealth almost 1,65,000 mHealth applications are available which has made a huge difference in countries similar to India. The Government of India has launched a few mHealth initiatives which has to be made aware to the population, including patients and providers of this new channel and its benefits as lack of awareness is a huge deterrent.



Structural Interventions Required from policymakers

For improving healthcare ecosystem in India several structured interventions are required from policymakers. There hasn't been as much development as was expected in leveraging the power of mobile to improve healthcare outcomes. Hence a collective effort will have to be made by all stakeholders i.e. healthcare leaders and providers in India to take stock of the situation and invest time and effort in identifying how best they can

leverage mobile technology to improve the healthcare outcomes for their doctors and patients and to achieve wider adoption of mHealth. This can be achieved through Government by supporting mHealth initiatives either providing incentives or making resources available. Patients needs to be diligent in sharing and capturing their clinical data and also doctors and leading hospitals will have to lead by example.



Learning from existing applications of technology

In India Peoples should understand the power of the sensor technology in smartphones and to address several real-life challenges significant strides in the leveraging of mobile devices as a diagnostic tool should be made.

Overall, there is greater pressure on health delivery organizations to improve their clinical quality and efficiency across rural and urban India. The key to responding to such expectations is to become more skilled at leveraging their data, consolidating and quantifying, and making it accessible, anytime and anywhere. This, combined with India's vast expanse and lack of last mile penetration of healthcare services, has compounded the problem greatly.

In an attempt to bridge the gap and bring quality healthcare to rural population, Balabhai Nanavati Hospital (BNH) decided to utilize current offerings and development in the mobile technology space in India. In association with BNH, UST Global launched an exclusive telemedicine application for mobile devices which enables doctors to provide clinical health care to patients situated in remote locations. In this application, the remote clinic staff enters the visiting patients' demographics, vital signs, illness details, preliminary diagnosis information, and uploads existing medical reports. The assigned doctor reviews the patient details and performs consultation with the patient remotely using a video session launched through BlackBerry Messenger (BBMTM). He provides the final opinion and uploads the prescription via the application. The remote clinic staff downloads and hands over a printed copy of the prescription to the patient.

Benefits of mHealth apps:

India stands to gain immensely from mHealth. The key to promoting mHealth adoption and enhancing healthcare outcomes lies in identifying the right use cases and utilizing available technology effectively. This process, as described below, will be iterative.

Approach for determining relevant mHealth use cases and implementing them in the Indian context

Healthcare providers play a crucial role in pinpointing key use cases, identifying major challenges, and recognizing potential benefits. Additionally, they will need to act as influencers to their patients. While the required time and effort might initially seem burdensome, providers are poised to experience substantial advantages for both themselves and their patients.

Improved Diagnostic Precision

mHealth apps used during in-person consultations provide the advantage of enhanced diagnostic accuracy and more informed decision-making. They allow doctors to easily assess a patient's current health status and medical history, enabling them to prescribe treatment more effectively by accessing comprehensive patient information at any time. Additionally, mHealth systems help track symptoms and include automated processes that save time, leading to more precise diagnoses and subsequent treatments.

Real-Time Interaction

mHealth solutions enable continuous communication between doctors and patients through texts, notifications, chats, video calls, and more. This fosters stronger relationships and removes the need for doctors to travel between hospitals and clinics for patient visits.

Increased Efficiency

mHealth apps allow doctors to store all patient data in one centralized location, making it easily accessible from their mobile devices at any time. This accelerates workflows, ensures more efficient treatment for patients, and helps prevent potential errors by doctors, all while adhering to regulatory standards.

Convenience for Caregivers

mHealth platforms have also simplified the role of caregivers. These platforms create a direct communication channel with doctors, allowing caregivers to constantly monitor and log progress reports and symptoms. This minimizes the risk of caregiver errors, enabling them to detect risk factors and symptoms more effectively. Additionally, it helps caregivers be better prepared for emergencies, ensuring they are well-informed and not caught off guard.

Crucial for Remote Areas

mHealth apps can be a literal lifesaver in regions with limited access to medical facilities. They enable doctors to monitor patients in locations that would otherwise be difficult to reach. Likewise, patients no longer need to struggle to find medical advice, as mHealth provides doctors with enhanced access to patients, and allows patients to easily consult with doctors using just a mobile device.

Lower Healthcare Costs

Over time, mHealth solutions will help both doctors and patients reduce healthcare expenses due to their immediacy, automation, and the ability to maintain lean infrastructure. The necessity for frequent visits to healthcare centres will decrease in the next decade, which will, in turn, reduce the indirect costs associated with accessing healthcare services. This mHealth revolution, driven by innovative startups, is set to transform the healthcare landscape.

During the "ideate" phase, key ideas and scenarios for mHealth solutions are formulated. mHealth can have a significant impact in several areas, such as maternal and child care, cardiology, diabetes management, and stress management, among others.

The first step is to raise awareness about the various opportunities, existing technologies, and successful implementations, as well as the potential for partnerships with foundations, government organizations, and telecom operators. It's also important to recognize that collective efforts from all stakeholders in the healthcare sector are crucial for mHealth's success in India.

Healthcare providers must take a leading role. Foundations and NGOs will contribute by drawing on global experience and resources, while telecom companies will view mHealth as a new revenue stream. Insurance firms are promoting healthier lifestyles by increasing patient engagement in their care. Technology and consulting companies will drive innovation and support mHealth adoption. Interestingly, patients are often more ready to embrace mHealth than the healthcare industry itself. The government is also backing and promoting mHealth initiatives. Providers are pivotal in making mHealth a reality in India, and while some have already led successful implementations, there remains significant room for expansion. This requires a coordinated effort between the government and private sector in this price-sensitive market.

The true value of mHealth tools lies in their ability to help both individuals and healthcare providers navigate the complex and constantly changing healthcare landscape. By serving as external repositories for an individual’s preferences in different situations and storing relevant information about their broader circumstances, mHealth tools can function as volitional aids (Wagner 2018). These tools ensure that the individual's

desires, autonomy, and agency are respected (Dickens and Picchioni 2012), rather than simply assuming they always want to be empowered.

Today, mobile technology allows hospitals and doctors to collect, store, process, and secure patient data in the cloud, accessible through a simple mobile interface. For instance, Max Healthcare has introduced an app that securely links medical information—such as radiology images, lab reports, and patient charts—to smartphones, allowing clinicians to access this data anytime, anywhere. A crucial aspect of patient care is capturing clinical information at the point of care. Tools like AppMobilizer enable doctors to input patient care details directly into various health assessment forms, with the data then transferred to a back-end system for reporting and billing purposes.

Taking this further, smartphone apps now serve as clinical calculators and decision-support tools, assisting with prognosis, guiding treatment, and determining dosages. Apps are also being designed as reference databases or ECG guides, reducing the need to carry physical EKG cards. Beyond apps, mobile technologies like near field communication (NFC) hold great promise as electronic health records become more widely adopted. Imagine doctors and nurses tapping a smartphone against a tag, instantly displaying the most recent and relevant page of a patient's medical record.

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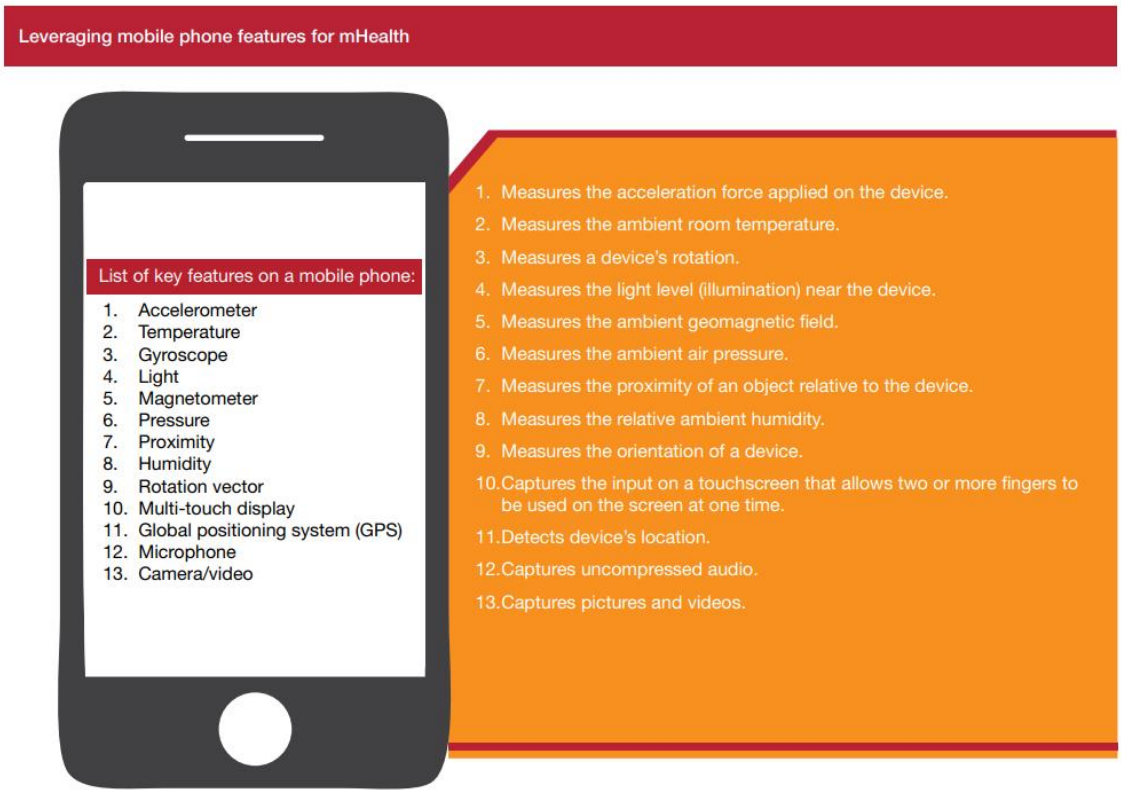


Source: Android developers

Android developers. API Guides - Sensors Overview. Retrieved from https://developer.android.com/guide/topics/sensors/sensors_overview.html

Ms. Sangita Reddy, Executive Director of Operations at Apollo Hospitals Enterprise, India, highlighted the growing initiatives by Apollo Hospitals, particularly in the least connected districts of India, during her address to the audience and fellow discussion leaders. She spoke about the telecom boom, the advantages of mHealth, and its potential integration with information technology to revolutionize healthcare in India, with a distinctly Indian approach. Ms. Reddy also emphasized the need to improve transaction

efficiency and reduce healthcare delivery costs. She noted that the initial stage of mHealth services would be offered at a nominal price, such as one dollar, to ensure maximum reach.

Malvinder Mohan Singh, Chairman of RHC Holding and Young Global Leader, agreed with her vision and supported this initiative, highlighting the role of telecom operators as key enablers of this change in India.

Ms. Reddy also addressed the limited impact of Corporate Social Responsibility (CSR) in delivering effective healthcare services and pointed out how the use of Unique Identification Numbers (UID) could enhance efficiency in data collection.

In addition to remote data access, technology now enables easy, on-the-go communication between medical staff and patients. Practo, a recently launched app and web portal, provides users with information on doctors and helps book medical appointments. With over 100,000 registered doctor profiles from India and Singapore, this service offers consumers a wealth of information anytime, anywhere. Patients can confirm appointments with doctors listed on Practo with just one click and even view detailed information about the doctor's specialization before booking. The app has seen widespread consumer adoption, highlighting the growing use of mobile technology in healthcare.

According to a survey by McKinsey and Deloitte on mHealth, patients reported improved convenience, better quality, and more affordable care through mobile-enabled health and fitness apps.

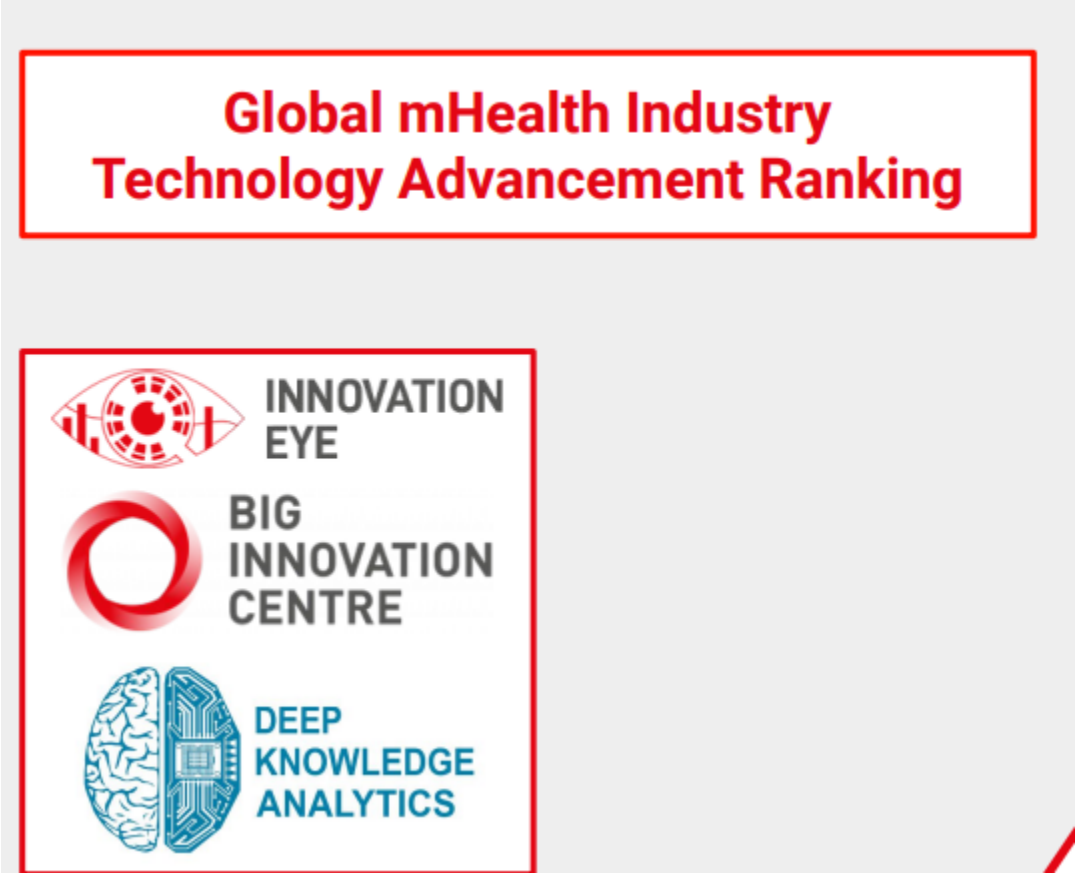
Let's make it happen !

mHealth has become a widespread global phenomenon, present everywhere. As India embraces digitalization, mobile broadband will be crucial in making healthcare more accessible. Healthcare providers must utilize technological advancements to extend affordable, high-quality care to more people. mHealth presents an opportunity to revolutionize healthcare delivery, allowing patients to access services anytime, anywhere. It calls for promotion and strategic planning in India. mHealth can enhance healthcare professionals' efficiency while empowering patients with tools for self-care and health monitoring.

The true potential of mHealth lies in its ability to reach a vast number of consumers, especially in rural areas, for purposes such as education, consultation, and health monitoring. The author also highlights the need for interdisciplinary partnerships and collaborative efforts to ensure the sustainable growth of mHealth 2.0, the next generation of mobile technology designed to support patients (Becker et al., 2014).

Technological advances in wireless communication offer enormous potential to improve patient well-being. Mobile phones have already transformed numerous sectors, and they may revolutionize healthcare as well—especially for rural and suburban populations.

Since these communities often face financial limitations, mHealth can be a game-changer if services are provided at subsidized rates or for free, in line with government commitments to provide healthcare for all. While mHealth has various applications globally, in India, offering access to healthcare consultation, counselling, and information is a significant step toward universal healthcare. mHealth apps and devices for vital sign monitoring, which are gaining traction in developed countries, represent the next stage in the value chain. The "Global mHealth Industry Landscape Overview 2020," produced by Deep Knowledge Analytics and Big Innovation Centre, powered by Innovation Eye, gives a comprehensive view of the rapidly expanding global mHealth ecosystem that supports mobile apps and wearable technology. The report includes a profile section on COVID-19-related mHealth apps, featuring data from Google Play and the App Store. It also discusses major trends in 2020, highlighting how mHealth is evolving from a focus on well-being to broader roles in prevention, care, and treatment support.



The analysis uses a 4-tier ranking system to classify apps based on their technological sophistication. This classification considers factors such as AI integration, the range of services provided, user personalization, and the level of expert knowledge embedded in the app.

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Tier 1 apps employ advanced AI technologies like Deep Learning and Machine Learning, cover a broad range of use cases (e.g., monitoring bio-signals and suggesting breathing techniques through an intuitive VR game), offer extensive user personalization, and include a high degree of expert knowledge.

Tier 2 apps use modern, though not cutting-edge, AI and may connect to wearables and other external devices. They have a relatively wide scope, offer personalized data analysis, and incorporate some expert knowledge. An example would be a general-purpose, dynamic chatbot integrated into a website.

Tier 3 apps use minimal or no AI, provide moderate user personalization, have limited or no connectivity to wearables, and typically serve a narrower range of applications, like a standard contact-tracing app.

Tier 4 apps have the most limited use cases, do not leverage advanced proprietary technology or expert knowledge, and make little to no use of AI. An example would be a basic exposure notification or self-check app.

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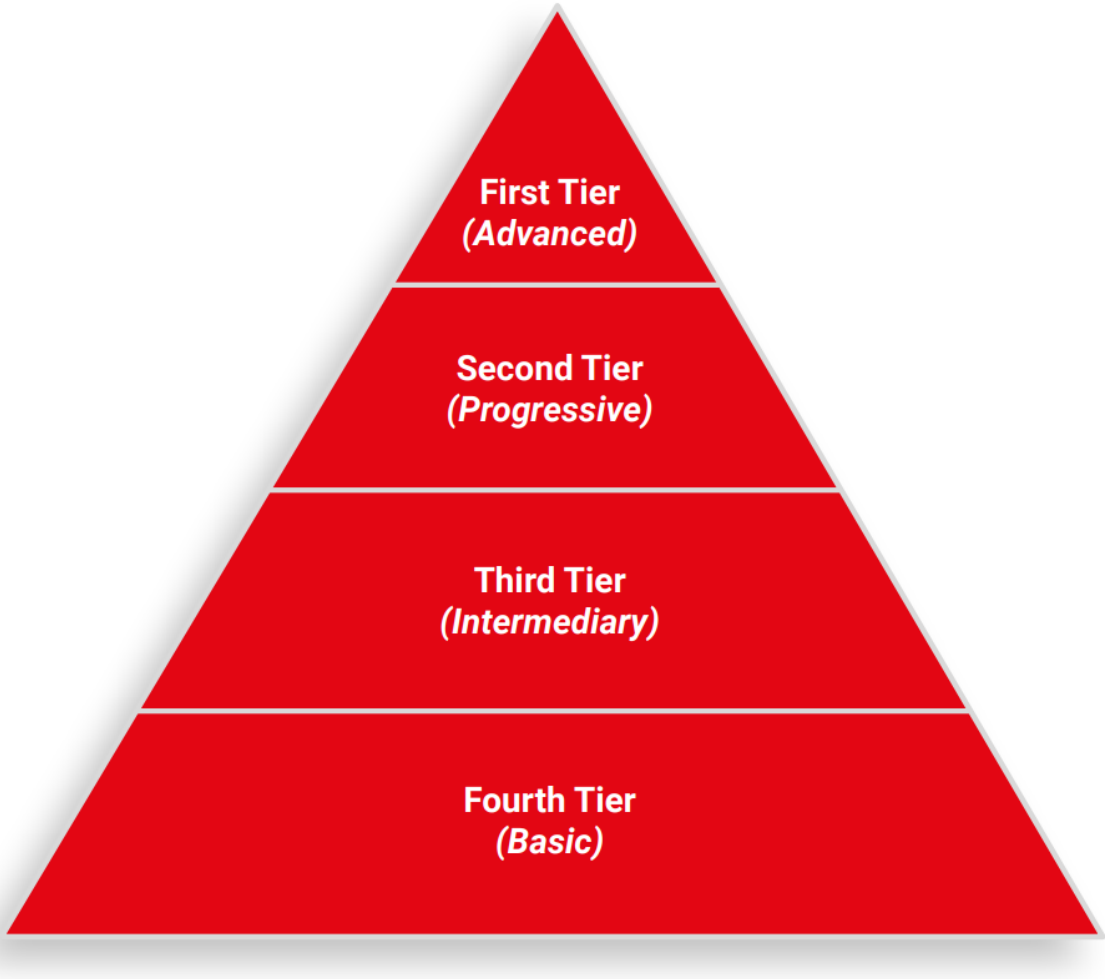

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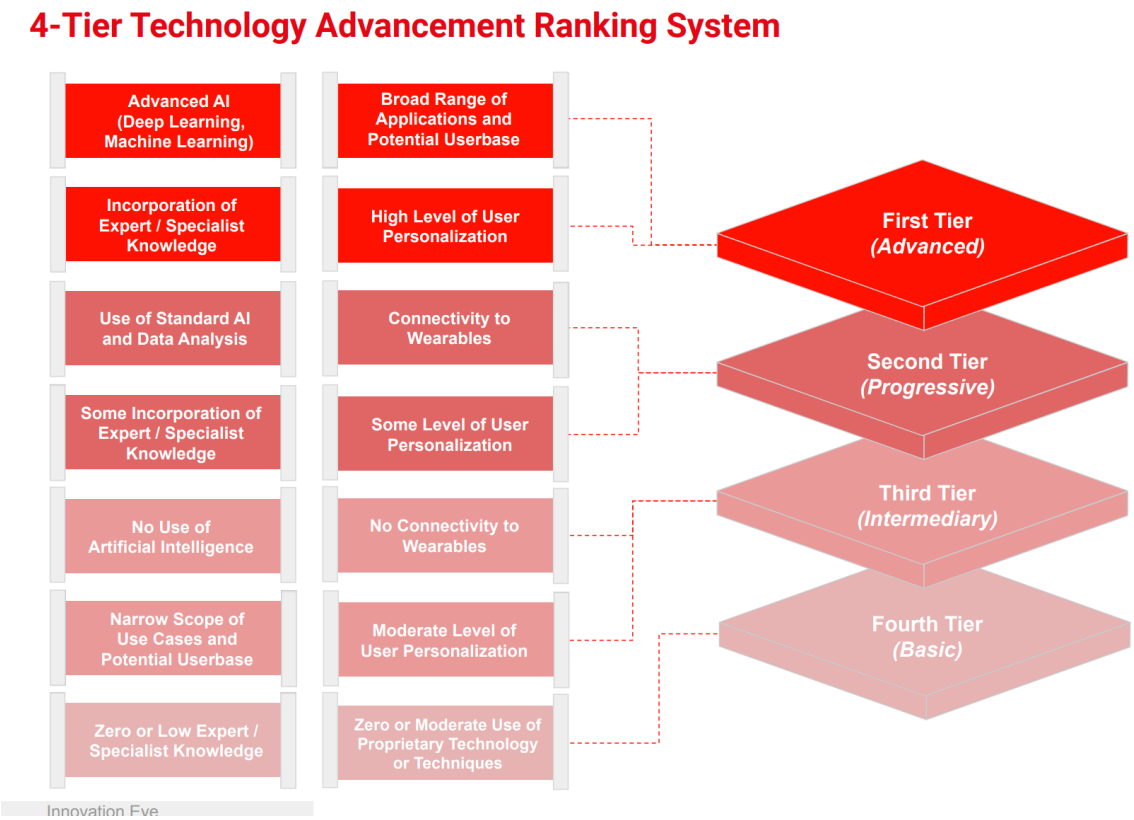

Key Technological Trends in mHealth

The influence of AI in mHealth is expanding quickly, with a rising number of apps using modern AI technologies, data science, and personalized user data analysis to offer customized recommendations. This trend is driven by the growing capabilities of AI, its decreasing costs, and its increasing accessibility to small and medium enterprises (SMEs).

Additionally, the number of apps utilizing advanced AI techniques, such as Machine Learning and Deep Learning, is on the rise, particularly in regions where governments emphasize the development of cutting-edge AI technologies as part of their national strategies, like in Asia-Pacific and the UK. Some governments are actively prioritizing mHealth as a means to reduce the economic strain of healthcare issues, which may contribute to the observed trends.

The rapid increase in mobile phone usage in both developed and developing nations has led to greater mobile penetration across large portions of the healthcare workforce and population, including people in rural areas, spanning all age groups and income levels. Alongside this, internet access is becoming more widespread across these same groups. However, the main obstacle remains the political will and dedicated government support needed to develop and distribute mHealth tools, to the point where they become a critical national priority and an integral part of government healthcare strategies.

A 2019 independent report for the UK Secretary of State for Health and Social Care highlighted the UK's potential to lead the world in healthcare technologies, which are set to reshape healthcare roles over the next 20 years. Advances in genomics, AI, digital medicine, and robotics will likely transform the work of clinical staff across all professions, ensuring safer, more efficient, and personalized patient care. Yet, a lack of strategic coordination is preventing the UK from fully realizing this potential. For instance, during the COVID-19 lockdown, a government-approved contact-tracing app was presented as a crucial tool for managing the pandemic. The app was designed to securely track those you had close contact with and notify you if they became infected, allowing for testing or self-isolation. However, its rollout in the UK faced delays due to technical issues, underscoring the need for a more cohesive strategy to fully leverage existing tools for COVID-19 contact tracing.

The **mHealth Innovation Eye** report highlighted the readiness of the mHealth industry, showing its potential not only in tackling COVID-19 but also in improving healthcare access and alleviating the economic burden of non-communicable diseases and aging populations. mHealth should be a fundamental part of forward-thinking healthcare policies. Over the next decade, it will be important to address challenges around data governance and cybersecurity, agree on ethical standards, and equip NHS staff to integrate genomics and digital technologies into their work. The complexity of data governance should not be an excuse for inaction.

Key Findings:

Market Growth Driven by Smartphone Penetration

The global mHealth market is experiencing consistent growth in terms of user numbers, active companies, investment levels, and the expanding range of practical applications. This growth is largely fuelled by rising smartphone penetration and usage rates, along with the continued expansion of internet connectivity worldwide. Recent estimates predict the global mHealth market will reach $57.57 billion by 2026, with a compound annual growth rate (CAGR) of 29.1% from 2019 to 2026.

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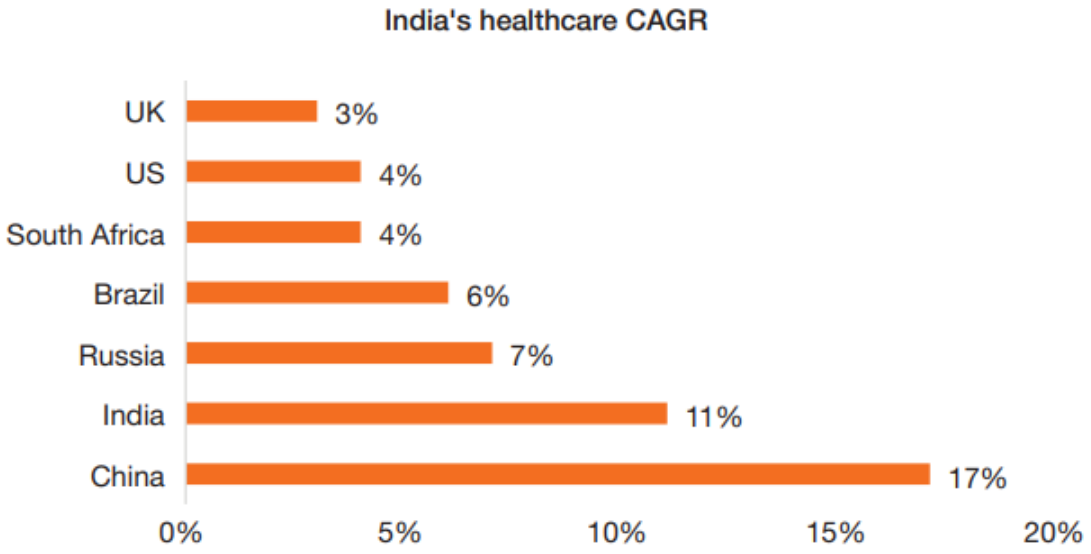

Source: World Bank data

Expanding Scope of mHealth Use Cases

There is a noticeable shift from apps with limited functionality to those offering a wider range of use cases, with a growing emphasis on preventive healthcare approaches. Sectors like mental health, which previously held a smaller share of the mHealth market, are now expanding rapidly, likely due to increased public awareness of issues like anxiety, depression, and overall mental and social well-being.

Democratization of AI Enhancing mHealth Functionality

The number of mHealth apps utilizing AI technologies, including advanced methods like Deep Learning and Machine Learning, is on the rise. This growth is driven by the wider accessibility of AI, as its capabilities continue to improve, while costs decrease. As a result, more mHealth developers and companies can integrate AI, allowing for personalized user recommendations through data analysis.

Population Aging Driving Demand for mHealth Solutions

A key factor fuelling the growth of the mHealth industry is the rising demand for solutions that cater to the health, mental well-being, and quality of life of the elderly. As aging populations in developed countries continue to grow, national healthcare and social welfare systems are under increasing pressure. One of the fastest-growing segments is mHealth technologies aimed at elderly care, including remote patient monitoring, telehealth, and Care Tech solutions.

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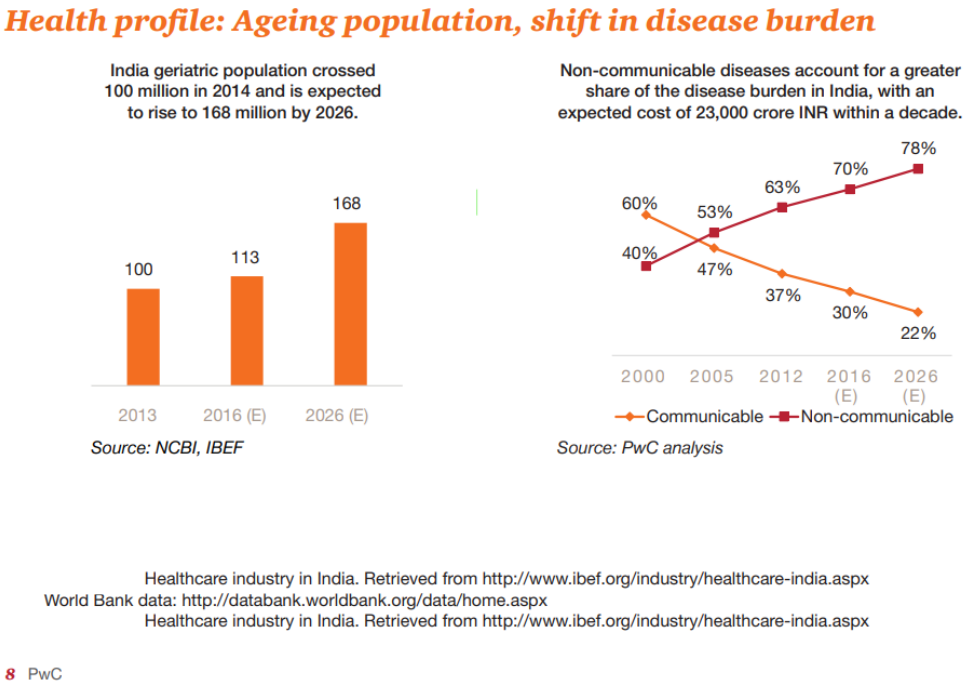

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COVID-19 as a Major Catalyst for mHealth Growth

The ongoing COVID-19 pandemic has significantly contributed to the growth and diversification of the mHealth market. This includes the rise of apps for tracking symptoms and contact tracing. Beyond COVID-specific solutions, the pandemic has driven overall industry growth, as people are more mindful of their health and increasingly seek to minimize unnecessary physical visits to healthcare providers.

Biodefense to Influence mHealth Industry Long-Term

The impact of the coronavirus pandemic is likely to shape the mHealth industry for years to come, with heightened awareness around health, wellness, and biodefense against future pandemics. Additionally, the global investment community's growing interest in health-related sectors will further support the industry's evolution.

Key Takeaways

The mHealth industry is experiencing consistent growth and diversification. The sector has expanded significantly in recent years, with a broader range of applications and technological advancements in its apps. This growth is largely driven by increasing mobile phone penetration and wider internet access globally.

Societal Drivers of mHealth Growth on the Rise

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This positive growth is also being influenced by several challenges that highlight the need for innovative healthcare solutions. These challenges include rising healthcare costs, decreasing affordability, economic disparities in healthcare access, the increasing prevalence of non-communicable diseases (NCDs), aging populations in developed nations, and the growing frequency of pandemics, which are driving demand for mHealth solutions.

Technological Advancements in mHealth

These factors, along with the increasing sophistication of mHealth apps, are creating a cycle of continuous industry growth. The use of AI in mHealth is rising steadily, with more apps incorporating AI, data science, and personalized data analysis to provide tailored recommendations. This is driven by advancements in AI technology, its declining costs, and wider accessibility for small and medium-sized enterprises (SMEs).

Improved Precision and Personalization

The rise in AI capabilities is also enhancing user personalization and the accuracy of data monitoring and analysis, allowing for more tailored health recommendations. As larger volumes of user data are collected and analyzed, AI-driven insights are becoming deeper and more precise. The number of apps utilizing advanced AI techniques, such as Machine Learning and Deep Learning, is growing, especially in countries like the UK, where governments have invested heavily in cutting-edge AI technologies. However, these investments have not yet been fully directed toward advancing mHealth.

Need for Greater Government Coordination

While pandemics continue to fuel the demand for mHealth, the available technologies for addressing health challenges are becoming more advanced. Despite this, many countries, such as the UK, have developed a strong mHealth ecosystem but are not fully leveraging their resources to tackle national health concerns. This shortfall is due to a lack of effective cross-sector collaboration and coordinated efforts at the government level.

It is now undeniable that mobile health technologies play a valuable role in healthcare delivery and monitoring systems worldwide. With the growing number of mobile users and affordable data plans, it is evident that mobile technology is here to stay in the healthcare sector. Healthcare in India is a prime candidate for investment, especially through digital interventions, and this trend is already picking up.

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