TRENDS & FUTURE DIRECTIONS OF DIGITAL HEALTH TECHNOLOGY IMPLEMENTATION IN INDIA FOR STRENGTHENING THE HEALTH CARE DELIVERY IN THE PRESENT ERA

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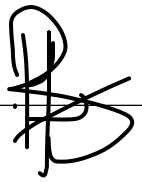

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Dedication

To the Residents of India-

Whose trust, strength, and aspirations light the path toward a healthier future.

This work is dedicated to you, with the belief that digital health technologies will empower access to compassionate, high-quality care for all—enriching lives and strengthening our nation's healthcare journey.

Acknowledgements

I would like to acknowledge my supervisor, Dr. Atul Pati Tripathi, PhD, whose guidance, encouragement, and insightful mentorship have been a constant source of motivation throughout this learning journey. Your unwavering support and guidance have shaped this thesis in meaningful ways.

And to my family—your support has been my foundation every step of the way.

ABSTRACT

TRENDS & FUTURE DIRECTIONS OF DIGITAL HEALTH TECHNOLOGY IMPLEMENTATION IN INDIA FOR STRENGTHENING THE HEALTH CARE DELIVERY IN THE PRESENT ERA

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Digital health technologies have emerged as a transformative force in addressing India's healthcare challenges, including accessibility, affordability, and quality of care. This dissertation explores the digital health readiness of healthcare professionals, patients, and key stakeholders, highlighting both opportunities and barriers to the adoption of these technologies. The study focuses on India's diverse demographic, socio-economic, and geographic landscape to provide a comprehensive understanding of the digital divide, the adoption of digital health tools, and the impact of government initiatives.

The research employs a mixed-methods approach, combining an extensive review of literature with a survey of healthcare professionals and the general population. The findings reveal significant optimism about digital health's potential, with 73.8% of

healthcare professionals expressing confidence in using digital tools and 48.4% agreeing that these technologies improve patient outcomes. However, challenges persist, including inadequate training (61.1%), lack of system integration (57.1%), limited awareness (64.3%), and digital literacy gaps (58.7%) among patients, particularly in rural areas. Vulnerable groups, such as geriatric patients and lower socio-economic communities, face disproportionate barriers to accessing digital health services.

Government initiatives like the Ayushman Bharat Digital Mission (ABDM) and the National Digital Health Blueprint (NDHB) have laid the groundwork for a unified digital health ecosystem. These initiatives promote interoperability, enhance data security, and foster patient empowerment. However, gaps in infrastructure, affordability, and enforcement of privacy frameworks hinder widespread adoption.

The study emphasizes the need for targeted interventions, including national digital literacy campaigns, subsidized access to digital tools, enhanced cybersecurity measures, and incentives for healthcare providers to adopt digital platforms. Future research should focus on long-term impact assessments, cultural factors influencing adoption, and the integration of traditional and digital healthcare models.

In conclusion, while digital health technologies offer immense potential to revolutionize healthcare in India, addressing systemic barriers and fostering a collaborative, multi-stakeholder approach is critical. This research provides actionable

insights and a roadmap for policymakers, technology developers, and healthcare providers to create an equitable, efficient, and patient-centric healthcare ecosystem.

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CHAPTER I:

1.1 Introduction

India is the largest democratic country in the world, with over 1.2 billion people consisting of 17 % of world population and 20% of global disease burden (expressed as disability adjusted life years-DALYS), with 18% of global deaths. (Balarajan et al, 2011), (Gogtay et. al., 2017). Universal access to healthcare is a challenge in India.

Digital Health

Digital health encompasses the utilization of information and communication technologies within the medical field and related healthcare occupations for the purpose of managing diseases, mitigating health risks, and fostering overall well-being. Its scope is wide-ranging and encompasses various aspects such as wearable gadgets, mobile health applications, telehealth services, health information technology, and telemedicine. (Ronquillo Y. et. al., 2022).

According to the United States Food and Drug Administration (USFDA), digital health encompasses a wide range of categories, including mobile health (mHealth), health information technology (IT), wearable devices, telehealth, telemedicine, and personalized medicine. (USFDA, 2020)

Digital Health in India

Digital Health technology has been emerging as a strong pillar in the delivery of healthcare. The world is witnessing a boom in the health technology market for products such as wearables, telemedicine, e-pharmacies etc. A lot of work is being done to integrate technologies such as robotics, artificial intelligence, blockchain and virtual reality with pharmaceuticals and healthcare. The implementation and scaling up of digital health solutions can revolutionize how India can achieve higher standards of healthcare and wellbeing.

To bolster implementation of digital initiatives in India, the Government of India launched the flagship programme Digital India Campaign (2015) which included public health initiatives oriented towards implementation of digital technologies in healthcare services particularly in rural areas.

Subsequently, the National Health Policy (2017) envisioned a fully digitized healthcare system in India which led to the commencement of the Digital Health Mission in India.

The new normal in healthcare ecosystem will be about how healthcare delivery will innovate in the coming decade.

1.2 Research Problem

While digital health technologies offer immense potential to revolutionize healthcare delivery in India, their implementation is not without challenges. The key to successful deployment lies in understanding the digital health readiness of critical stakeholders,

including patients, healthcare providers, government bodies, and technology enablers. It is also essential to identify and address the barriers that could impede the widespread adoption of these technologies. A nuanced, multi-dimensional approach is required to gauge how prepared various groups are to embrace digital health innovations, given India's diverse population and regional disparities.

Previous research on digital health readiness in India provides some insight into the landscape but has several significant limitations. Most of these studies are confined to specific target groups and geographic regions, particularly focusing on the geriatric population in selected areas. This narrow scope does not reflect the broader population, leaving gaps in understanding the readiness of different age groups, particularly among younger populations who may have greater access to technology and different healthcare needs.

Moreover, these studies tend to focus on urban regions, neglecting the rural areas that constitute a significant portion of India's population. Rural areas often face distinct challenges, such as limited healthcare infrastructure, lower levels of digital literacy, and restricted access to technology and internet connectivity. Without a comprehensive analysis of both rural and urban settings, the current understanding of digital health readiness remains incomplete and skewed toward more digitally advanced, resource-rich regions.

Additionally, while patient readiness is an important aspect, there is a substantial lack of research on the digital preparedness of healthcare professionals in India. Doctors are

critical to the success of any digital health initiative, as they are the ones who interact with these technologies directly. If they are not adequately trained or digitally literate, the implementation of digital health solutions may falter. Addressing this gap requires a focused effort on assessing healthcare professionals' familiarity with, access to, and comfort in using digital tools like electronic health records (EHRs), telemedicine platforms, mobile health apps, and digital diagnostic tools.

This can create disparities in access to digital healthcare services and hinder the government’s efforts to create a unified digital health ecosystem under initiatives like the Ayushman Bharat Digital Mission (ABDM).

Challenges such as data security and privacy concerns also play a significant role in shaping the willingness of both patients and healthcare providers to adopt digital health solutions. India is in the process of strengthening its data privacy laws, but fears of data breaches and misuse of personal health information remain prevalent. This can lead to hesitance in adopting digital platforms for sensitive health data management.

Another critical issue is the digital divide in India. Despite rapid advancements in digital technologies, large segments of the population, particularly in rural areas and among marginalized communities—still lack access to smartphones, computers, and the internet. Digital literacy varies widely across different socio-economic groups, which may further impede the ability of people to benefit from these technologies. Addressing this issue requires concerted efforts in building digital infrastructure,

increasing access to affordable technologies, and educating both healthcare providers and the public on the benefits of digital health.

To address these challenges effectively, future research and policymaking must take a holistic approach. A comprehensive study is needed that evaluates the digital health readiness of different population groups across the country, taking into account factors like age, gender, socio-economic status, and geographic location. Such research should not only assess patient readiness but also focus on the training, education, and preparedness of healthcare professionals in using digital tools. Moreover, policymakers must consider investing in healthcare infrastructure improvements and develop targeted interventions that address specific barriers in rural areas.

In conclusion, while digital health technologies present a tremendous opportunity to transform healthcare in India, the path to successful implementation is complex. Understanding the digital readiness of both patients and healthcare providers, addressing infrastructure and literacy gaps, and ensuring data security will be key to achieving the full potential of digital health in India. A more inclusive, data-driven approach will ensure that digital health solutions reach all segments of society and lead to a more equitable and efficient healthcare system.

1.3 Purpose of Research

While digital health technologies offer great promises to address the healthcare needs in India, the implementation may come with its own challenges. For successful

implementation, it is important to understand the digital health readiness of the key stakeholders and the challenges that may impede implementation.

Despite the existence of previous studies on digital health readiness in India, these studies have significant limitations, such as narrow target groups and geographical scope, focusing primarily on the geriatric population in specific areas of the country. Therefore, these studies cannot provide an accurate representation of the digital health readiness of the general population across different age groups and rural-urban settings in India. Additionally, there is a lack of research specifically addressing the digital readiness of healthcare professionals in the country.

Considering these findings, there is an urgent need for focused research aimed at generating credible evidence on the efficacy and user acceptability of mHealth interventions and digital health technologies for health systems strengthening in India. Well-designed and cost-effective studies can assist policymakers in making informed decisions and optimizing the utilization of limited resources to achieve better health outcomes.

1.4 Significance of the Study

With this research, we aim to generate credible and comprehensive evidence on the user acceptability of digital health interventions and technologies, specifically those designed to strengthen health systems in India. By understanding the attitudes, behaviors, and preferences of both healthcare providers and users, we will explore how various digital health solutions are perceived, adopted, and utilized in real-world

settings. This will help identify the factors that drive or hinder the integration of these technologies into the healthcare ecosystem.

Our study will focus on collecting data from diverse population groups, healthcare facilities, and key stakeholders across different regions of India. The goal is to assess how well digital health technologies are being received, particularly in terms of accessibility, ease of use, trust, and effectiveness. This evidence will provide insights into user experience and help identify potential barriers that may prevent widespread adoption, such as concerns over privacy, digital literacy gaps, infrastructure issues, and socio-economic factors.

The outcome of this study is expected to offer not only a conceptual framework for understanding digital health adoption in India but also a practical roadmap for its successful implementation. By analyzing the challenges and opportunities presented by these technologies, we will propose actionable strategies that can facilitate smoother integration of digital health tools into India's healthcare system. These strategies will address key areas such as technology design, user training, data privacy, and infrastructure development.

This research is designed to be a valuable resource for policymakers, helping them create informed regulations and guidelines that promote the effective use of digital health solutions. It will also support digital health solution developers and service providers in designing and deploying more user-friendly, efficient, and secure technologies. Ultimately, the findings of this study will empower all stakeholders to

work towards a more digitally advanced and robust healthcare system, resulting in improved health outcomes, greater efficiency, and enhanced access to quality healthcare for India's population.

In summary, this research will contribute to building a strong foundation for efficient digital health technology implementation, aligning with India's vision of a modernized, accessible, and effective healthcare system. The evidence generated will inform future developments in digital health policies, product innovations, and service delivery models, making healthcare more inclusive, equitable, and patient-centered across the country.

1.5 Research Purpose and Questions

The overall goal of the research is to generate credible evidence on efficacy and user acceptability of mHealth interventions and digital health technologies aimed toward health systems strengthening.

Specific Aims

Accordingly, the objectives of the study are the following:

1. To analyze the impact of government initiatives on digital health adoption in India
2. To assess the digital health readiness of healthcare professionals and patients across India
3. To identify the key barriers and enablers for digital health implementation in India.

CHAPTER II:

REVIEW OF LITERATURE

2.1 Theoretical Framework

Over the past two decades, India has increasingly embraced digital innovations to address socio-economic disparities and healthcare delivery challenges. While several studies have examined aspects of the digital health landscape, the COVID-19 pandemic has significantly accelerated the humanization and adoption of digital technologies, prompting a rapid evolution in this space. As such, there is a growing need to assess current trends and future directions in India's digital health ecosystem.

Despite the proliferation of digital health initiatives, the literature reveals a notable gap: no comprehensive nationwide study has been conducted to assess digital health readiness among both healthcare professionals and the general population. Earlier works, such as Bagchi (2006), highlighted the promise of telemedicine in bridging rural healthcare gaps but did not examine readiness for adoption. Similarly, studies by Kumari (2019) and Rasekaba et al. (2022) explored knowledge and digital literacy in small, rural cohorts, but their limited scope underscores the absence of a broader, representative analysis.

Research Gaps & Future Considerations

The literature review indicates that prior studies have only partially addressed the question of digital health readiness in India. Existing research has been limited in scope—focused primarily on specific groups such as the geriatric population in select

regions of Karnataka (Manipal, Mysore, and Suttur)—and thus cannot be considered representative of India's broader population across rural-urban settings and diverse age groups. Moreover, no studies were identified that specifically assess the digital readiness of healthcare professionals nationwide.

Bassi et al. (2018), in a systematic review of 318 articles, examined mHealth interventions in India and highlighted that, despite widespread mobile penetration and optimism about digital solutions, the quality of supporting evidence remains inadequate. Their findings underscore the need for rigorous, cost-effective research to evaluate the efficacy, scalability, and user acceptability of digital health tools—particularly to inform policy and optimize health system strengthening efforts

2.2 Theory of Reasoned Action

Existing studies on digital health readiness in India are limited in scope, having primarily focused on narrow demographic groups such as the geriatric population in specific regions of Karnataka (Manipal, Mysore, and Suttur). As a result, these studies do not adequately reflect the digital preparedness of India's diverse population across rural-urban settings, age groups, and socioeconomic strata. Furthermore, there is a notable absence of research assessing the digital readiness of healthcare professionals, leaving a critical gap in understanding the capacity of providers to adopt and implement digital health technologies.

Digital health readiness—defined as the preparedness of individuals, providers, and health systems to adopt digital tools—is vital for the effective deployment and success

of digital health interventions. Understanding this readiness is essential for informed policy development, targeted resource allocation, and the design of equitable implementation strategies. A nationally representative study would not only capture variations in digital access and literacy but also help identify challenges faced by vulnerable populations, such as the elderly, economically disadvantaged groups, and rural residents.

Equally important is assessing the digital readiness of healthcare professionals. Insights into their knowledge, skills, and perceptions can reveal gaps in training, support systems, and infrastructure. Addressing these gaps is essential to ensure successful adoption and utilization of digital health technologies in clinical care and health system operations.

Despite the proliferation of mHealth and digital health initiatives in India, existing evidence on their effectiveness and user acceptability remains limited. A comprehensive study can bridge this evidence gap by generating robust data on implementation outcomes, challenges, and enablers—supporting evidence-based policymaking and optimal use of limited resources.

In addition, understanding systemic readiness—such as infrastructure adequacy, interoperability, data privacy, and regulatory alignment—is crucial for scaling digital health initiatives. Strengthening these dimensions will support the long-term sustainability and integration of digital solutions within India's health system.

Future research should adopt a mixed-methods design and engage a representative cross-section of the population and healthcare providers. It should prioritize the generation of credible, actionable evidence to guide digital health policy and practice, ultimately contributing to more inclusive, efficient, and resilient healthcare delivery.

2.3 Human Society Theory

Human Society Theory offers a valuable framework for understanding the interplay between societal structures and the adoption of digital health technologies in India. Rooted in the notion that human behaviors are closely linked to broader cultural, economic, and institutional systems, the theory provides insights into how societal dynamics influence the integration of technological innovations in healthcare.

In the Indian context, cultural norms and perceptions play a significant role in shaping attitudes toward digital health. Many rural communities continue to rely on traditional medical practices and often exhibit skepticism toward telemedicine and e-pharmacy services. Broader societal concerns, particularly around data privacy and digital trust, further moderate the pace and extent of adoption.

Community networks are also central to this dynamic. As highlighted by the theory, community leaders and peer groups act as influential change agents in shaping health-seeking behaviors. Digital health interventions that engage local influencers can therefore be instrumental in building trust, closing knowledge gaps, and improving uptake, especially in underserved areas.

Socioeconomic factors remain a major determinant of digital health access. Economic disparities and unequal access to digital infrastructure disproportionately affect rural and marginalized populations. Human Society Theory underscores the importance of addressing these inequalities through targeted strategies—such as

providing subsidized devices and ensuring affordable internet connectivity—to foster inclusivity.

Institutional actors, including government agencies, healthcare systems, and technology providers, play a pivotal role in shaping societal readiness for digital transformation. National initiatives like the Ayushman Bharat Digital Mission (ABDM) exemplify the influence of institutional frameworks in promoting system-wide adoption of digital health technologies.

By applying the Human Society Theory, policymakers and stakeholders can better design and implement culturally sensitive, socially inclusive, and contextually appropriate digital health strategies. This theoretical lens facilitates a deeper understanding of the complex human-technology interface, ultimately supporting more effective integration of digital health innovations within India's diverse societal landscape.

2.4 Summary

This chapter reviewed the theoretical underpinnings and current literature surrounding digital health readiness in India. The analysis highlighted the potential of digital health technologies, such as telemedicine, mobile health applications, and electronic health records, to revolutionize healthcare delivery. However, significant challenges remain, including digital literacy gaps, infrastructural deficiencies, and cultural resistance, which hinder widespread adoption.

Key gaps in existing research were identified, particularly the narrow focus on specific demographic groups and geographies, such as the geriatric population in select regions of Karnataka. These studies fail to provide a comprehensive view of digital health readiness across India's diverse population. Additionally, limited research exists on the digital

preparedness of healthcare professionals, an essential factor in successful digital health implementation.

The application of Human Society Theory provided insights into how societal dynamics, cultural norms, and economic structures influence the adoption of digital health technologies. Community leaders, institutional frameworks, and localized interventions were identified as critical components for promoting digital health solutions.

In conclusion, while digital health technologies hold immense promise for addressing India's healthcare challenges, achieving their full potential requires addressing systemic barriers. Future research should adopt a holistic approach, examining diverse population segments and focusing on evidence-based strategies to ensure equitable, inclusive, and sustainable digital health adoption across India.

CHAPTER III:

METHODOLOGY

3.1 Overview of the Research Problem

While digital health technologies offer great promises to address the healthcare needs in India, the implementation may come with its own challenges. For successful implementation, it is important to understand the digital health readiness of the key stakeholders and the challenges that may impede implementation.

Despite the existence of previous studies on digital health readiness in India, the past studies have significant limitations, such as narrow target groups and geographical scope, focusing primarily on the geriatric population in specific areas of the country. Therefore, these studies cannot provide an accurate representation of the digital health readiness of the general population across different age groups and rural-urban settings in India. Additionally, there is a lack of research specifically addressing the digital readiness of healthcare professionals in the country.

3.2 Operationalization of Theoretical Constructs

In this study, the theoretical constructs of digital health readiness are operationalized through a multi-dimensional approach. These constructs include levels of understanding, acceptance of digital health solutions, and perceived challenges and opportunities among key stakeholders. Each dimension is assessed through survey questions designed to measure specific aspects such as awareness, adaptability, and potential barriers. For instance, understanding is evaluated by gauging the respondents' familiarity with digital health concepts and technologies, while acceptance is measured by their willingness to

adopt and use these solutions. Challenges and opportunities are identified through open-ended and multiple-choice questions that allow respondents to express their views on the implementation and efficacy of digital health frameworks in the Indian context.

3.3 Research Purpose and Questions

Considering the above limitations, there is an urgent need for focused research aimed at generating credible evidence on the efficacy and user acceptability of mHealth interventions and digital health technologies for health systems strengthening in India. Well-designed and cost-effective studies can assist policymakers in making informed decisions and optimizing the utilization of limited resources to achieve better health outcomes.

Overall Objective

The overall goal of the research is to generate credible evidence on efficacy and user acceptability of mHealth interventions and digital health technologies aimed toward health systems strengthening.

Specific Aims

1. To analyze the impact of government initiatives on digital health adoption in India
2. To assess the digital health readiness of healthcare professionals and patients across India
3. To identify the key barriers and enablers for digital health implementation in India

3.4 Research Design

The primary research method for this study is literature review and survey among key stakeholders.

This study will first review the landscape of digital health in India.

The review of published literature available in public domain will include an overall environment scan including:

1. The existing ecosystem
2. The initiatives by Government of India towards digital health implementation and
3. Study of the business environment- particularly the landscape of digital health providers in India.

Subsequently, in the second stage of this study, a survey will be conducted among public and practicing health care professionals to understand their levels of understanding, acceptance of digital health solutions and perceived challenges and opportunities/advantages from stakeholders' point of view. Finally, once the opportunities and challenges are identified, a conceptual framework for successful implementation of digital health framework for addressing the healthcare needs in India will be outlined.

3.5 Population and Sample

The survey population will include public and health care professionals (primarily practicing physicians)

Sample Size and Selection of Sample

The survey questionnaires will be distributed among public and health care professionals randomly across the country. Efforts will be made to distribute the survey questionnaires across all parts of the country including urban and rural settings. In this study we intend to collect around 400 responses from the public and around 100 responses from health care professionals.

3.6 Participant Selection

Participants for the survey were selected randomly, ensuring a diverse representation of public and healthcare professionals across India. The survey questionnaires were distributed via WhatsApp and email through immediate social networks and various WhatsApp groups. This method allowed for broader outreach, ensuring inclusion from both rural and urban settings. The random selection process aimed to minimize selection bias and provide a comprehensive view of digital health readiness across different demographics and professional backgrounds.

3.7 Instrumentation

No instrumentation was required for this study

3.8 Data Collection Procedures

The collection of data will include review of published literature available in public domain for the environmental scan and an extensive survey among public and health care professionals, using the questionnaires in Appendix 1.

For conducting the survey, standard survey tools like google forms or Survey Monkey or similar tools will be used.

3.9 Data Analysis

All completed questionnaires will be subjected to descriptive statistical analysis, with responses summarized using measures such as percentages, means, and frequencies. Given the exploratory nature of the study—focused on understanding trends, perceptions, and adoption patterns—descriptive statistics are appropriate and sufficient for addressing the research objectives.

The study does not employ inferential techniques such as regression or chi-square analysis, as it lacks predefined hypotheses and does not seek to establish causal relationships or generalize findings beyond the sample. Additionally, the limited use of open-ended questions reduces the applicability of qualitative methods such as thematic analysis. Thus, a descriptive approach provides a clear and effective means of interpreting the structured survey data.

3.9 Research Design Limitations

While the study aims to provide a comprehensive assessment of digital health readiness in India, several limitations must be acknowledged. The broad scope—spanning diverse demographic and geographic segments—presents challenges related to resource requirements, stakeholder engagement, and logistical feasibility. Despite efforts to ensure representativeness, the findings may have limited generalizability due to sample size constraints and the inherent heterogeneity of India's population.

Additionally, while the study explores multiple dimensions of digital health readiness, certain contextual factors—particularly cultural and behavioral influences—may not be examined in depth. The reliance on self-reported survey data introduces the possibility of response bias, including inaccuracies and social desirability effects, which could affect the reliability of results.

Moreover, the study focuses primarily on current perceptions and adoption trends, and does not assess the long-term impact, sustainability, or scalability of digital health interventions. Given the evolving nature of digital technologies, future longitudinal studies will be essential to capture these dynamics over time.

3.9 Conclusion

The study aims to address critical gaps in understanding digital health readiness among key stakeholders in India. By employing a mixed-methods approach that combines a comprehensive literature review with a broad-based survey, the research provides valuable insights into the levels of understanding, acceptance, and perceived challenges associated with digital health technologies. The findings are expected to inform policymakers and stakeholders, facilitating the development of targeted strategies for

successful implementation. However, the limitations of the study, including potential biases in self-reported data and the challenges of achieving full generalizability, underscore the need for further research to validate and build upon the results. Ultimately, this study contributes to the growing body of knowledge on digital health in India and lays the groundwork for future advancements in the field.

CHAPTER IV:

RESULTS

4.1 Research Question One

To analyse the impact of government initiatives on digital health adoption in India

A comprehensive review of the landscape of digital health in India- The existing ecosystem & The initiatives by Government of India towards digital health implementation

Digital health technologies have emerged as a cornerstone of modern healthcare, with innovations such as wearables, telemedicine, and e-pharmacies gaining widespread adoption globally. Advancements in artificial intelligence, robotics, virtual reality, blockchain, and gamification have further enhanced healthcare delivery, enabling more personalized, efficient, and interactive health management approaches. The integration of ambient computing has supported seamless coordination between digital tools and conventional medical practices, contributing to more accurate and responsive care systems.

Recognizing the transformative potential of these technologies, the Government of India launched the Digital India Campaign in 2015, aiming to expand healthcare access—particularly in rural areas—through digital platforms (Press Information Bureau, 2020). This vision was further institutionalized through the Ayushman Bharat Digital Mission (ABDM), introduced under the National Health Policy (2017), which aspires to build a fully digitalized, interoperable, and inclusive healthcare ecosystem

across the country (Press Information Bureau, 2021). These initiatives have positioned India as a promising landscape for health technology innovation and investment.

Broadly, digital health encompasses the application of information and communication technologies (ICT) to promote wellness, monitor health, and support clinical care. The growing focus on digital infrastructure and policy support reflects a national commitment to leveraging technology to achieve equitable and accessible healthcare for all.

Here are a few important uses:

A. Telehealth

Telemedicine utilizes telecommunications technology to deliver healthcare services remotely, integrating traditional care with modern digital tools. Encompassing applications such as tele-consultation, tele-radiology, tele-ICU, and tele-surgery, it is particularly significant in India, where over 75% of healthcare infrastructure serves just 27% of the population in urban areas (Basu, 2022). For the rural majority, telemedicine offers a vital bridge to healthcare access, helping to overcome geographic and socioeconomic barriers and improve health outcomes in underserved communities.B. B. Point of Care Diagnostics (POCD)

Point-of-care diagnostics (POCD) represent a growing trend in medical technology, offering real-time, resource-efficient diagnostic solutions, particularly in low-infrastructure settings (Drain, 2024). These tools—ranging from biosensors and

handheld ultrasounds to smartphone-based devices—enable rapid diagnosis and disease monitoring at the patient's location, bypassing the need for traditional lab-based systems (Vashist, 2017; Ayatollahi, 2021).

Many POCD devices integrate AI and machine learning to enhance accuracy and speed, empowering patients and clinicians with immediate insights for clinical decision-making. Implantable biosensors further support continuous monitoring of chronic conditions. In India, where rural healthcare infrastructure is limited, POCD technologies are especially valuable in enabling remote diagnosis and supporting telehealth services by reducing the need for travel and increasing accessibility (Ayatollahi, 2021).

C. m-Health

According to the WHO, mobile health (mHealth) refers to the use of mobile phones, wireless devices, and related technologies to support medical and public health practices (WHO Global Observatory for eHealth, 2011). With India emerging as the world's second-largest smartphone market, mHealth holds significant potential for transforming healthcare delivery. Smartphone users in India surpassed one billion in 2023 and are projected to reach 1.55 billion by 2040 (Statista, n.d.). Additionally, internet subscriptions grew from 251.59 million in 2014 to 954.40 million in 2024, at a CAGR of 14.26% (Press Information Bureau, 2024).

The widespread adoption of mobile devices makes app-based health solutions both practical and scalable. mHealth enhances the accessibility of digital healthcare and creates new opportunities for patients, providers, and investors in this rapidly evolving sector.

D. Medical Virtual Assistants (MVAs)

Medical virtual assistants (MVAs), including AI-powered chatbots and digital aides, represent a key advancement in mobile health. These tools facilitate continuity of care between in-person visits by managing tasks such as prescription reminders, appointment scheduling, health record maintenance, and information dissemination (Anitha et al., 2021). Leveraging advanced AI, MVAs enhance patient engagement and streamline healthcare workflows by delivering personalized support and analyzing large datasets to offer tailored recommendations.

E. Robotic Surgery

Robotic surgery, a minimally invasive technique, enhances surgical precision through advanced systems comprising robotic arms, a surgeon-controlled console, and high-definition 3D imaging (Reddy et al., 2023). By integrating human expertise with robotic technology, it offers greater control and safety compared to traditional surgical methods.

Emerging innovations like microbots—tiny robots capable of targeted diagnostics and therapy—are poised to further transform medicine. Approved applications such as

capsule endoscopy demonstrate their potential, while future uses may include tumor targeting, plaque removal, tissue sampling, and localized drug delivery (Technology Review, 2023). Their minimally invasive nature reduces collateral tissue damage and improves drug efficacy by focusing on specific sites.

Advancements in deep learning may also enable robots to perform repetitive clinical tasks, thereby enhancing procedural efficiency and allowing healthcare professionals to focus on more complex interventions.

F. Wearable Devices (Self-Monitoring Healthcare Devices)

Wearable devices equipped with sensors are transforming personal healthcare by enabling continuous monitoring of physiological metrics such as blood pressure, glucose levels, sleep patterns, posture, and physical activity. These smart devices empower individuals to track their health, detect early symptoms, and receive alerts for potential health issues, fostering proactive and preventive care (Appelboom et al., 2014; Medical News Today, 2025).

G. Electronic Health Records (EHRs)

Electronic Health Records (EHRs) are comprehensive digital systems that store and manage a patient's medical information in real time, enabling seamless access across healthcare settings (ISO, 2025). Unlike paper records, EHRs improve accessibility, facilitate coordination among providers, and reduce errors and redundancies.

By centralizing patient data, EHRs enhance continuity of care, support informed clinical decisions, and streamline cost-effective healthcare delivery. Recognizing their transformative potential, India's Ministry of Health introduced the EHR Standards Version 2016 to promote standardization, interoperability, and secure data exchange across Health IT systems (PIB, 2016).

H. Aggregation of Health Services

Health service aggregators have become key enablers in India's evolving healthcare landscape, offering integrated platforms that connect patients to a range of services including teleconsultations, diagnostics, home care, and medicine delivery. Platforms like Zoctr Health Network exemplify this model, providing long-term care, wellness programs, and corporate health services (The Silicon Review, 2025).

By leveraging technology, these aggregators enhance accessibility, particularly in remote areas, and reduce reliance on traditional clinical settings (Arthur D. Little, 2025). Their bundled service offerings promote cost efficiency, addressing high out-of-pocket expenditures in India (Your Story, 2019). Additionally, partnerships with accredited providers ensure standardized, high-quality care through adherence to uniform protocols and ongoing monitoring (Arthur D. Little, 2025).

I. Big Data in Medical Practice

Big data is transforming healthcare by enabling the development of comprehensive health profiles and predictive models, thereby improving diagnosis, treatment, and

patient outcomes (McKinsey, 2025). By integrating biological data across multiple levels—from genomics to organ systems—providers gain deeper insights into disease mechanisms and can deliver more personalized care.

The proliferation of wearable devices and mobile health apps allows for continuous, real-time health monitoring, supporting early detection and timely intervention. Additionally, machine learning algorithms are increasingly applied to analyze complex datasets, predict health trends, and enhance clinical decision-making. This convergence of big data and advanced analytics marks a pivotal shift toward precision medicine.

J. Blockchain in Healthcare

Blockchain is transforming healthcare by enabling secure, transparent, and decentralized management of medical data. It facilitates safe data exchange across hospitals, laboratories, pharmaceutical firms, and providers, enhancing accuracy, accessibility, and data security (Haleem et al., 2021).

The technology mitigates errors, prevents data tampering, and ensures confidentiality through decentralized storage and robust authentication. Its applications span clinical trial integrity, fraud prevention, and secure record sharing, fostering trust, interoperability, and global collaboration. As a result, blockchain strengthens healthcare system performance and reliability.

K. Online Pharmacies

E-pharmacies are web-based platforms that enable users to purchase medications and access healthcare services from home, offering convenience and timely delivery (Desai, 2016). In India, their rapid growth has been driven by increasing digital adoption and demand for accessible healthcare solutions.

These platforms provide prescription and over-the-counter drugs, consultations, and diagnostic services, improving access—particularly in remote areas—while offering competitive pricing and enhanced privacy (Dcruz et al., 2022). However, concerns about drug authenticity, prescription misuse, and patient safety underscore the need for robust regulation.

To address these issues, the Indian government has proposed draft rules to regulate e-pharmacies, aiming to safeguard consumers and uphold supply chain integrity. While e-pharmacies hold promise for expanding access, their success depends on strict regulatory compliance (Desai, 2016; Dcruz et al., 2022).

The initiatives by Government of India towards digital health implementation

Ayushman Bharat Digital Mission

Following the National Digital Health Blueprint (NDHB) developed in 2019 under the National Health Policy 2017, the Government of India launched the National Digital Health Mission (NDHM) in 2020, later rebranded as the Ayushman Bharat Digital

Mission (ABDM). Initially piloted in six Union Territories, ABDM is now being implemented nationwide on a voluntary basis (NHA, 2025).

ABDM, led by the National Health Authority (NHA), aims to create an integrated digital health ecosystem by connecting stakeholders through interoperable, standards-based infrastructure. It ensures data security, confidentiality, and patient control, forming the backbone of India's digital health transformation (Deloitte, 2023).

Core features of the mission include the Health ID, a unique digital identifier enabling seamless sharing of health records; the Healthcare Professionals Registry (HPR), a database of certified professionals across both modern and traditional systems; and the Health Facility Registry (HFR), a centralized list of registered healthcare institutions. Electronic Health Records (EHRs) allow real-time, shareable access to patient data, while the Consent Manager enables individuals to control the sharing of their health information, supported by the Digital Personal Data Protection Act, 2023.

ABDM offers several benefits. It enhances healthcare delivery through timely access to accurate records, empowers patients with ownership of their data, and increases administrative efficiency by digitizing key healthcare processes. Additionally, the aggregation of health data supports evidence-based policy decisions and public health planning.

The initiative also presents multiple opportunities. It provides a platform for innovation in digital health technologies, supports medical research through data accessibility,

fosters public-private partnerships, and contributes to job creation in healthcare, IT, and data services. Entities such as Health Information Providers, Health Lockers, and the ABDM Sandbox play a vital role in integrating digital health services and enabling ecosystem-wide collaboration.

A. Health Data Management

The 2020 Health Data Management (HDM) Policy, introduced under the Ayushman Bharat Digital Mission (ABDM), provides a security-by-design framework for managing digital health data. It mandates the creation of three distinct identifiers: Health ID for patients, Practitioner ID for healthcare professionals, and Facility ID for institutions—each with defined access rights (ABDM, 2025). The policy grants patients full control over their data, enabling secure, streamlined access to medical histories and facilitating informed clinical decisions. Additionally, anonymized data will be leveraged to monitor public health trends and guide data-driven policymaking.

B. Sandbox

The Ayushman Bharat Digital Mission (ABDM) Sandbox is a controlled testing environment that enables developers and health tech organizations to integrate and validate their digital solutions using ABDM's APIs before live deployment. It supports secure testing of components such as the ABHA Number Service, Healthcare Professionals Registry (HPR), and Health Facility Registry (HFR) (ABDM Sandbox, 2025).

The sandbox allows developers to assess functionality, interoperability, and compliance with ABDM standards without using real-world data. It offers detailed documentation, technical support, and resources to guide integration. Key benefits include reduced deployment risks, assured compliance with data standards, and a platform to foster innovation in health technology.

Participation is limited to India-based entities that comply with relevant data protection laws. Access is revoked if regulatory or performance criteria are not met.

C. Unified Health Interface

The Unified Health Interface (UHI), launched by the National Health Authority in January 2022 as part of the Ayushman Bharat Digital Mission (ABDM), is a network of open protocols designed to enable interoperability and seamless delivery of digital health services across India. Although no formal governance policies have been published yet, UHI functions as a foundational layer of the ABDM Stack, integrating existing registries and data exchange systems to support end-to-end service access (UHI, 2025).

Through UHI-enabled applications, patients can search for, book, and pay for services such as teleconsultations, in-person appointments, lab tests, ambulance bookings, and blood donations, using any compatible platform. For patients, UHI offers improved access, service transparency, and freedom of platform choice. For providers, it enhances visibility, allows flexible pricing, and supports expansion beyond physical

facilities. UHI represents a key step toward creating an inclusive, interoperable digital health ecosystem in India.

D. Proposed Retention of Health Data Policy

On November 23, 2021, the National Health Authority (NHA) released a consultation paper on the proposed Health Data Retention Policy (HDRP) under the Ayushman Bharat Digital Mission (ABDM). This document discusses the necessity, scope, key components, and governance structure of the policy, aiming to establish standardized guidelines for the retention, usage, storage, and accessibility of health data in India (Economic Times, 2021).

The Regulatory Framework

Although digital health is not specifically regulated in India, it is covered by a number of regulations, some of which are listed below:

A. The 1940 Drugs and Cosmetics Act, the 1945 Drugs Rules, and the 2018 Draft E-Pharmacy Rules

The main regulatory framework controlling the production, distribution, importation, and sale of pharmaceuticals in India is comprised of the Drugs and Cosmetics Act, 1940 ("DCA") and the Drugs Rules, 1945 ("DR"). The Central Drugs Standard Control Organization (“CDSCO”) is in charge of coordinating and ensuring that the DCA is applied consistently throughout India.

Although online services and product delivery are not directly covered by the DCA, online pharmaceutical services in India are required to follow the DCA and DR framework. The regulations' wide application guarantees that they apply to both online and conventional pharmacy operations.

According to these guidelines, e-pharmacies must apply for a license. E-pharmacies can function anywhere in the country, unlike physical pharmacies that are restricted to a certain region. Other issues with e-pharmacies, however, include limitations on drug storage and the acceptability of prescriptions that are scanned or photographed (Drugs and Cosmetics Act, 1940; Drugs Rules, 1945).

The Draft E-Pharmacy Rules, 2018 were established in order to address these problems (CDSCO, 2025).

The Draft E-Pharmacy Rules, 2018, introduced by India's Ministry of Health and Family Welfare, aim to regulate the online sale of medicines, ensuring safety, transparency, and accountability in the e-pharmacy sector. Key provisions include mandatory registration with the CDSCO, valid prescriptions for drug sales, storage in licensed premises, and dispensing by registered pharmacists. E-pharmacies must maintain patient confidentiality and are prohibited from selling narcotics, psychotropic substances, or advertising drugs. Regulatory authorities can inspect for compliance, with penalties for violations. The rules intend to curb counterfeit drugs, improve access to medicines, and formalize the e-pharmacy sector while addressing concerns about

implementation and its impact on traditional pharmacies (Draft E-Pharmacy Rules, 2018).

B. The National Medical Commission Act of 2019 and the National Medical Commission Regulations for Professional Conduct for Registered Medical Practitioners of 2023

In India, medical education and practice are governed by the National Medical Commission Act, 2019 ("NMC Act"), which is overseen by the National Medical Commission ("NMC").

In addition to highlighting the necessity of digitizing medical information for easy access, the MCI Code is still in force for interactions between physicians, patients, and pharmaceutical companies. Physicians are required to abide by the MCI Code and provide a declaration attesting to their compliance.

To the extent that they deal with medical treatment provided by doctors to Indian patients, the provisions of the MCI Code and the NMC Act are both pertinent to digital health services (National Medical Commission Act, 2019; National Medical Commission Regulations, 2023).

C. Telemedicine Practice Guidelines, 2020

The Government of India introduced the Telemedicine Practice Guidelines in March 2020, providing a detailed framework to regulate and guide the practice of telemedicine across the country.

These guidelines address various aspects, including:

- Physician-Patient Relationship: Defining protocols to maintain effective interactions between healthcare providers and patients.
- Liability and Negligence: Clarifying the responsibilities and potential legal implications for practitioners.
- Management and Treatment: Outlining standards for delivering medical care remotely.
- Informed Consent: Ensuring patients are adequately informed before receiving telemedicine services.
- Continuity of Care: Promoting consistent and ongoing patient management.
- Medical Records: Mandating proper documentation and maintenance of patient records.
- Privacy and Security: Safeguarding patient information during storage and transmission.

The guidelines also outline the use of technology platforms and tools to ensure effective healthcare delivery. In alignment with these guidelines, the Ministry of Health and Family Welfare launched the National Telemedicine Service, eSanjeevani, providing free outpatient department (OPD) services to all citizens. Operating on a hub-and-spoke model, it facilitates both doctor-to-doctor and patient-to-doctor consultations. By

integrating with approximately 3.74 lakh Common Service Centers (CSCs), eSanjeevani has expanded its reach to remote regions, promoting equitable healthcare access. To uphold service quality, telemedicine practitioners on eSanjeevani are carefully vetted by State Nodal Officers before being onboarded, ensuring that only qualified professionals provide care. (Press Information Bureau, 2021).

D. The Drugs and Magic Remedies (Objectionable Advertisements) Act, 1954 and Rules, 1955 ("DMRA")

The Drugs and Magic Remedies (Objectionable Advertisements) Act, 1954, and its associated Rules, 1955, prohibit misleading advertisements for drugs and remedies claiming to cure or prevent certain diseases or conditions. The Act restricts the promotion of drugs that claim magical or miraculous properties and bans advertisements for conditions such as cancer, diabetes, and sexual disorders. It aims to protect consumers from exploitation, safeguard public health, and ensure ethical marketing practices in the pharmaceutical and healthcare sectors. Violations attract penalties, including fines and imprisonment.

The Ministry of Health and Family Welfare (MoHFW) published a draft DMRA amendment on February 3, 2020. This amendment broaden the term of "advertisement" to include internet and electronic media (Drugs and Magic Remedies Act, 1954; Drugs and Magic Remedies Rules, 1955)

E. **Telecom Commercial Communication Customer Preference Regulations, 2018 ("TCCCPR")**

The TCCCPR, aim to curb unsolicited commercial communication using Distributed Ledger Technology (DLT) for secure tracking and verification. It mandates explicit customer consent for promotional messages, with a centralized consent registry, and classifies communication into transactional and promotional categories. Telecom providers ensure compliance, with penalties for violations, including service suspension. For the digital health industry, TCCCPR fosters trust by enforcing consent-based communication, enabling targeted outreach, and promoting regulatory compliance. These measures enhance credibility and patient engagement while ensuring ethical, transparent messaging practices (Telecom Regulatory Authority of India, 2018).

F. Consumer Protection Act, 2019 and Consumer Protection (E-commerce) Rules, 2020

The Consumer Protection Act, 2019, strengthens consumer rights and incorporates measures to address grievances effectively, covering areas such as product liability, unfair trade practices, and deceptive advertisements. It also establishes the Central Consumer Protection Authority (CCPA) to safeguard consumer interests and ensures faster dispute resolution through dedicated mechanisms (NCDRC, 2019).

The Consumer Protection (E-commerce) Rules, 2020, outline a framework to promote fair practices in e-commerce, emphasizing transparency in pricing, returns, refunds, and grievance redressal.

They ensure that consumers are well-informed and protected against fraud and unfair practices. As per the rules, e-commerce entities must appoint a grievance officer, a nodal officer, and a compliance officer who are residents of India to ensure accountability and compliance with the rules. (Ministry of Consumer Affairs, 2020)

India's framework for data protection

India's data privacy laws are changing. On August 11, 2023, the Ministry of Electronics and Information Technology passed India's first comprehensive data protection law, known as the Digital Personal Data Protection Act, 2023 (DPDP Act). To maintain security and privacy, it controls how digital personal data is gathered, processed, and stored.

Important Aspects of the 2023 DPDP Act

1. Relevance

Concerning digital personal data pertaining to Indian citizens, it applies to both data processed outside of India and data gathered within India.

Covers the handling of personal data by both public and private organizations.

2. Individuals' rights as data principals

Right to Information: Understand the use of their data.

Right to Erasure & Correction: Ask for personal data to be deleted or corrected.

Right to Consent: Prior to data collection, explicit and informed consent is necessary.

Grievance Redressal Right: Report instances of abuse or noncompliance.

3. Data Fiduciaries' (Organizations Processing Data) Duties

Consent-Based Processing: Prior to processing personal data, explicit consent must be obtained.

Data Protection Measures: Guard against illegal access and provide security.

Breach Notification: In the event of a data breach, alert the relevant authorities and impacted parties.

Limits on Data Retention: Information cannot be kept for longer than is necessary.

4. Data Processing for Children

When processing the data of children under the age of 18, parental consent is required.

Prohibits child-targeted advertising, profiling, or tracking.

5. Exclusions

For the sake of public safety, law enforcement, and national security, government organizations may process data without permission.

There are some exceptions for journalistic, archival, and research purposes.

6. Transnational Data Transmission

Transfers of personal data to particular nations may be restricted by the government.

7. Penalties for Failure to Comply

Penalties for violations and data breaches might reach ₹250 crore.

There are severe penalties for misusing children's data or failing to stop security breaches.

8. India's Data Protection Board (DPBI)

A regulatory agency to deal with grievances, ensure adherence, and administer sanctions.

Effects on Companies

Businesses' data processing policies need to be reviewed and updated.

Strong cybersecurity safeguards and data localization procedures are required.

Required compliance audits and record-keeping for major data processors.

The Digital Personal Data Protection (DPDP) Act of 2023's effects on India's digital health sector

The digital health sector, including telemedicine, health tech startups, electronic health records (EHRs), and pharmaceutical businesses, is greatly impacted by the Digital Personal Data Protection (DPDP) Act, 2023. Compliance with the Act is essential because healthcare data is considered sensitive personal data.

1. More stringent requirements for consent and data protection

Clear Consent Required: Before collecting patient data, digital health platforms must get explicit, informed, and unambiguous consent.

Granular Consent Mechanisms: Patients must be able to choose whether or not to share their data with health applications and telemedicine providers.

Consent Withdrawal: Patients have the right to ask at any moment for their personal medical records to be deleted or corrected.

Impact: Digital health organizations must rethink consent gathering procedures and make sure consent withdrawal procedures are easy to use.

2.Health Tech Platforms' Data Fiduciary Duties

Data Security: To avoid breaches of private patient information, health tech companies need to implement strict cybersecurity procedures.

Data Retention & Deletion Policies: Organizations are required to establish explicit deletion procedures and refrain from storing patient data for longer than necessary.

Requirements for Breach Notification: Regulators and impacted parties must be notified of any illegal access or data release.

Impact: Strong encryption, access control, and breach response systems are essential investments for digital health providers.

3. Effect on Health Tech Startups and Telemedicine

To reduce compliance risks, telemedicine apps and online consultation services need to encrypt medical communications and improve user authentication.

Wearable and health monitoring gadgets, particularly those with Internet of Things connectivity, must protect user data.

AI in Healthcare: AI-powered diagnostic systems need to provide data processing that respects privacy while avoiding overly long data retention.

Impact: New businesses need to incorporate privacy-first product design and uphold open data handling procedures.

4. Limitations on Cross-Border Data Transfer

Unless otherwise authorized, the government may impose restrictions on the transfer of health data to foreign servers.

International collaborations and other global telemedicine platforms may encounter compliance challenges.

Impact: Businesses that use cloud storage overseas need to look into local data centers and transfer policies that have been approved by the government.

5. Managing Health Information for Children

When minors (less than 18 years old) use digital health services, parental consent is required.

Prohibition of targeted advertisements and profiling based on children's health information.

Impact: Parental restrictions and age verification are required for pediatric health apps and online mental health platforms.

6. Higher Compliance Expenses for New Healthcare Businesses

To comply with the DPDP Act, one must:

Employing DPOs (Data Protection Officers)

Establishing mechanisms for consent management

Frequent compliance checks and audits

Penalties for noncompliance can reach ₹250 crore.

Impact: Small and medium-sized digital health businesses need to either engage with privacy-as-a-service providers or set aside funds for compliance infrastructure (Ministry of Electronics and Information Technology, 2023).

B. The Clinical Establishments (Registration and Regulation) Act, 2010, Clinical Establishments Rules, 2012, and Electronic Health Record Standards, 2016

The Clinical Establishments Rules, 2012 (CER), issued under the Clinical Establishments (Registration and Regulation) Act, 2010 (CE Act), mandate that clinical facilities maintain Electronic Health Records (EHRs) as per the standards set by the Central Government. To ensure uniformity and consistency in EHR management across India, the Electronic Health Record Standards, 2016 (EHR Standards), were introduced. These standards apply to all digital health entities governed by the CE Act. They outline best practices for safeguarding medical data and define the protocols for securely maintaining and managing health records within clinical facilities. They also prove that people are the owners of their medical records, and that medical professionals are the information's trustees. Guidelines for consent management, clinical information systems, interoperability, informatics standards, and data protection and security measures are also included in the standards (National Health Portal of India, n.d.; Ministry of Health and Family Welfare, n.d.).

C. Health Data Management Policy, 2020 ("HDM Policy")

The HDM Policy provides the framework for protecting the security and privacy of digital health data and is applicable to all organizations taking part in the ABDM. It includes those who have been given a Health ID, registered medical practitioners, and ABDM-participating organizations. The policy establishes fundamental data privacy standards to ensure adherence to applicable laws, rules, and regulations. The HDM Policy draws its definitions and principles from the 2018 Data Protection Bill, which mandated that personal or sensitive personal data could be collected or processed by data fiduciaries only with the explicit consent of the data principal and solely for the intended purpose. With the enactment of the DPDP Act, sensitive personal data has been reclassified under the broader category of "digital personal data." Nevertheless, the DPDP Act continues to enforce compliance requirements related to accountability, transparency, and robust security measures. Additionally, data fiduciaries are required to formalize confidentiality and non-disclosure agreements with data processors, clearly defining their responsibilities for maintaining privacy and data protection. Additionally, the Act gives data principles some rights to their personal information, such as the ability to access and verify their information, as well as the ability to have it corrected and deleted.

In two particular situations, the HDM Policy permits the transfer of sensitive and identifiable data.

First, a Health Information User (HIU) may seek personal information from a data fiduciary, but only after obtaining the data principal's express approval.

Secondly, for any other NHA-designated purpose, data fiduciaries may supply aggregated anonymized or de-identified data for use in clinical and health research, academic studies, archiving, statistical analysis, policy development, and the development of diagnostic solutions (Ayushman Bharat Digital Mission, 2020.; Ministry of Electronics and Information Technology, 2018)

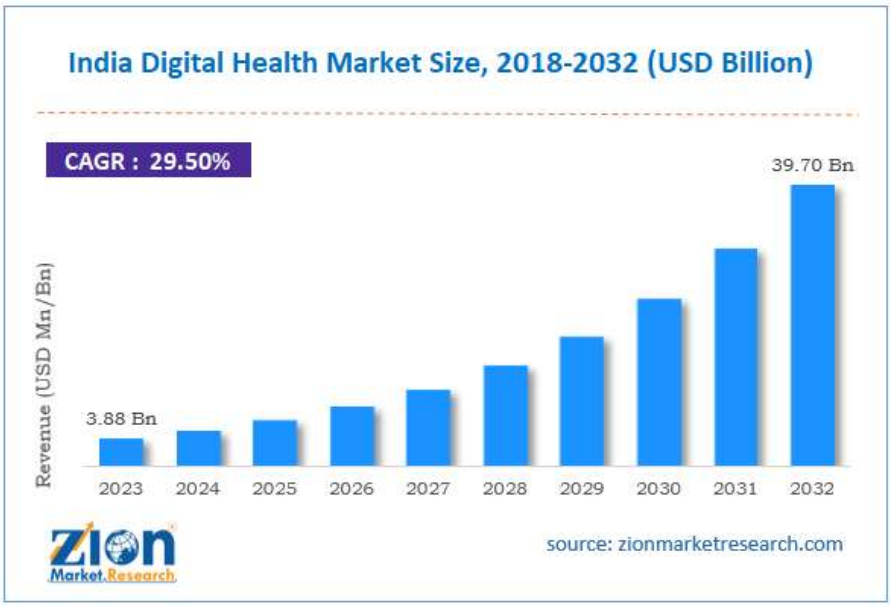
Study of the business environment- particularly the landscape of digital health providers in India

Digital Health

Digital health encompasses the utilization of information and communication technologies within the medical field and related healthcare occupations for the purpose of managing diseases, mitigating health risks, and fostering overall well-being. Its scope is wide-ranging and encompasses various aspects such as wearable gadgets, mobile health applications, telehealth services, health information technology, and telemedicine. (Ronquillo Y. et. al., 2022)

India digital health market size was worth around USD 3.88 billion in 2023 and is predicted to grow to around USD 39.70 billion by 2032 with a compound annual growth rate (CAGR) of roughly 29.5% between 2024 and 2032 (Zion Market Research, n.d.).

Figure 1: India Digital Health Market 2018-2032



The COVID-19 pandemic has accelerated digital transformation within the healthcare sector, enhancing access to healthcare services, improving provider efficiency, and increasing price transparency for consumers. Additionally, rising patient awareness and widespread internet adoption—with over 50% penetration and more than 700 million internet users—have contributed to the growing use of digital health platforms (Press Information Bureau, 2004).

As of January 2025, India has around 12158 health-tech startups. Among these, 1,490 startups have received funding, with 301 reaching Series A+ funding rounds, and 6 attaining unicorn status (Tracxn, 2025-a.)

Between 2017 and 2022, India secured over USD 6.5 billion in private capital investments in the health-tech sector (Tata Capital Healthcare Fund, n.d.).

India's digital health market can be categorized into the following segments based on their significant impact on the industry so far:

Online Pharmacy & Diagnostics

The market is valued at approximately USD 3 billion and is experiencing an annual growth rate of 35%.

The eHealth market now caters to over 5 million households, with the COVID-19 facilitating increase in adoption. This growth is largely fueled by rising consumer trust in non-metro areas, a shift toward accessible, cost-effective, and comprehensive healthcare options, and robust support from healthcare professionals, hospitals, and regulatory authorities Furthermore, the government has officially designated ePharmacy as an essential service, allowing the home delivery of medicines (Tata Capital Healthcare Fund, n.d.)

The key players in the market are

Company	Revenue FY 23-24
PharmEasy	Rs 5664 Crore (Entrackr, 2024.)
TATA 1Mg	Rs 1,968 crore (The Economic Times, 2024.)
Netmeds.com	Rs 67.24 Crore (StartupTalky, 2025.)
Flipkart Health +	Rs 32.9 Crore (Tracxn, 2024.-i)

The eHealth market has the potential to achieve a gross merchandise value (GMV) of $10 billion by FY27, driven by penetration into 40–70 million households. Among its segments, eConsultation is witnessing the fastest growth, while ePrescriptions contribute to 60% of the market share.

Currently, the industry is characterized by increased investments and mergers & acquisitions (M&A), with a focus on geographical expansion and integrated service offerings (Tata Capital Healthcare Fund, n.d.).

Pharma Analytics

The Indian market is valued at approximately US$ 250 million, growing at an annual rate of 20%. Meanwhile, Indian companies are serving a global market worth around US$ 130 billion.

India has established itself as a global leader in outsourced IT services, and this trend has extended into the healthcare sector, services aimed primarily at US and European clients. These businesses typically follow a software services or SaaS model with a growing investor interest in the Healthcare SaaS market, fueled by the growing requirement of digital transformation in healthcare. Interestingly, most companies in this sector are developing solutions for the global market, as the domestic market in India offers limited scalability. This trend suggests that Indian companies are well-positioned to succeed in the global healthcare software market (Tata Capital Healthcare Fund, n.d.).

The key players are:

Company	Revenue FY 23-24
CitiusTech	Rs 3,536 crore (Entrackr, 2024.)
Innovaccer	Rs 397.64 crore (Kredible, 2021.) (FY 22-23)

HealthPlix	Rs 30.09 crore (Tracxn, 2025-b.)

Technology based Healthcare Services

The market is approximately valued at USD 60 million, with an annual growth rate of 35%. This category of digital health companies has eliminated the burden of hospital infrastructure costs by establishing a virtual healthcare ecosystem. They digitally acquire patients and either conduct surgeries at partner hospitals using their own team of surgeons or refer the leads to hospitals for fulfillment. Pristyn Care has gained a significant market share in this domain. While this model has proven effective for daycare surgeries, expanding into other areas that require hospitalization, and extended care will need to be evaluated (Tata Capital Healthcare Fund, n.d.).

The key players are:

Company	Revenue FY 23-24
Pristyn Care	Rs 632 crore *(*PTI News, n.d.)
Glamyo Health	Rs 11.6 crore (Tracxn, 2025-c)

	(FY 21-22)
Ayu Health	Rs 35.96 crore (Kredible, 2025)
Medfin	Rs 12.8 crore (Tracxn, 2025-d)

B2B –Hospital/Pharma Supplies

The market is estimated at around USD 1.2 billion, growing at an annual rate of 35%. A new wave of technology-driven platforms is transforming hospital and pharmaceutical supply procurement. The healthcare supply industry, encompassing pharmaceuticals, medical devices, and hospital supplies, is vast and complex, featuring over 500,000 SKUs produced by 5,000 manufacturers and distributed to a network of over one million hospitals, 100,000 pharmaceutical distributors, and 800,000 retail pharmacies. Unlike conventional distributors, B2B procurement platforms offer pharmacies and hospitals solutions like just-in-time inventory, credit facilities, and operational simplification, enhancing efficiency and profitability. Established players like Keimed and Ascent continue to dominate the organized segment, controlling nearly 90% of the market.

However, a shift toward organized distribution is gaining momentum, led by digital-first companies. By 2025, the organized market share is expected to expand to 10%, with consolidation playing a crucial role, mirroring trends seen in developed economies. Traditional firms with strong financial resources are expected to drive this

consolidation by integrating digital capabilities. For instance, Entero has acquired 10 unorganized distributors in the past two years, while PharmEasy has strengthened its presence through acquisitions of Retailio and Aknamed (Tata Capital Healthcare Fund, n.d.).

The key players are:

Company	Revenue FY 23-24
Entero Health	Rs. 3936.7 crore (Entero Healthcare, n.d.)
Medika Bazaar	Rs 1600 crore (Tracxn, 2025.-e) (FY 21-22)
Aknamed	Rs 1170 crore (Tracxn, 2025.-f) (FY 22-23)

Telemedicine

The market is approximately valued at USD 250 million, with an annual growth rate of 20%. Telemedicine utilizes technology to deliver remote healthcare services, such as virtual consultations, remote nursing, teleradiology, and telesurgery. With over 75% of India's healthcare infrastructure located in urban areas while the majority of the population lives in rural regions, telemedicine plays a crucial role in bridging the gap between patients

and doctors. The COVID-19 pandemic significantly boosted the use of online consultations, further supported by regulatory guidelines that enable doctors to prescribe approved medications during virtual consultations. Although telemedicine usage has grown significantly, the technology itself has become mainstream, with nearly all B2C digital health platforms, including online pharmacy companies, offering it as part of their services. This widespread integration has created challenges for standalone telemedicine providers, who now face financial strain and are being acquired at reduced valuations (Tata Capital Healthcare Fund, n.d.).

The key players are:

Company	Revenue FY 23-24
Practo	Rs 240 crore (The Economic Times, n.d.)
Mfine	Rs 35.34 crore (YourStory, 2024) (FY 22-23)
DocsApp	Rs 327 crore (Tracxn, 2025-g) (FY 22-23)
Clinikk	Rs 16.9 crore (Tracxn, 2025-tracxn-h) (FY 22-23)

Wellness, Nutrition, and Chronic Care Solutions

The market is valued at approximately USD 350 million, with an annual growth rate of 35%. Health Tech companies in this space are implementing standardized protocols to create a digitally-driven fitness ecosystem. They provide customers with an integrated online and offline approach covering fitness, nutrition, and chronic care services. The effectiveness of this model hinges on key factors such as building a loyal and high-value customer base, attracting and retaining skilled professionals (like trainers, dieticians, and doctors), securing adequate resources and equipment for setup, and implementing a cost-efficient customer acquisition strategy. The management of chronic illnesses is facilitated by technologies in this field, including wearables, mobile health applications, and remote patient monitoring. These innovations also empower patients by allowing them to track their health metrics and receive tailored interventions remotely.

The chronic disease management sector is still in its nascent stages, with business models continuously evolving. Given the rising burden of chronic diseases in India, this segment is likely to garner increased investor interest in the near future (Tata Capital Healthcare Fund, n.d.).

The key players are:

Company	Revenue FY 23-24
Cure.Fit (Cult.Fit)	Rs 926.6 crore (The Arc Web 2024.)
FITTR	Rs 86.33 crore Kredible (2021)
HealthifyMe	Rs 206.3 crore YourStory (2024)
UltraHuman	Rs 107 crore Entrackr (2025.)

India Digital Health Market: Constraints

Proliferation of Open-Source Solutions Hindering Market Expansion

The widespread availability of open-source digital health solutions is slowing market growth. Open-source vendors offer an extensive range of digital health tools, often providing the same functionalities as proprietary on-premises and cloud-based solutions. By integrating multiple open-source products, users can access similar features without investing in licensed platforms. The appeal of open-source software lies in its flexibility, decentralized governance, and cost-effectiveness. Consequently, these alternatives are reducing the market share of proprietary digital health providers, thereby limiting the growth of India's digital health sector in the coming years.

India Digital Health Market: Growth Opportunities

Increasing Healthcare Expenditure Driving Market Expansion

Rising healthcare costs—driven by an aging population, the increasing prevalence of chronic diseases, and technological advancements—are fueling revenue growth in India's digital health sector. According to the Press Information Bureau, India's current healthcare expenditure stands at approximately USD 64 billion. Digital health technologies present cost-effective solutions by improving patient engagement, streamlining healthcare delivery, and minimizing unnecessary medical expenses.

For example, telemedicine platforms enable virtual consultations, reducing the need for in-person visits and their associated costs. Additionally, digital health solutions can identify inefficiencies in the healthcare system, further strengthening the market outlook. As healthcare spending continues to rise, the digital health sector in India is poised for substantial growth.

India Digital Health Market: Key Challenges

Infrastructure and Data Security Concerns Limiting Adoption

The expansion of digital health solutions in India is significantly constrained by inadequate healthcare infrastructure, particularly in rural areas with limited internet connectivity and insufficient access to digital tools. Moreover, as the adoption of digital health technologies grows, concerns regarding patient data privacy and cybersecurity risks are also increasing. These security challenges may lead to hesitation among both healthcare providers and patients in embracing digital health solutions.

Unless these infrastructure and security issues are effectively addressed, they will continue to act as significant barriers to the widespread adoption and growth of India's digital health market (Zion Market Research, n.d.)

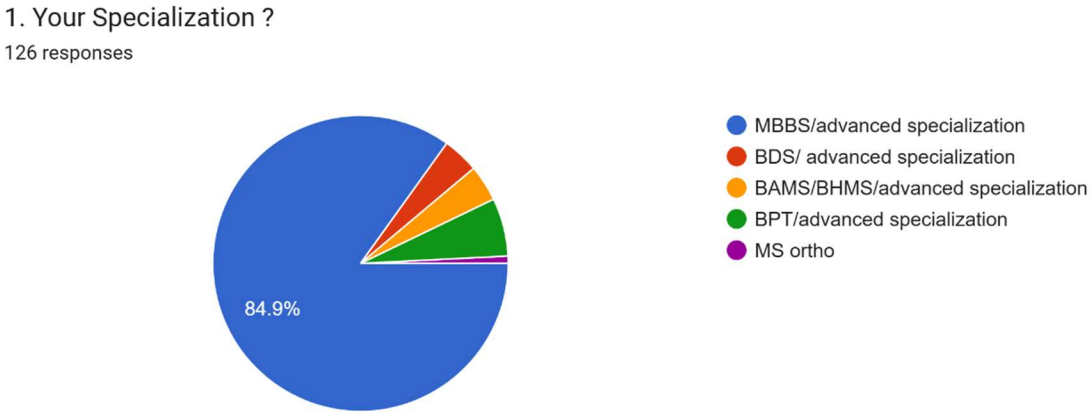
4.2 **Research Question Two & Three**

Surveys were conducted among public (residents of India) (N=480) and practicing health care professionals (N=126) to understand their levels of understanding, acceptance of digital health solutions and perceived challenges and opportunities/advantages from stakeholders' point of view.

The results are shared below.

Digital Health Technology Readiness Survey Results- Health Care Professionals

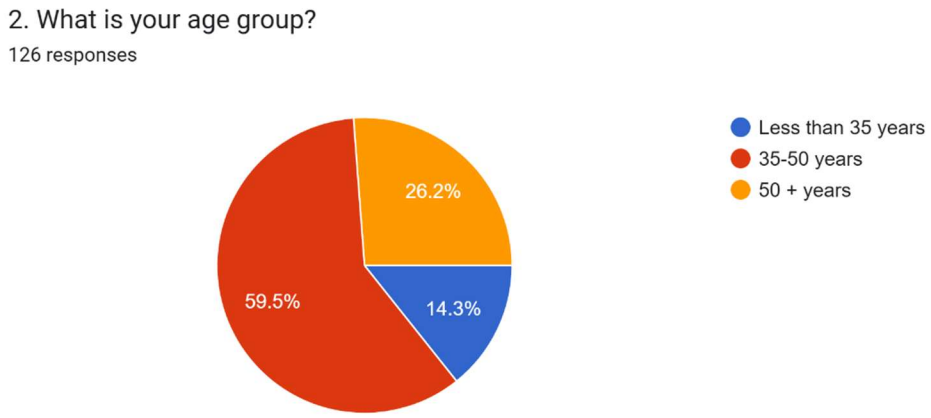
Figure 2: Distribution of Specializations Among Respondents (HCPs)



The professional background of the 126 respondents reveals a predominantly medical composition. A substantial majority (84.9%) hold an MBBS degree or possess advanced specializations in general medicine, underscoring the strong representation of conventionally trained allopathic doctors in the respondent pool. This high proportion suggests that the findings of the study are largely informed by individuals with extensive medical education and clinical experience within mainstream healthcare systems.

In contrast, smaller proportions of respondents come from other healthcare domains. A segment is composed of professionals with a Bachelor of Dental Surgery (BDS) or advanced qualifications in dentistry, while others represent alternative systems of medicine, including Ayurveda (Bachelor of Ayurvedic Medicine and Surgery – BAMS) and Homeopathy (Bachelor of Homeopathic Medicine and Surgery – BHMS). Additionally, a modest group of respondents consists of physiotherapy practitioners (Bachelor of Physiotherapy – BPT) with specialized training. The diversity in professional backgrounds, although skewed towards MBBS-trained doctors, reflects a multi-disciplinary cohort.

Figure 3: Distribution of Age Group Among Respondents (HCPs)



The age distribution of the 126 respondents indicates a predominance of mid- to late-career professionals within the survey population. A majority of respondents (59.5%) fall within the 35–50 years age group, suggesting that the study primarily engaged individuals in the middle stages of their careers who are likely to possess substantial professional experience and established roles within their respective fields.

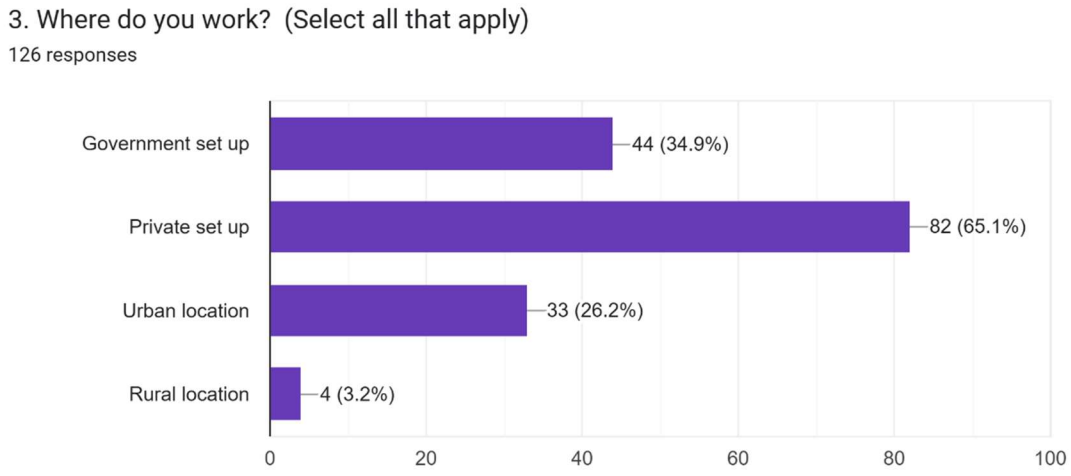
An additional 26.2% of respondents are aged 50 years or older, representing a significant proportion of senior professionals, domain experts, and leadership-level individuals. Their presence adds depth to the data, as these individuals may bring a strategic and long-term perspective shaped by years of experience in healthcare practice, policy, or administration.

Conversely, respondents younger than 35 years comprise 14.3% of the sample, reflecting early-career professionals or recent entrants to the field. While smaller in

number, this cohort contributes emerging viewpoints and familiarity with newer digital trends.

Overall, the respondent pool is skewed toward experienced professionals, with more than 85% of participants aged 35 or older.

Figure 4: Distribution of workplace Among Respondents (HCPs)



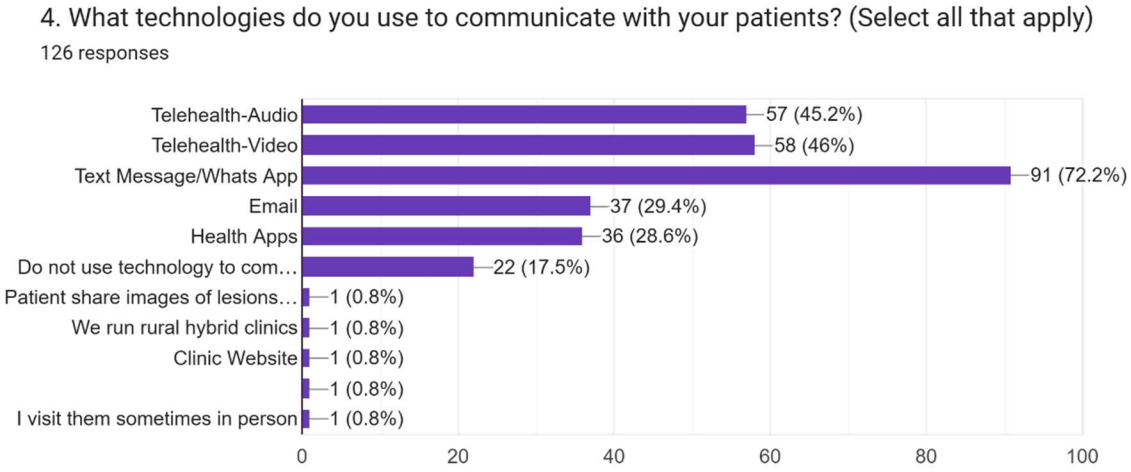
The analysis of workplace distribution among the 126 respondents, who were allowed to select multiple applicable options, reveals key patterns in healthcare employment settings. A significant majority (65.1%) of respondents reported working in private healthcare setups. This high percentage underscores the dominant role of the private sector in healthcare service delivery and suggests that private institutions form the primary professional environment for many healthcare practitioners in the sample.

In contrast, 34.9% of respondents indicated employment within government healthcare facilities, signifying a meaningful representation from the public sector. Although the proportion is smaller than that of the private sector, the presence of government-employed professionals ensures a balanced inclusion of perspectives from both public and private healthcare systems in the dataset.

Further stratification of responses by geographic location reveals that 26.2% of participants work in urban areas, compared to a mere 3.2% in rural settings. This sharp disparity highlights the urban-centric nature of the respondent pool and mirrors the broader national trend of healthcare infrastructure being concentrated in cities. The minimal representation from rural areas points to a potential gap in the inclusivity of healthcare experiences across geographies, which could have implications for interpreting the accessibility and adoption of healthcare innovations.

Collectively, these findings illustrate a respondent base that is not only largely engaged in private sector healthcare but also predominantly urban in location. Nevertheless, the considerable participation from government setups offers a more comprehensive view of India's mixed healthcare system, encompassing both public service delivery and market-driven care.

Figure 5: Technologies healthcare professionals use to communicate with their patients



Survey data from 126 respondents indicate a strong reliance on digital tools for patient communication, with multiple selections permitted. The most frequently used method is mobile-based messaging, such as WhatsApp or SMS, employed by 72.2% of respondents (n=91), highlighting its convenience and widespread acceptance in clinical interactions.

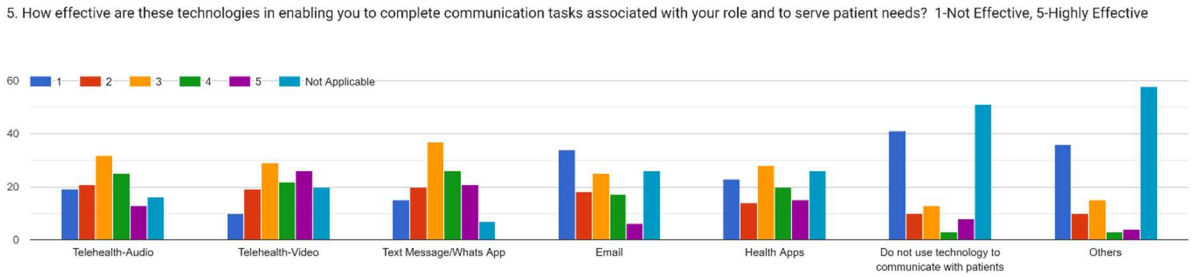
Telehealth platforms also feature prominently. Video consultations are used by 46% (n=58) and audio-based telehealth by 45.2% (n=57), reflecting the growing integration of virtual care into routine practice—particularly accelerated in the post-pandemic era. Email, used by 29.4% (n=37), serves as a formal communication channel for documents, prescriptions, or follow-ups. Health-specific mobile apps, reported by 28.6% (n=36), suggest emerging interest in specialized tools for patient engagement

and monitoring, though adoption remains lower compared to general-purpose platforms.

Notably, 17.5% of respondents (n=22) reported not using any technology for patient communication, indicating continued reliance on traditional methods, likely due to infrastructural, demographic, or contextual limitations. A minority (~0.8%) cited alternative methods, including hybrid rural clinics, clinic websites, image-sharing by patients, and in-person visits, reflecting localized adaptations in care delivery.

Overall, the data point to a digital-first shift in communication practices, led by messaging apps and telehealth, while also acknowledging existing gaps in technology use and the persistence of conventional approaches in specific settings.

Figure 6: Effectiveness of different technologies in enabling healthcare professionals to communicate with patients



The effectiveness of various technologies in facilitating healthcare communication was assessed using a 5-point Likert scale (1 = Not Effective to 5 = Highly Effective), with

an additional "Not Applicable" category. The results reveal nuanced perspectives among respondents based on the type of technology employed.

Telehealth–Audio received mixed reviews, with responses distributed fairly evenly across the effectiveness scale. This indicates that while some healthcare professionals find audio consultations adequate, others encounter limitations, possibly due to lack of visual cues or contextual clarity.

In contrast, Telehealth–Video was more positively received, with a significant number of respondents assigning high effectiveness scores (4 or 5). This suggests a strong preference for visual interaction, which enhances diagnostic capability and patient engagement during remote consultations.

Text Messaging/WhatsApp also ranked highly, with a substantial share of respondents rating it effective. The tool's accessibility, speed, and user-friendliness likely contribute to its widespread acceptance in both clinical and patient settings.

Email, while still used, showed a more even distribution of ratings, with fewer respondents assigning high effectiveness scores. This pattern implies that email may be more appropriate for structured follow-up or document sharing, but less optimal for real-time communication.

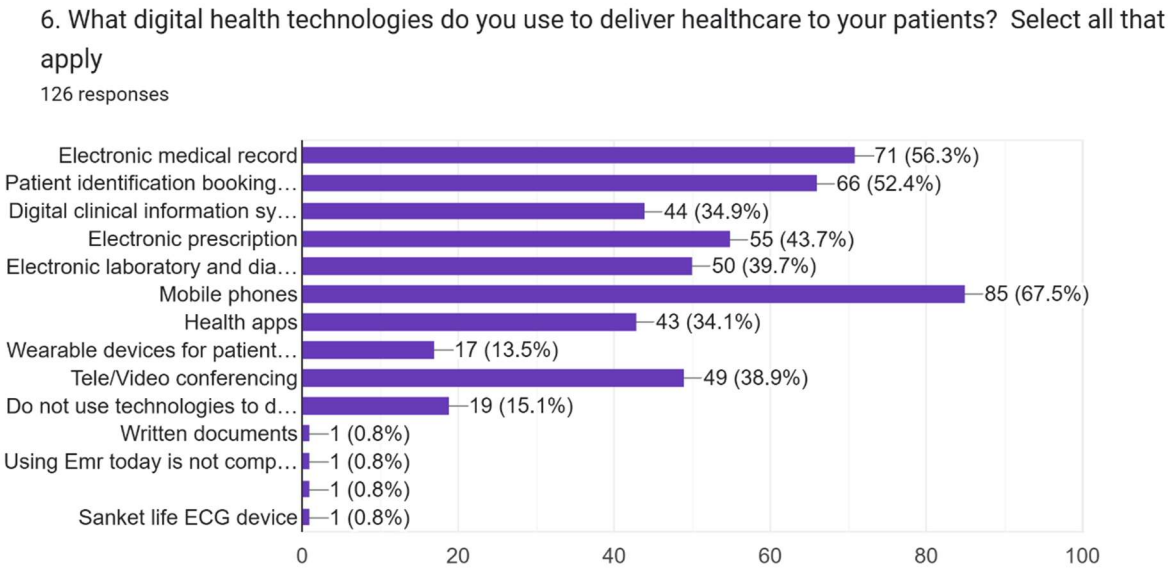
For Health Apps, effectiveness ratings varied, with fewer high scores compared to other tools. This suggests that while health apps are emerging as viable platforms, their role in direct communication remains limited or underdeveloped among respondents.

A notable proportion of respondents selected "Do Not Use Technology to Communicate", with most marking "Not Applicable" or assigning low effectiveness ratings (1 or 2). This highlights the perceived inadequacy of non-digital communication methods in modern clinical workflows.

Responses under "Others" primarily fell under "Not Applicable," reflecting limited use or relevance of niche communication tools outside the mainstream options.

Overall, the findings underscore a clear preference for telehealth–video and mobile messaging platforms as the most effective communication tools. In contrast, email and health apps lag behind, and non-digital methods are largely considered ineffective for addressing contemporary communication needs in healthcare.

Figure 7: Digital health technologies used by healthcare professionals to deliver healthcare to their patients



The survey findings reveal a broad adoption of digital health technologies among the 126 healthcare professionals surveyed, with multiple responses permitted. The most commonly reported technology was the mobile phone, cited by 67.5% of respondents (n=85). Its widespread use underscores its versatility in healthcare, serving as a multipurpose tool for communication, data access, and app-based patient engagement.

Electronic Medical Records (EMRs) were used by 56.3% of participants (n=71), reflecting their central role in managing patient data and streamlining clinical workflows. Similarly, patient identification and booking systems were used by 52.4% (n=66), emphasizing the growing integration of administrative digital tools to enhance operational efficiency.

Electronic prescriptions were adopted by 43.7% (n=55), indicating a significant move toward paperless medication management. Electronic laboratory and diagnostic reporting systems, used by 39.7% (n=50), further support digitalization in clinical diagnostics, improving accessibility and timeliness of patient results.

Telehealth via video or audio conferencing was employed by 38.9% (n=49), signifying the value of remote consultations in expanding healthcare access. Meanwhile, digital clinical information systems, used by 34.9% (n=44), contribute to integrated care by supporting data consolidation and decision-making.

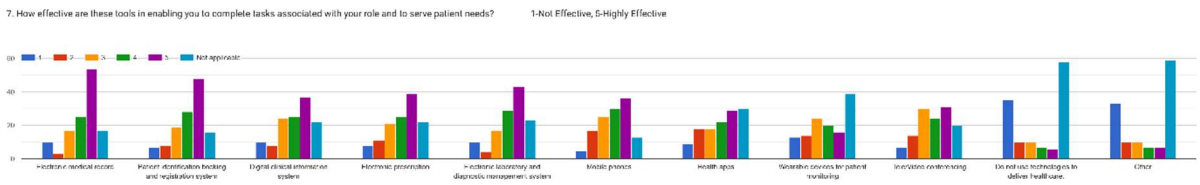
Health apps, utilized by 34.1% (n=43), reflect emerging trends in patient monitoring and engagement, though their adoption remains moderate. Wearable devices, cited by only 13.5% (n=17), appear to be in earlier stages of adoption, potentially limited by cost, interoperability, or clinical integration.

A minority of respondents (15.1%, n=19) reported not using any digital technologies to deliver healthcare, suggesting possible barriers such as limited infrastructure, training, or context-specific preferences for traditional care delivery. Additionally, a small number (~0.8%) referenced other tools, including written documentation and niche devices like the Sanket Life ECG system, highlighting isolated cases of customized technology use or compatibility issues.

Overall, the data reflect a clear trend toward digitally enabled healthcare delivery, with core technologies such as mobile phones, EMRs, and booking systems being widely

embedded in clinical practice. At the same time, emerging tools like wearables and health apps show potential but have yet to achieve widespread integration. The low proportion of non-digital users underscores the ongoing digital transformation of healthcare in both clinical and administrative domains.

Figure 8: Effectiveness of various tools in enabling healthcare professionals to complete tasks related to their roles



This evaluation explores healthcare professionals' perceptions of various digital tools in facilitating their professional responsibilities and meeting patient care needs. Respondents rated each tool on a five-point scale (1 = Not Effective to 5 = Highly Effective), with an additional "Not Applicable" option.

Electronic Medical Records (EMRs) emerged as one of the most highly rated tools, with the majority of respondents assigning effectiveness scores of 4 or 5. This affirms their critical role in optimizing clinical workflows and ensuring reliable patient data management. Patient identification, booking, and registration systems received similarly high ratings, underscoring their importance in administrative efficiency and structured patient flow management.

Digital clinical information systems received a broader range of ratings, with moderate (score of 3) and high (4 or 5) responses. While their utility is acknowledged, the more even distribution suggests challenges related to system usability, interoperability, or partial implementation. Electronic prescriptions were rated highly effective by most respondents, reflecting strong support for digital prescribing as a means to enhance accuracy, reduce errors, and accelerate service delivery.

Electronic laboratory and diagnostic management systems also received strong effectiveness ratings. Their perceived value lies in improving access to diagnostic results and expediting care decisions. Mobile phones were consistently rated highly (4 or 5), reinforcing their role as a flexible and accessible tool for real-time communication, teleconsultation, and patient engagement.

In contrast, health apps received a more varied distribution of scores, indicating emerging utility but continued barriers such as limited integration into clinical practice or inconsistent adoption. Similarly, wearable devices received relatively lower effectiveness ratings, suggesting that these technologies, while promising, are still at a nascent stage of adoption and may face constraints related to cost, accuracy, or provider familiarity.

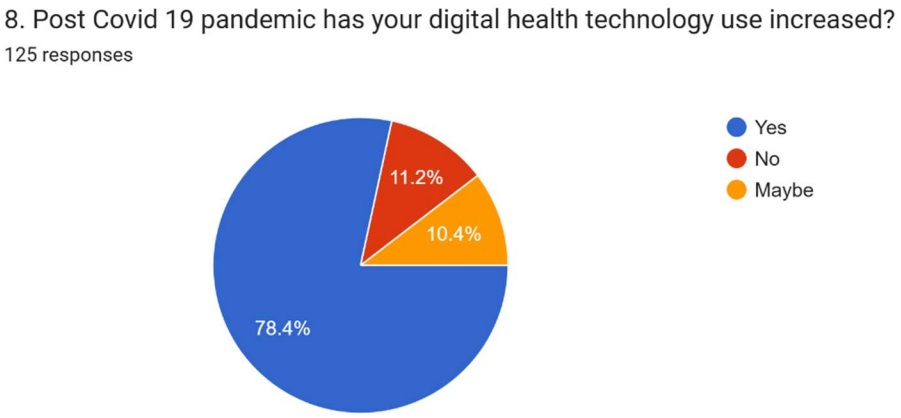
Tele/video conferencing tools were highly rated by a significant proportion of respondents, validating their utility in expanding access to care through remote consultations and hybrid care delivery models. On the other hand, the category “Do Not Use Technologies to Deliver Healthcare” attracted mostly “Not Applicable”

responses, indicating the declining relevance of non-digital workflows in contemporary practice.

Finally, responses under “Other Tools” were predominantly marked as “Not Applicable,” reinforcing the marginal use or visibility of niche or experimental technologies.

Tools such as EMRs, patient registration systems, electronic prescriptions, mobile phones, and telehealth platforms are regarded as the most effective in supporting healthcare delivery. Health apps and wearable devices reflect the early stages of integration and potential for growth. The low utility of non-digital approaches underscores the accelerating digital transformation within clinical environments.

Figure 9: Impact of COVID-19 on Digital Health Technology Usage by healthcare professionals



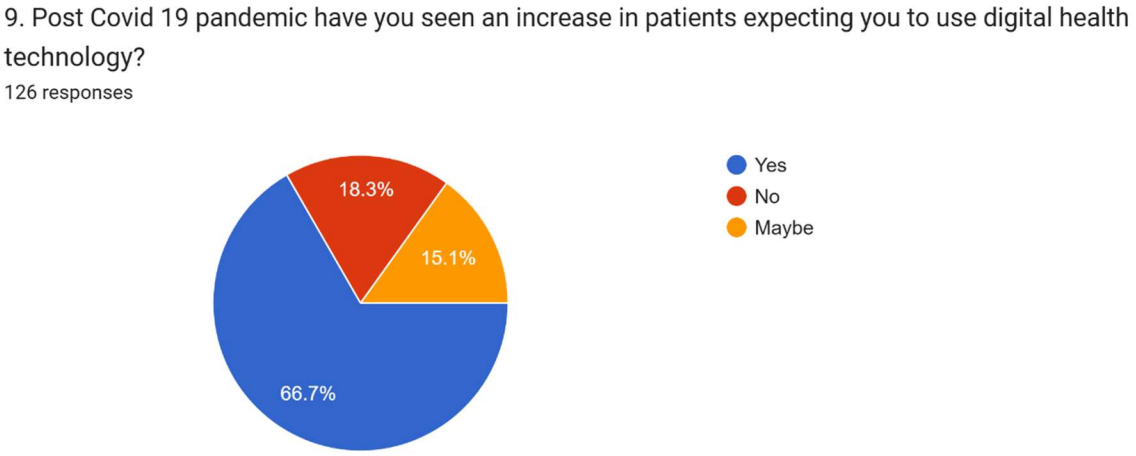
The survey examined changes in digital health technology usage following the COVID-19 pandemic, based on responses from 125 healthcare professionals. A substantial 78.4% of respondents indicated that their use of digital technologies in healthcare had increased post-pandemic. This marked shift underscores the pandemic's role as a catalyst for digital transformation, particularly in promoting the uptake of virtual care, teleconsultations, electronic record-keeping, and other technology-enabled services essential for continuity of care during periods of restricted physical interaction.

Conversely, 11.2% of respondents reported no increase in their digital health technology usage. This suggests the presence of persistent barriers such as infrastructural limitations, role-specific inapplicability, or resistance to change—factors that may hinder widespread digital adoption even in crisis contexts.

An additional 10.4% of participants selected "Maybe," indicating uncertainty regarding changes in their usage patterns. This ambiguity may reflect gradual or incremental shifts that are not immediately perceptible, or a lack of clarity in how digital health technologies are defined or distinguished from traditional tools.

Overall, the data demonstrate that the COVID-19 pandemic significantly accelerated digital health adoption among healthcare professionals. However, the presence of "No" and "Maybe" responses also points to uneven uptake and the need for ongoing support, training, and infrastructure development to ensure more inclusive and sustainable integration of digital technologies across all healthcare settings.

Figure 10: Shift in patient expectations regarding the use of digital health technology following the COVID-19 pandemic



The survey explored whether healthcare professionals have observed a shift in patient expectations regarding the use of digital health technologies following the COVID-19 pandemic. Of the 126 respondents, 66.7% reported an increase in such expectations, indicating that patients are increasingly seeking or preferring digital modes of healthcare delivery. This includes tools such as teleconsultations, electronic prescriptions, remote monitoring, and app-based engagement—suggesting that the pandemic not only transformed clinical practices but also reshaped patient attitudes toward technology-enabled care.

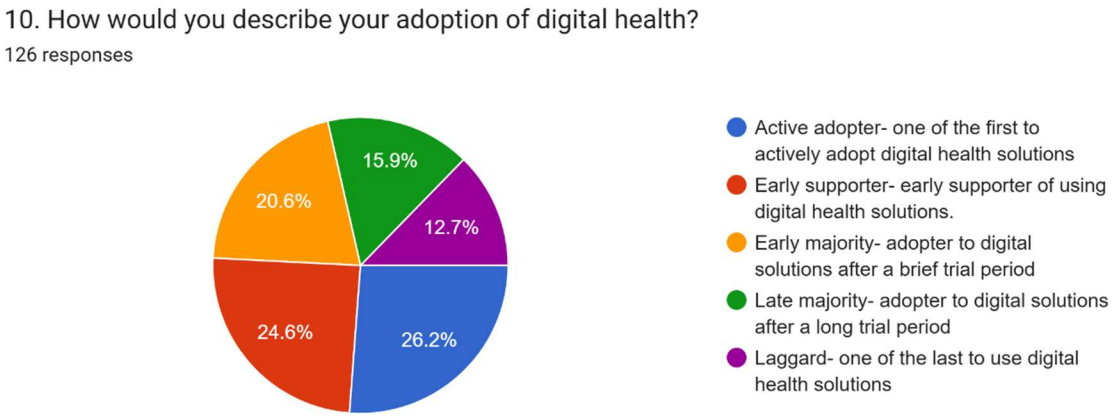
Conversely, 18.3% of respondents noted no significant change in patient expectations. This may reflect patient populations with limited digital literacy, restricted access to

technology, or regional disparities where digital health tools have not yet been widely adopted or demanded.

A further 15.1% of respondents selected “Maybe,” indicating uncertainty or variability in the visibility of such changes. This group likely reflects contexts where shifts in patient expectations are more subtle or inconsistent, possibly influenced by individual patient preferences, provider-patient communication styles, or evolving awareness of digital health options.

Overall, the data suggest a growing demand from patients for healthcare providers to incorporate digital tools into routine practice. However, the presence of “No” and “Maybe” responses points to ongoing disparities in digital expectations, highlighting the need for context-sensitive strategies to increase patient engagement, awareness, and equitable access to digital health technologies.

Figure 11**:** Adoption of digital health technologies by healthcare professionals



This survey explored how healthcare professionals self-identify in terms of their adoption of digital health technologies. Among the 126 respondents, adoption patterns were categorized into five groups based on the relative timing of adoption.

A notable 26.2 % of respondents described themselves as active adopters, indicating that they were among the first to actively implement digital health solutions in their practice. These early movers play a crucial role in driving innovation and setting the stage for broader adoption within the healthcare ecosystem.

An additional 24.6 % identified as early supporters, signifying strong enthusiasm for digital health technologies shortly after their introduction. Combined with the active adopters, these two groups represent over half of the respondent pool (50.8 %), highlighting a substantial proportion of professionals who were quick to embrace digital transformation.

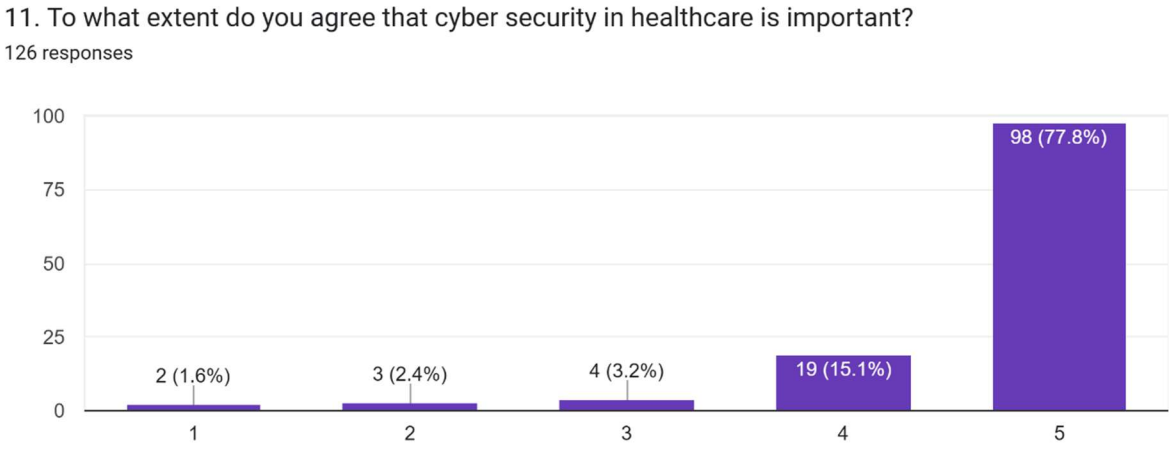
The early majority, comprising 20.6 % of respondents, represents those who adopted digital technologies following an initial period of observation or evaluation. This group reflects a cautious but timely approach, typically engaging with digital tools once they gained sufficient credibility and evidence of effectiveness.

A further 15.9 % categorized themselves as part of the late majority, indicating that they waited until digital health solutions were more widely accepted and established before integrating them into practice. This group may reflect hesitancy due to uncertainty, limited resources, or institutional inertia.

Finally, 12.7 % of respondents described themselves as laggards, adopting digital tools only after most of their peers had already done so. This group may be influenced by skepticism, lack of digital infrastructure, or limited exposure to training and support.

Overall, the data reveal a strong culture of early adoption, with over half of respondents actively or enthusiastically engaging with digital health technologies at an early stage. The presence of early and late majority groups underscores the importance of demonstrable value and systemic support in encouraging broader uptake. Meanwhile, the laggard group highlights persistent barriers that may be addressed through targeted interventions such as digital literacy initiatives, peer engagement, and improved access to technology.

Figure 12: Perception of healthcare professionals on importance of cybersecurity in healthcare



This analysis examines healthcare professionals' views on the importance of cybersecurity, based on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). A total of 126 responses were collected.

A significant majority of respondents (77.8 %, n = 98) strongly agreed that cybersecurity is important in healthcare. This widespread consensus reflects a clear understanding of the vital role cybersecurity plays in safeguarding patient information and maintaining trust in digital health systems.

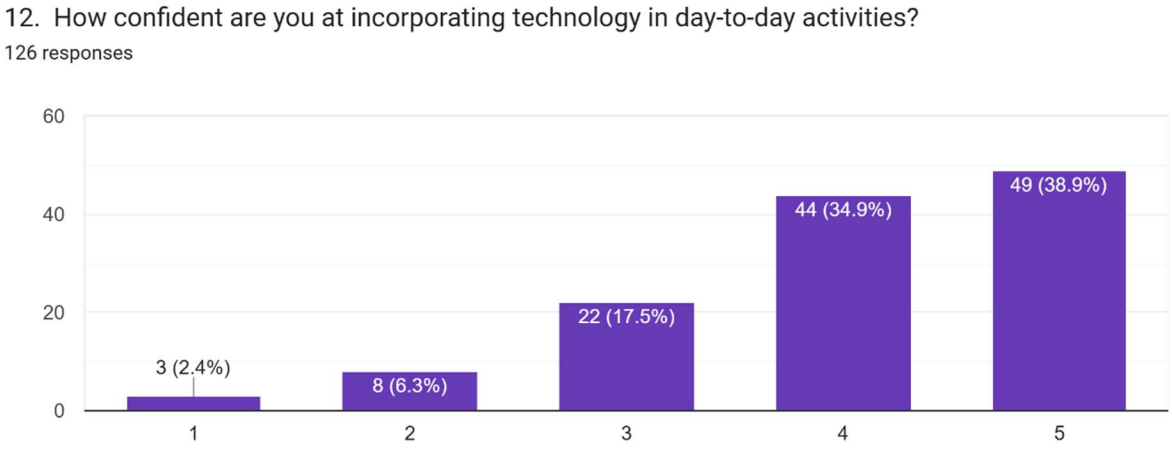
An additional 15.1 % (n = 19) agreed with the statement, though with slightly less intensity. Taken together, 92.9 % of respondents expressed some level of agreement,

indicating an overwhelming acknowledgment of the importance of cybersecurity in clinical practice.

A small proportion of respondents (3.2 %, n = 4) remained neutral, suggesting limited engagement or uncertainty about cybersecurity's role in their professional context. Only 2.4 % (n = 3) expressed disagreement, and an even smaller share (1.6 %, n = 2) strongly disagreed, representing marginal views that may be context-specific or due to a lack of exposure to digital health risks.

Overall, the findings demonstrate a near-universal consensus on the importance of cybersecurity in healthcare. The minimal opposition suggests that resistance is low, paving the way for strategic investment in cybersecurity training, infrastructure, and protocols. This strong professional alignment provides a sound basis for integrating robust cybersecurity measures into health systems as digital health adoption continues to grow.

Figure 13: Healthcare professionals' confidence in using technology daily tasks



The survey explored respondents' self-assessed confidence in incorporating technology into their daily work, using a 5-point scale where 1 indicated not confident and 5 indicated very confident. A total of 126 responses were recorded.

The largest proportion of respondents (38.9 %, n = 49) rated themselves at the highest level of confidence. This suggests a strong degree of digital fluency and comfort with using technology among a considerable segment of healthcare professionals. An additional 34.9 % (n = 44) rated themselves as confident but not at the highest level, indicating a solid but potentially improvable foundation. Combined, 73.8 % of respondents expressed overall confidence in integrating technology into routine tasks.

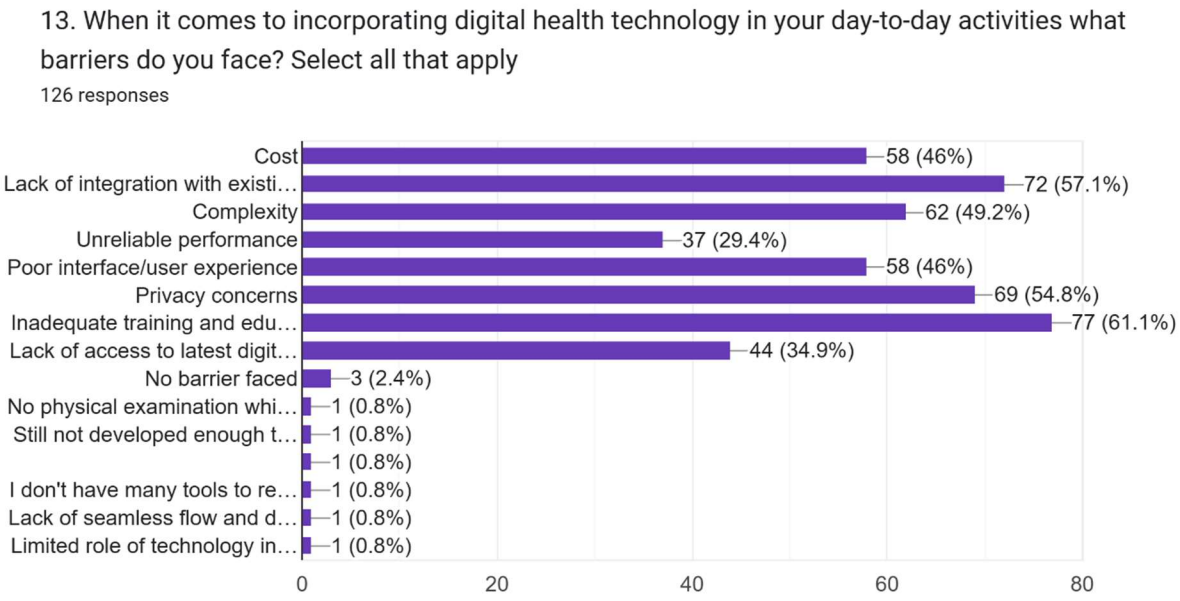
Moderate confidence was reported by 17.5 % of participants (n = 22), suggesting that while these individuals are generally comfortable with technology, they may

occasionally encounter challenges or uncertainties. This group may benefit from targeted support, such as practical training, troubleshooting resources, or peer mentoring.

A smaller group of respondents (6.3 %, n = 8) expressed low confidence, pointing to limited familiarity or experience with digital tools. Only 2.4 % (n = 3) reported no confidence at all, highlighting a minimal number of healthcare professionals for whom technology adoption remains a significant barrier.

In summary, the majority of respondents appear confident in their ability to incorporate digital tools into daily clinical workflows. However, the presence of individuals with moderate or low confidence (26.2 %) suggests that tailored interventions—such as hands-on training or role-specific guidance—could help build capacity and ensure more consistent and effective use of technology across all levels of digital readiness.

Figure 14: Barriers to adopting digital health solutions by healthcare professions



The survey explored the key barriers faced by healthcare professionals in adopting digital health technologies, based on responses from 126 participants. Multiple options were allowed, and the results reflect a combination of user-level, systemic, and resource-related challenges.

The most frequently cited barrier was inadequate training and education of patients, reported by 61.1 % of respondents (n = 77). This finding suggests that patient preparedness remains a critical challenge, with low digital literacy and limited awareness potentially impeding effective use of digital health tools.

The lack of integration with existing systems was identified by 57.1 % of respondents (n = 72), pointing to interoperability and compatibility issues that hinder seamless adoption. Inadequate system integration can create workflow disruptions and reduce the perceived utility of digital technologies in routine clinical practice.

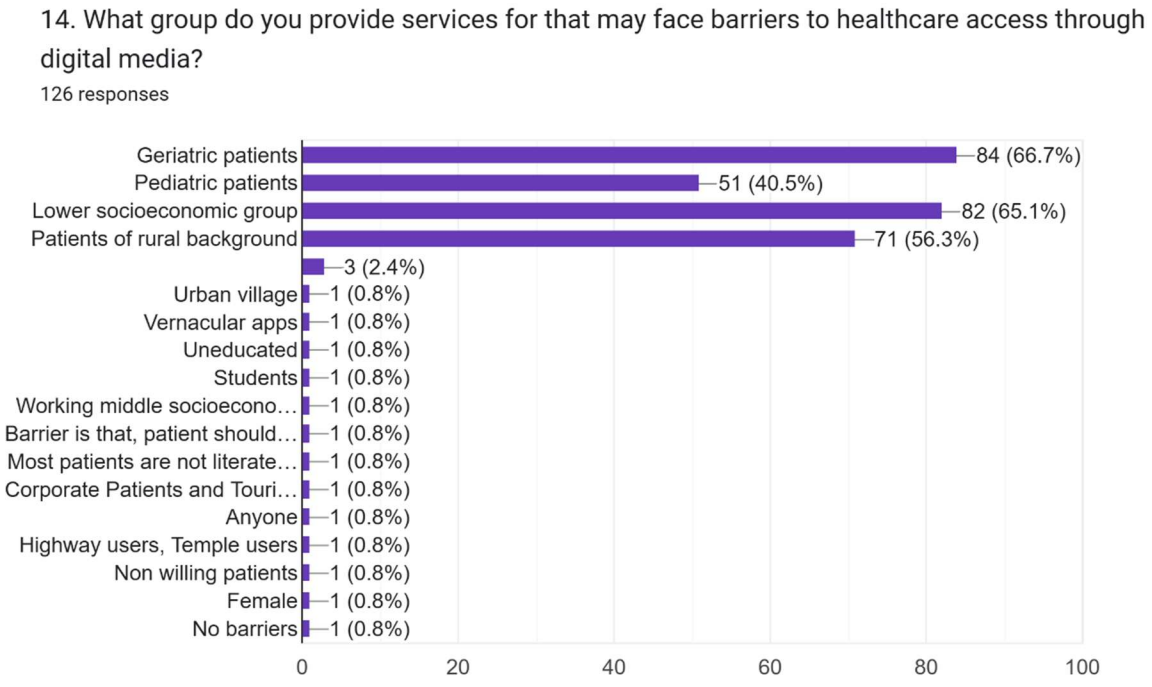
Privacy concerns were noted by 54.8 % (n = 69), reflecting ongoing apprehensions about data security, confidentiality, and regulatory compliance. These concerns are particularly relevant in healthcare, where sensitive patient information is involved and digital solutions must adhere to strict legal and ethical standards.

Complexity of digital tools was identified as a barrier by 49.2 % (n = 62) of respondents, indicating that usability challenges remain a significant deterrent. Closely related, poor interface or user experience was reported by 46 % (n = 58), underscoring the need for intuitive design and user-friendly interfaces that align with clinical workflows.

An equal proportion, 46 % (n = 58), cited cost as a barrier, suggesting that financial considerations—whether related to implementation, training, or maintenance—pose significant obstacles, particularly in resource-constrained settings. Additionally, 34.9 % (n = 44) of respondents reported limited access to the latest technology as a constraint, pointing to unequal availability of digital infrastructure across healthcare environments.

These findings reveal that digital health adoption is influenced by both system-level factors and end-user experience. The high frequency of responses related to patient education, system integration, and privacy indicates a need for comprehensive strategies that address technical, regulatory, and educational dimensions of adoption. Moreover, the role of affordability, ease of use, and access to updated technologies highlights the importance of inclusive design and equitable resource distribution to support broader uptake across diverse healthcare settings.

Figure 15: Populations served by healthcare professionals with potential barriers to digital healthcare access



The survey examined which patient groups healthcare professionals serve that may face barriers to accessing healthcare through digital media. Of the 126 respondents, multiple selections were allowed, providing a comprehensive view of the populations most affected.

The most frequently identified group was geriatric patients, selected by 66.7 % of respondents (n = 84). This finding reflects well-documented challenges faced by older adults in the digital health context, including limited digital literacy, difficulty adapting to new technologies, and physical or cognitive limitations that can hinder engagement with digital tools.

Lower socioeconomic groups were cited by 65.1 % of respondents (n = 82). Barriers for this population are likely tied to limited access to smartphones, internet connectivity, and financial constraints, all of which contribute to digital exclusion and reduced uptake of digital health solutions.

Patients from rural backgrounds were identified by 56.3 % of respondents (n = 71), highlighting barriers such as inadequate digital infrastructure, poor internet access, and geographic isolation. These findings are consistent with broader concerns regarding rural healthcare disparities in technology access and service delivery.

Paediatric patients were noted by 40.5 % of respondents (n = 51). Although children may be digitally savvy, their reliance on caregivers for healthcare decisions and access

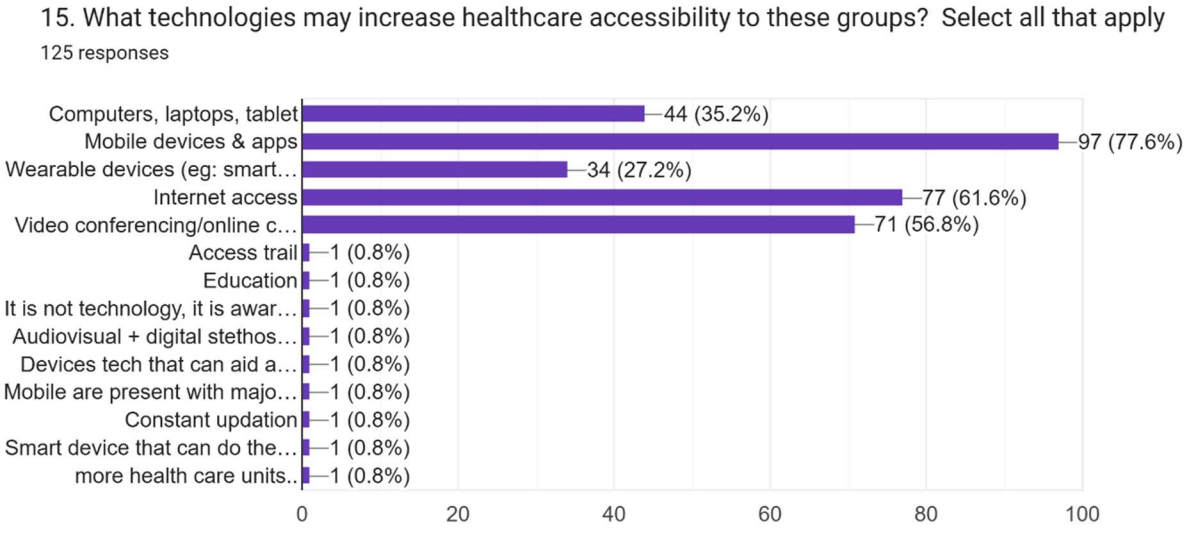
can create indirect barriers, particularly when caregivers lack digital literacy or access to digital resources.

A small number of respondents (~0.8 %) mentioned other groups, including residents of urban villages, patients using vernacular applications, uneducated individuals, students, working-class patients, tourists, and corporate clients. These responses highlight the diversity of populations that may encounter context-specific challenges when navigating digital healthcare systems.

Only one respondent (0.8 %) indicated that none of the groups they serve face barriers to digital access, suggesting that such challenges are nearly universal and not restricted to any single demographic.

Overall, the findings reveal that geriatric populations, economically disadvantaged groups, and rural communities are the most significantly affected by barriers to digital healthcare access. While pediatric and smaller demographic groups also encounter challenges, the data points to the widespread nature of this issue. These insights emphasize the need for inclusive and tailored strategies that address the specific barriers faced by different populations to ensure equitable access to digital healthcare services

Figure 16: What technologies may increase healthcare accessibility to the groups with ppotential barriers to ddigital hhealthcare aaccess



The survey asked respondents to identify technologies that could enhance healthcare access for populations facing barriers, with a total of 126 responses and multiple selections permitted. The findings reveal strong support for foundational digital tools, particularly those that enable remote and low-cost engagement.

Mobile devices and apps were the most frequently cited, selected by 77.6 % of respondents (n = 97). This reflects a clear consensus that smartphones and mobile health applications are among the most effective means of improving healthcare accessibility. Their portability, affordability, and growing penetration across diverse populations make them especially valuable for addressing healthcare disparities.

Internet access was identified as a crucial enabler by 61.6 % of respondents (n = 77). Reliable connectivity is fundamental to the success of digital health interventions, particularly in rural and underserved areas where access is often limited. The emphasis on internet infrastructure highlights its role as a prerequisite for digital health engagement.

Video conferencing and online consultations were selected by 56.8 % of participants (n = 71), underscoring the rising adoption of telehealth for extending the reach of healthcare services. These technologies facilitate remote consultations, reduce the need for travel, and provide an efficient means of delivering follow-up care, especially in geographically dispersed regions.

Computers, laptops, and tablets were chosen by 35.2 % of respondents (n = 44). Though less frequently selected than mobile devices, these tools are still seen as relevant—particularly in clinical or institutional settings where more robust interfaces and computing power may be required.

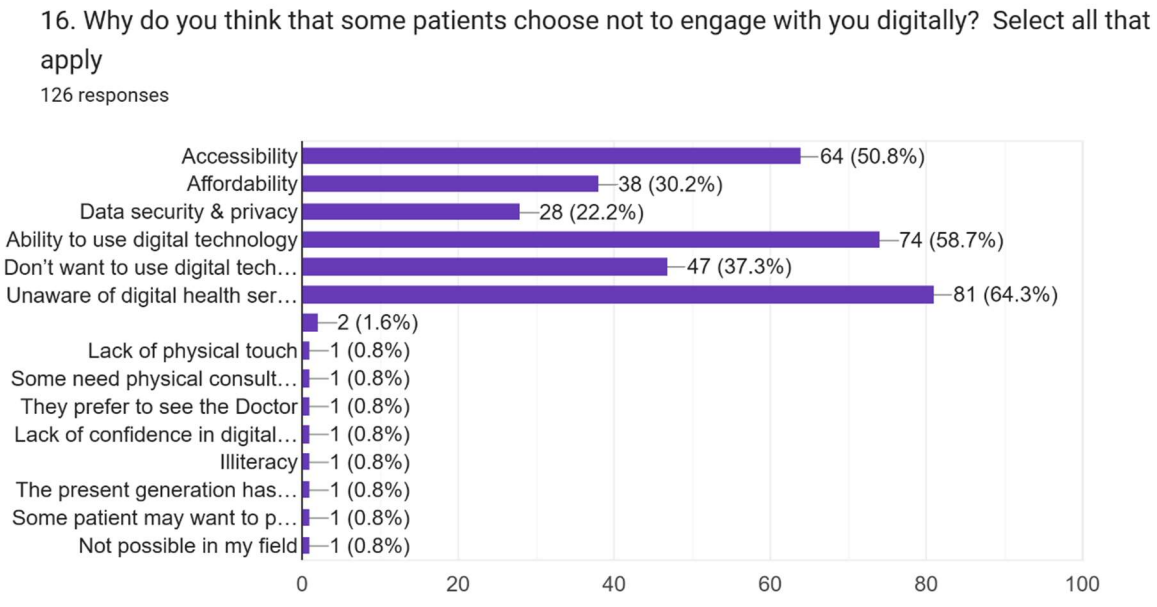
Wearable devices were identified by 27.2 % of respondents (n = 34). While these technologies hold potential for real-time health monitoring and preventive care, their relatively lower prioritization may be due to cost barriers or limited adoption among vulnerable populations.

A small number of respondents (~0.8 %) provided additional suggestions, including the need for patient education and awareness, mobile-friendly design, audiovisual tools

such as digital stethoscopes, and mechanisms for maintaining continuous access and system updates.

Overall, the findings suggest that mobile-first strategies, supported by robust internet connectivity, are viewed as the most impactful means of improving digital healthcare accessibility. While more advanced tools like wearables show promise, current emphasis remains on expanding access through widely available and affordable technologies. These insights point to the critical importance of digital infrastructure and user-centered design in bridging the healthcare access gap.

Figure 17: Why do some patients choose not to engage with healthcare providers digitally?



The survey investigated reasons why patients may choose not to engage with healthcare providers through digital platforms, based on 126 responses. Participants could select multiple reasons, providing a multifaceted view of patient-level barriers to digital healthcare adoption.

The most frequently cited reason was lack of awareness about available digital health services, identified by 64.3 % of respondents (n = 81). This indicates a critical gap in communication and outreach efforts, where many patients may simply be uninformed about digital options for accessing care.

Closely following, 58.7 % of respondents (n = 74) indicated that patients struggle with the ability to use digital technology. This challenge likely reflects low levels of digital literacy, unfamiliarity with devices, or age-related difficulties, particularly among elderly populations.

Accessibility was identified as a barrier by 50.8 % of respondents (n = 64). This encompasses a range of issues, including lack of internet connectivity, unavailability of digital devices, or geographic and infrastructural challenges common in underserved areas.

A notable 37.3 % of respondents (n = 47) reported that some patients simply do not want to use digital technology. This preference may stem from a desire for in-person interaction, discomfort with digital interfaces, or mistrust of virtual consultations.

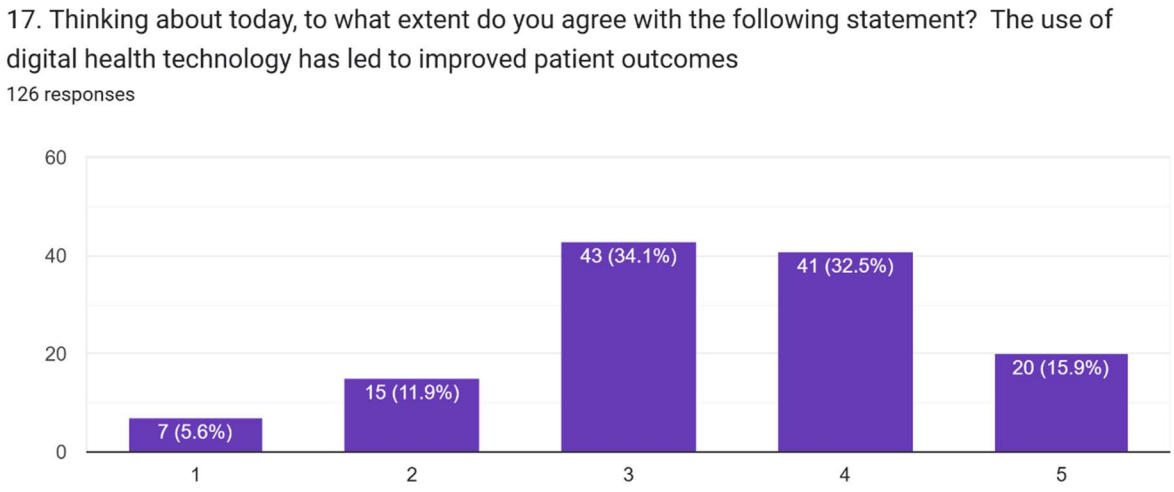
Affordability was cited by 30.2 % of respondents (n = 38), suggesting that the cost of accessing digital tools—such as smartphones, data plans, or paid teleconsultation platforms—remains a barrier for economically disadvantaged groups.

Concerns related to data security and privacy were noted by 22.2 % of respondents (n = 28). While smaller in proportion, this group represents patients who may be reluctant to share sensitive health information via digital platforms due to fears of data breaches or misuse.

A few respondents (~0.8 %) offered additional reasons, such as the perceived lack of physical interaction, preference for face-to-face consultations, lack of confidence in digital systems, or generational gaps in technology use.

Overall, the findings underscore that lack of awareness and limited digital literacy are the most significant barriers to patient engagement with digital healthcare. Accessibility and affordability remain core infrastructural challenges, while trust, privacy, and patient preferences point to the need for adaptable care models. These insights highlight the importance of a hybrid approach that integrates digital innovations with traditional care, ensuring inclusivity and responsiveness to diverse patient needs.

Figure 18: Impact of Digital Health Technology on Patient Care: Health Care Professionals' Perspectives



This graph presents the distribution of responses to the statement: "The use of digital health technology has led to improved patient outcomes," rated on a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). A total of 126 responses were recorded.

The largest clusters of responses were around ratings 3 and 4, with 34.1 % of respondents (n = 43) selecting a neutral position and 32.5 % (n = 41) indicating agreement. This central distribution suggests a generally favorable or balanced perception, with many healthcare professionals acknowledging some benefit while also expressing caution or uncertainty.

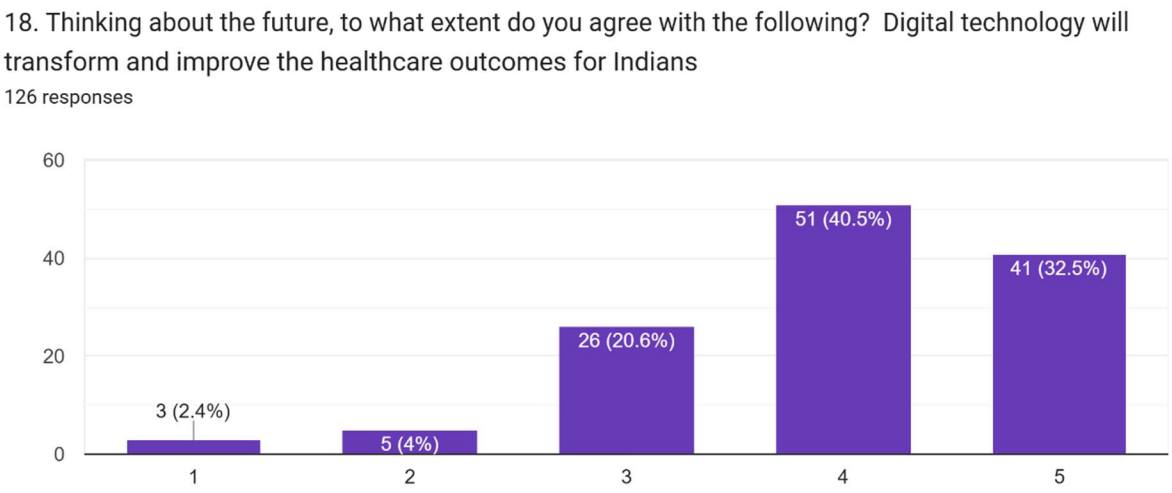
A combined 48.4 % of respondents (n = 61) selected either rating 4 or 5, reflecting a notable proportion who perceive digital health technology as positively contributing to patient outcomes. This indicates a substantial level of support for the effectiveness of digital tools in improving care quality, patient engagement, or health management.

In contrast, 17.5 % of respondents (n = 22) expressed disagreement, selecting ratings 1 or 2. This group may represent individuals who have not observed meaningful clinical benefits, who work in settings where digital tools are poorly implemented, or who remain skeptical of digital health claims.

The presence of a significant neutral segment, along with a moderate lean toward agreement, suggests that while the overall sentiment is positive, there remains room for further validation and demonstration of impact. The data indicate that although a majority of respondents recognize the potential benefits of digital health technology, others may require more evidence or experience before fully endorsing its value.

These findings highlight the need for continued evaluation of digital health initiatives, including qualitative insights into specific outcomes perceived by practitioners. Clear evidence of improved clinical results, patient satisfaction, and operational efficiency may help strengthen confidence and promote broader adoption of digital solutions in healthcare practice

Figure 19: Digital technology as a catalyst for improved healthcare outcomes in India: Perspectives from healthcare professionals



This graph presents the distribution of responses to the statement: "Digital technology will transform and improve healthcare outcomes for Indians," based on a 5-point Likert scale where 1 denotes strong disagreement and 5 denotes strong agreement. A total of 126 responses were collected.

A significant majority of respondents expressed optimism about the transformative potential of digital health. Specifically, 40.5 % (n = 51) selected rating 4, and 32.5 % (n = 41) selected rating 5, resulting in a combined 73 % of respondents indicating agreement with the statement. This widespread confidence suggests strong belief

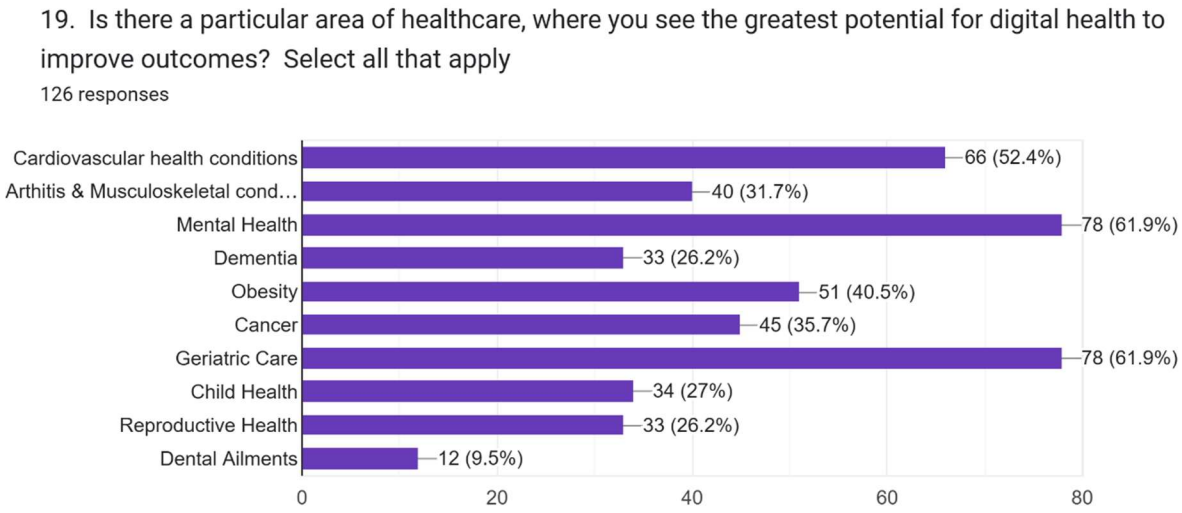
among healthcare professionals in the role of digital technology as a driver of improved healthcare outcomes in the Indian context.

A smaller segment, 20.6 % (n = 26), selected a neutral position (rating 3). This group may reflect individuals who are cautiously optimistic, undecided, or waiting for more empirical evidence before committing to a definitive view. Only 6.4 % (n = 8) expressed disagreement, selecting ratings 1 or 2. This minimal proportion indicates limited skepticism regarding the future role of digital technologies in healthcare transformation.

Compared to the previous question regarding the current impact of digital health on patient outcomes, this graph reflects greater forward-looking optimism. While some respondents may view the present impact of digital health as still developing, there is broader consensus around its future potential to drive systemic improvements in access, efficiency, and quality of care.

These results suggest a prevailing positive outlook among healthcare professionals about the future of digital health in India. This optimism may be influenced by ongoing advancements in mobile technology, national digital health policies, or anticipated investments in infrastructure. To accelerate this transformation, future strategies should focus on addressing implementation barriers, enhancing digital literacy, and ensuring equitable access to technology across diverse populations.

Figure 20: Where Can Digital Health Improve Outcomes Most? Respondent Insights: Health Care Professionals' Perspectives



This graph captures the responses to the question: "Is there a particular area of healthcare where you see the greatest potential for digital health to improve outcomes?" Respondents were allowed to select multiple options, providing a broad view of perceived priority areas for digital health innovation.

Mental health and geriatric care emerged as the top two areas of perceived potential, each cited by 61.9 % of respondents (n = 78). The strong focus on mental health may reflect rising awareness of mental wellness needs and the growing accessibility of digital tools for mental health screening, therapy, and self-management. Similarly, the emphasis on geriatric care aligns with the increasing demands of an aging population

and the recognition that digital health can support aging-in-place, chronic disease management, and remote monitoring for older adults.

Cardiovascular health was also identified as a high-potential area, with 52.4 % of respondents (n = 66) selecting it. This reflects the critical burden of cardiovascular disease and the well-established use cases for digital health interventions such as wearable monitors, virtual cardiac rehabilitation, and teleconsultations.

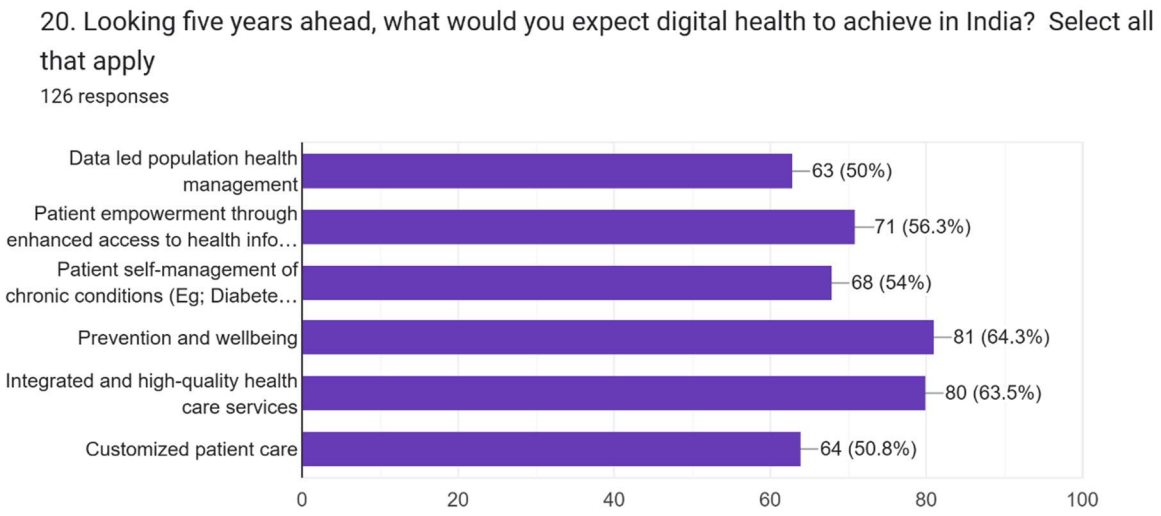
Cancer (40.5 %, n = 51) and arthritis and musculoskeletal conditions (31.7 %, n = 40) were also noted as important domains, though to a slightly lesser extent. Obesity (35.7 %, n = 45) and child health (27 %, n = 34) received moderate attention, indicating awareness of their public health relevance but potentially fewer current digital health applications compared to other areas.

The least frequently selected areas included reproductive health (26.2 %, n = 33), dementia (26.2 %, n = 33), and dental ailments (9.5 %, n = 12). These lower figures may reflect perceived limitations in digital applicability, existing program coverage, or a lack of awareness about current technological interventions within these fields.

Overall, the data suggest that respondents view digital health as having the greatest transformative potential in addressing broad, systemic challenges—particularly in mental health, geriatric care, and cardiovascular disease. While areas such as dental and reproductive health were cited less frequently, they may represent underexplored opportunities for targeted innovation and increased digital integration. This distribution

underscores the importance of aligning digital health strategies with areas of high disease burden while also expanding awareness and capability in less prioritized domains

Figure 21: Health care professionals' perspectives on the future impact of digital health in India



This graph presents the distribution of responses to the question: "Looking five years ahead, what would you expect digital health to achieve in India?" A total of 126 responses were recorded, with participants permitted to select multiple options, allowing for a comprehensive overview of stakeholder expectations.

The most frequently selected expectation was the advancement of prevention and wellbeing, identified by 64.3 % of respondents (n = 81). This reflects a strong belief in digital health's capacity to transform the healthcare paradigm from reactive treatment

to proactive disease prevention and health promotion, enabled through digital monitoring, behavior-tracking applications, and wellness platforms.

Closely following was the expectation for integrated and high-quality healthcare services, selected by 63.5 % of respondents (n = 80). This suggests that many respondents foresee digital health as a key enabler of seamless, coordinated care across primary, secondary, and tertiary levels, potentially reducing fragmentation and improving patient outcomes.

Enhanced patient access to health information, cited by 56.3 % (n = 71), indicates strong expectations that digital technologies will empower patients through better access to their medical records, health education, and decision-support tools. Similarly, 54 % (n = 68) of respondents anticipated improved patient self-management of chronic conditions, such as diabetes and hypertension, likely through remote monitoring, AI-driven alerts, and mobile health applications.

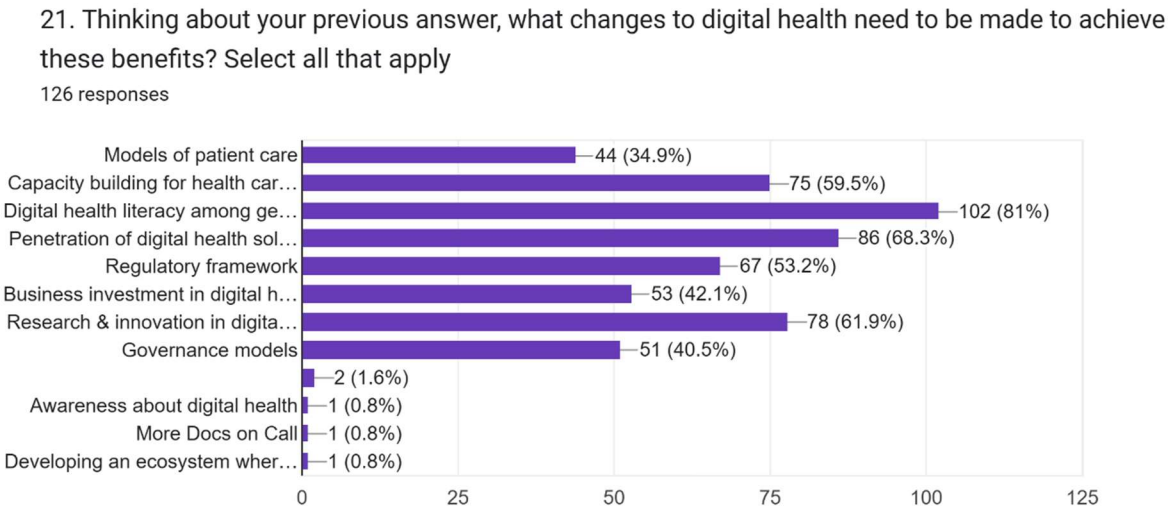
Customized patient care was selected by 50.8 % (n = 64), reflecting the expectation that digital platforms will increasingly enable personalized treatment pathways based on individual health data, preferences, and risk profiles.

Interestingly, the least selected—though still significant—option was data-led population health management, with 50 % of respondents (n = 63) identifying it as a likely outcome. This suggests that while the potential of data analytics at the population

level is recognized, its full realization may be seen as dependent on long-term investments in infrastructure, data governance, and inter-institutional collaboration.

Overall, the results reveal an optimistic and forward-looking outlook for digital health in India, particularly around prevention, integration, patient empowerment, and chronic disease management. While population-level analytics currently appears to be a secondary priority, it remains an essential area for strategic development. These expectations offer valuable direction for policymakers, innovators, and healthcare providers to focus on creating scalable, interoperable, and inclusive digital health solutions that can meaningfully improve health outcomes across diverse Indian populations.

Figure 22: What Must Change for Digital Health to Succeed in India? Insights from Health care professionals



This graph presents findings from a survey in which 126 respondents identified the most important changes needed to realize the benefits of digital health in India. Participants were allowed to select multiple options.

Improving digital health literacy among the general population was the most frequently cited need (81 %, n = 102), emphasizing the critical role of education and awareness in enabling effective use of digital tools. This was followed by the need to increase penetration of digital health solutions (68.3 %, n = 86), reflecting concerns about equitable access, particularly in underserved regions.

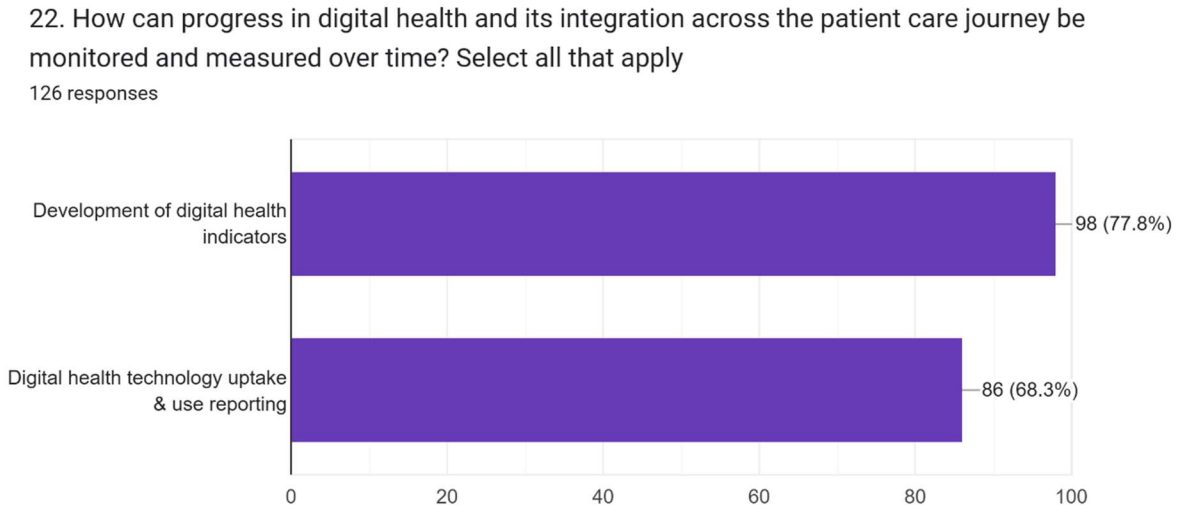
Capacity building for healthcare providers (59.5 %, n = 75) was also seen as essential, highlighting the importance of equipping clinicians and health workers to integrate technology into their workflows. Similarly, 61.9 % (n = 78) called for enhanced research and innovation, suggesting a demand for locally relevant, evidence-based digital solutions.

A robust regulatory framework was noted by 53.2 % (n = 67), indicating a need for clearer policies to ensure standardization, accountability, and data protection. Business investment (42.1 %, n = 53) and improved governance models (40.5 %, n = 51) were seen as supportive factors, though less urgent. Revisions to patient care models (34.9 %, n = 44) were also suggested to facilitate better integration of digital tools into healthcare delivery.

A small number of respondents (below 1 %) suggested additional changes, including greater public awareness, expanded teleconsultation services, and the development of a comprehensive digital ecosystem.

In summary, the results underscore the primacy of education, access, and provider readiness in advancing digital health. While regulatory reform, innovation, and governance are also important, foundational gaps must be addressed first to enable scalable, inclusive, and sustainable digital health adoption across India.

Figure 23: How should the progress of digital health and its integration be measured over time?- insights from health care professionals



This graph presents responses from 126 participants on how best to monitor and evaluate progress in digital health integration across the patient care journey. Multiple selections were allowed.

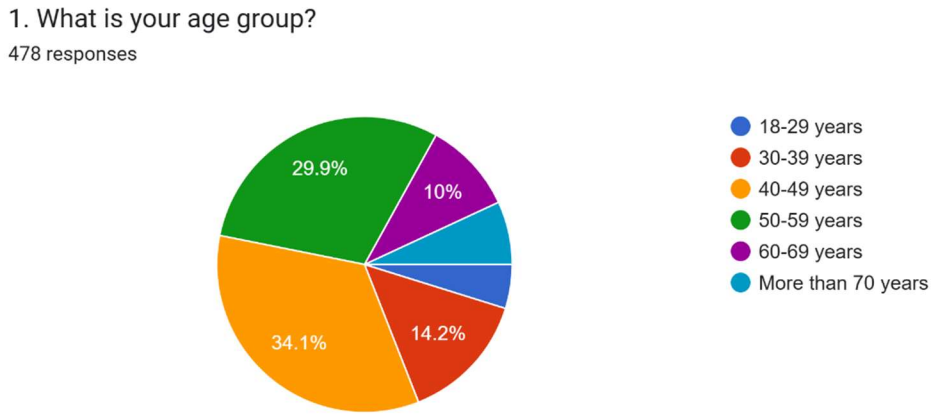
The development of digital health indicators was the most frequently selected option (77.8 %, n = 98), indicating strong support for establishing measurable benchmarks such as patient outcomes, system performance, and adoption rates to assess impact over time.

Tracking the uptake and use of digital health technologies was also emphasized (68.3 %, n = 86), reflecting the importance of monitoring actual usage patterns, including user volume, frequency, and integration into routine care.

Overall, respondents prioritized structured indicators as foundational for meaningful assessment, while also acknowledging that adoption metrics serve as a critical complement to ensure that technologies are not only available but effectively utilized.

Digital Health Technology Readiness Survey Results- Residents of India

Figure 24: Age demographics of survey participants (Residents of India)



This pie chart illustrates the age distribution of 478 respondents from the Digital Health Technology Readiness Survey conducted among residents of India, segmented into six age groups.

The largest proportion of respondents (34.1 %) were aged 40–49, representing middle-aged adults likely balancing professional and personal responsibilities—a key demographic for digital health engagement. This was followed by the 50–59 age group (29.9 %), a population with growing healthcare needs and high relevance for preventive and chronic care interventions.

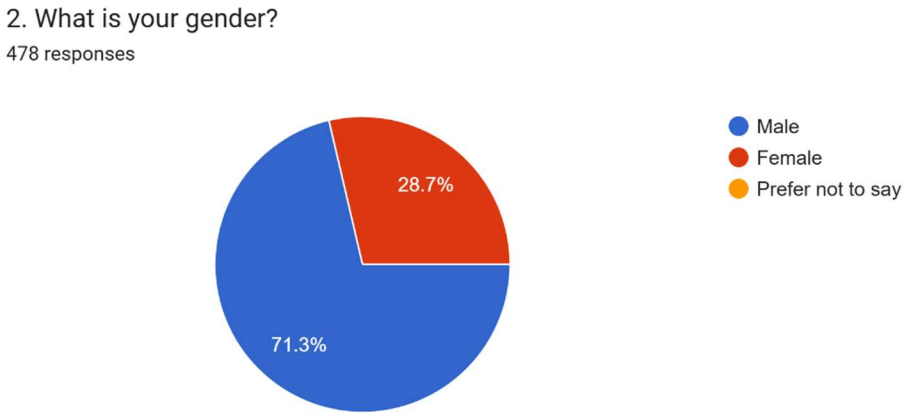
Respondents aged 30–39 accounted for 14.2 %, reflecting a tech-savvy cohort potentially using digital tools for wellness and early preventive care. Those aged 60–

69 comprised 10 %, representing older adults who may face digital access barriers but could benefit significantly from remote health support.

The youngest group, aged 18–29, made up 7.8 %, indicating fewer immediate health needs but likely higher openness to technology adoption. Individuals over 70 years constituted the smallest segment (4 %), suggesting limited engagement due to factors such as low digital literacy and accessibility challenges.

Overall, the distribution reflects a concentration of respondents in mid- to late-career age groups, aligning with both healthcare need and decision-making capacity—critical considerations for the successful targeting of digital health initiatives.

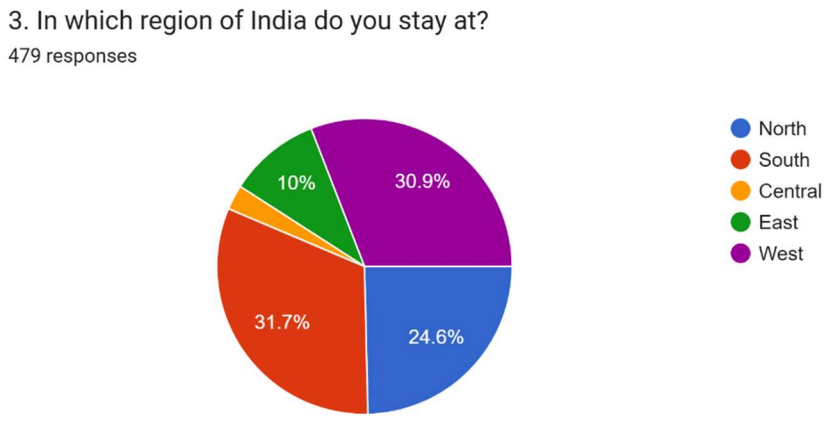
Figure 25: Gender Distribution of Survey Participants (Residents of India)



This pie chart depicts the gender distribution of 478 respondents from the Digital Health Technology Readiness Survey conducted among residents of India.

The majority of respondents were male, comprising 71.3 % of the sample, while female respondents accounted for 28.7 %.

Figure 26: Regional demographics of survey participants (Residents of India)



This pie chart presents the regional distribution of 479 respondents to the Digital Health Technology Readiness Survey of Residents of India, categorized into five geographic regions: North, South, East, West, and Central.

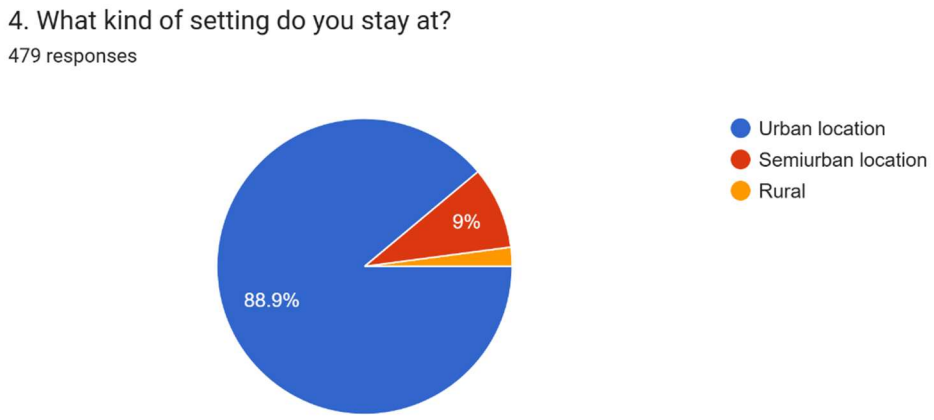
The highest proportion of respondents were from southern India (31.7 %), indicating strong regional representation, possibly driven by greater awareness, infrastructure, or access to digital health technologies. Western India followed closely with 30.9 %, suggesting comparable levels of engagement, likely influenced by urbanization and digital penetration.

Northern India accounted for 24.6 % of the respondents, reflecting moderate participation relative to the South and West. Eastern India contributed 10 %, pointing

to comparatively lower engagement with digital health initiatives. Central India had the smallest share at 3 %, suggesting limited outreach or adoption in this region.

Overall, the data reveal uneven regional representation, with stronger participation from southern and western states, and potential gaps in digital health readiness or accessibility in eastern and central regions.

Figure 27: Type of living settings among survey respondents (Residents of India)



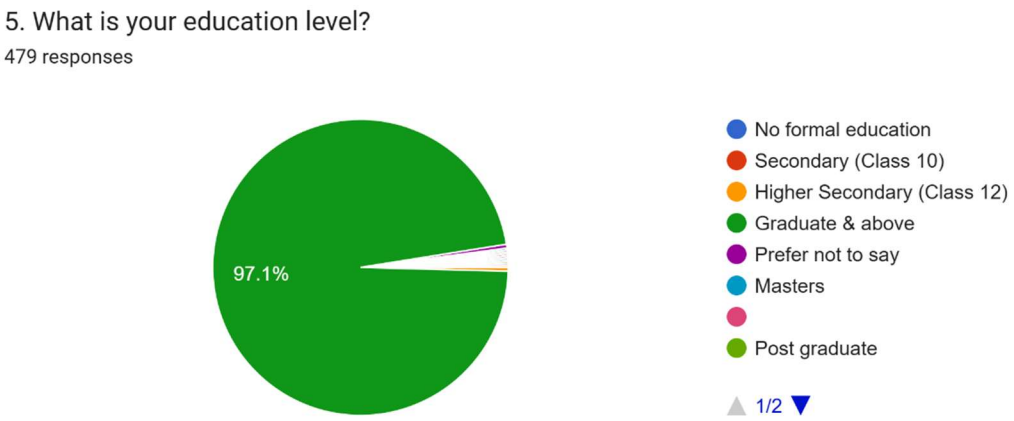
This pie chart illustrates the residential distribution of 479 respondents from the Digital Health Technology Readiness Survey of Residents of India, categorized into urban, semiurban, and rural settings.

A substantial majority of respondents (88.9 %) reported residing in urban areas, indicating a strong urban skew in the sample. Semiurban residents accounted for 9 %, suggesting emerging engagement in these areas, although digital health infrastructure may still be developing.

Only 2.1 % of respondents were from rural locations, pointing to a significant underrepresentation of rural populations. This disparity highlights potential barriers such as limited digital access, lower awareness, and infrastructural challenges that may inhibit participation in digital health initiatives and surveys.

The data suggest that digital health readiness is currently concentrated in urban regions, underscoring the need for targeted outreach and infrastructure development in rural and semiurban areas to ensure equitable participation and access.

Figure 28: Educational background of survey respondents (Residents of India)



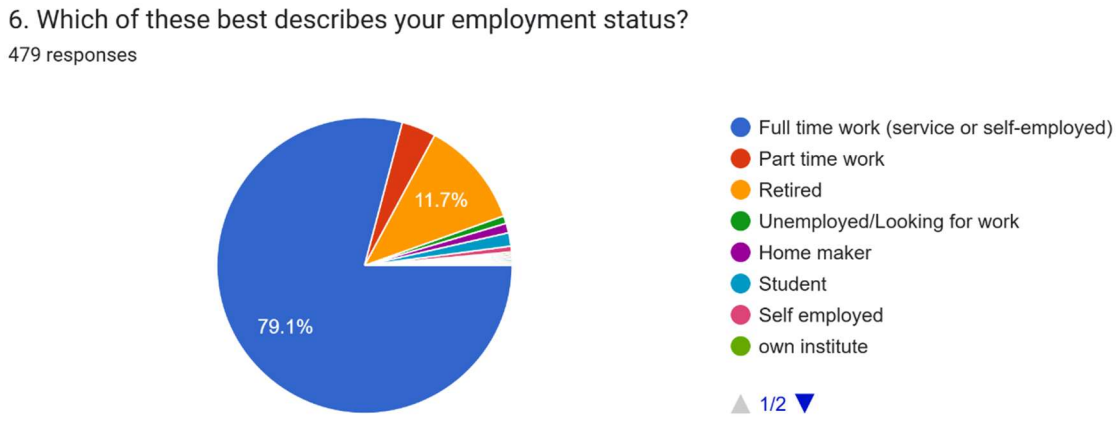
This pie chart presents the educational distribution of 479 respondents to the Digital Health Technology Readiness Survey of Residents of India.

An overwhelming majority (97.1 %) reported holding a graduate degree or higher, indicating that the survey primarily engaged a highly educated population. This demographic profile suggests a higher likelihood of digital health readiness due to greater digital literacy and familiarity with technology.

Respondents with lower educational attainment—including those with no formal education, secondary (Class 10), or higher secondary (Class 12) qualifications—represented less than 3 % of the sample. Additionally, only a few respondents opted not to disclose their education level.

The findings point to a clear skew toward more educated individuals, highlighting a potential gap in inclusivity. Those with limited formal education may face substantial barriers to accessing and benefiting from digital health technologies, underscoring the need for targeted strategies to enhance digital literacy and accessibility among underserved educational groups.

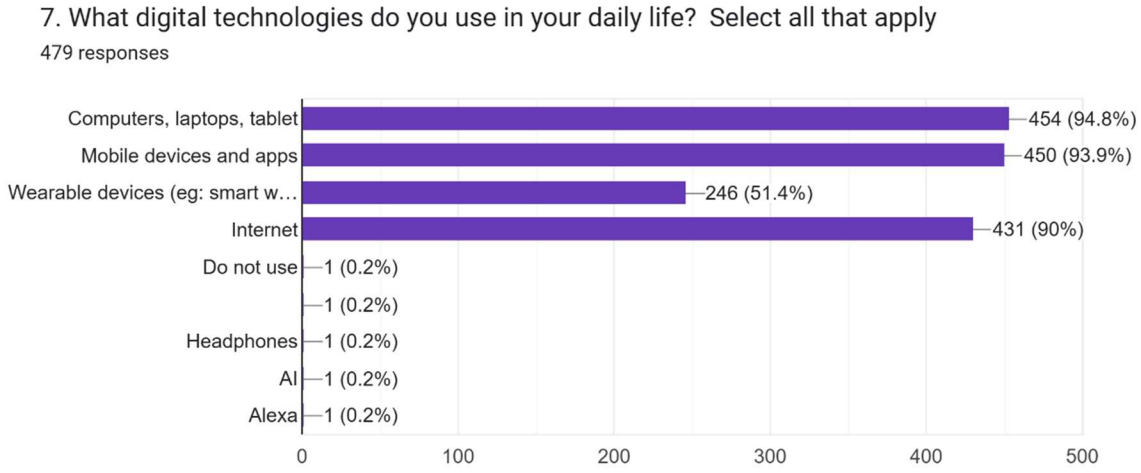
Figure 29 : Employment status of survey respondents (Residents of India)



A large majority (79.1 %) reported being employed full-time, either in service or self-employment, indicating that most participants were professionally active—a factor likely contributing to greater exposure to digital technologies. Part-time workers made up 11.7 % of the sample, suggesting varied levels of engagement depending on their occupational context.

Other categories—including retired individuals, homemakers, students, and unemployed respondents—were minimally represented. These groups may have distinct needs and barriers related to digital health, yet their perspectives are underrepresented in the data.

Figure 30: Types of digital technologies used by survey respondents (Residents of India)



This bar chart presents the types of digital technologies used by 479 respondents in their daily lives, with multiple selections permitted.

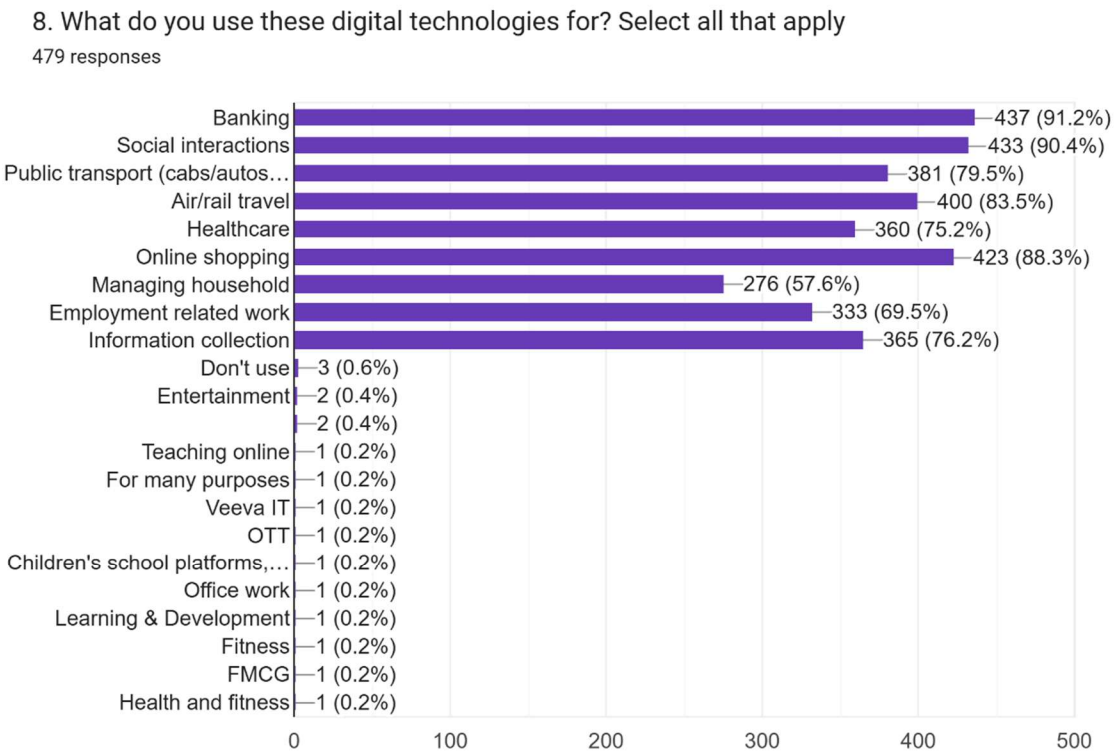
Computers, laptops, and tablets were the most widely used, reported by 94.8 % of respondents (n = 454), closely followed by mobile devices and apps at 93.9 % (n = 450). Internet use was similarly high, with 90 % (n = 431) indicating regular connectivity, underscoring its central role in enabling access to other digital tools.

Wearable devices, such as smartwatches, were used by 51.4 % (n = 246), suggesting growing interest in health and fitness tracking, though adoption remains less widespread than more traditional devices.

Only one respondent (0.2 %) reported not using any digital technologies, while a few others noted niche tools like headphones, AI applications, or voice assistants.

The findings indicate a high level of digital engagement among participants, driven by widespread access to core technologies and internet connectivity. Wearables represent an emerging trend, while the near-universal use of digital tools reflects strong integration of technology into daily life.

Figure 31: Digital technology usage patterns among survey respondents (Residents of India)



This bar chart illustrates the various purposes for which 479 respondents use digital technologies, with multiple selections allowed.

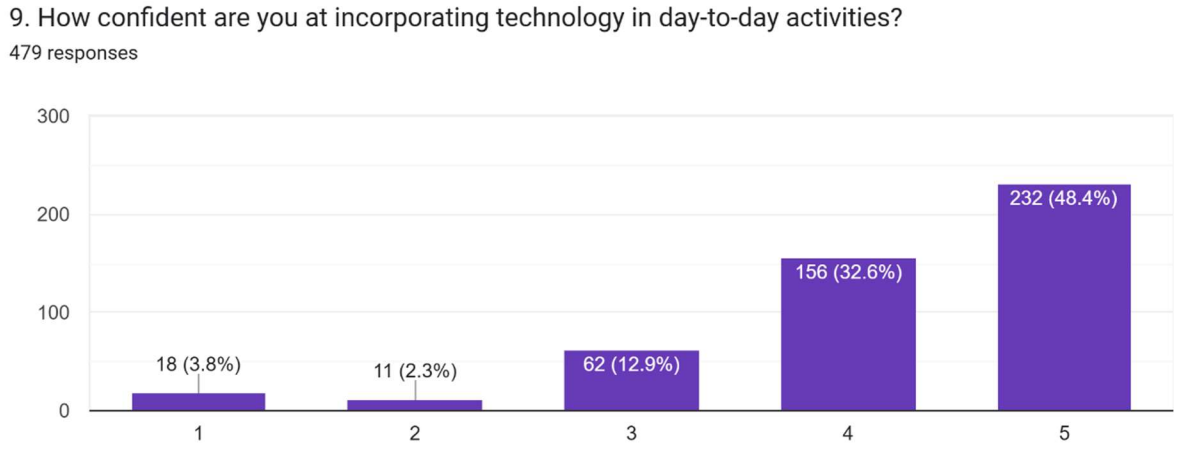
Banking was the most common use, cited by 91.2 % (n = 437), followed closely by social interactions (90.4 %, n = 433) and online shopping (88.3 %, n = 423), reflecting the centrality of financial transactions, communication, and e-commerce in daily life. Travel-related applications also saw high engagement, with 83.5 % (n = 400) using digital tools for air or rail bookings, and 79.5 % (n = 381) for local public transport services such as cabs and autos.

Information collection (76.2 %, n = 365) and healthcare (75.2 %, n = 360) were also significant areas of use, indicating growing reliance on digital platforms for knowledge acquisition and access to medical services. Employment-related activities were reported by 69.5 % (n = 333), while 57.6 % (n = 276) used digital technologies for managing household tasks, such as paying bills or ordering essentials.

A few respondents noted additional uses, including online teaching, fitness, entertainment, and education-related platforms for children, though these were minimal (below 1 %).

Overall, the data reveal widespread integration of digital technologies across key areas of everyday life, with especially strong adoption in finance, communication, commerce, and travel. Healthcare and household management also show considerable uptake, though with greater potential for further expansion.

Figure 32: How confident are respondents (Residents of India) in using technology in daily life?



This bar chart presents the self-reported confidence levels of 479 respondents in using technology for day-to-day tasks, rated on a scale from 1 (not confident) to 5 (very confident).

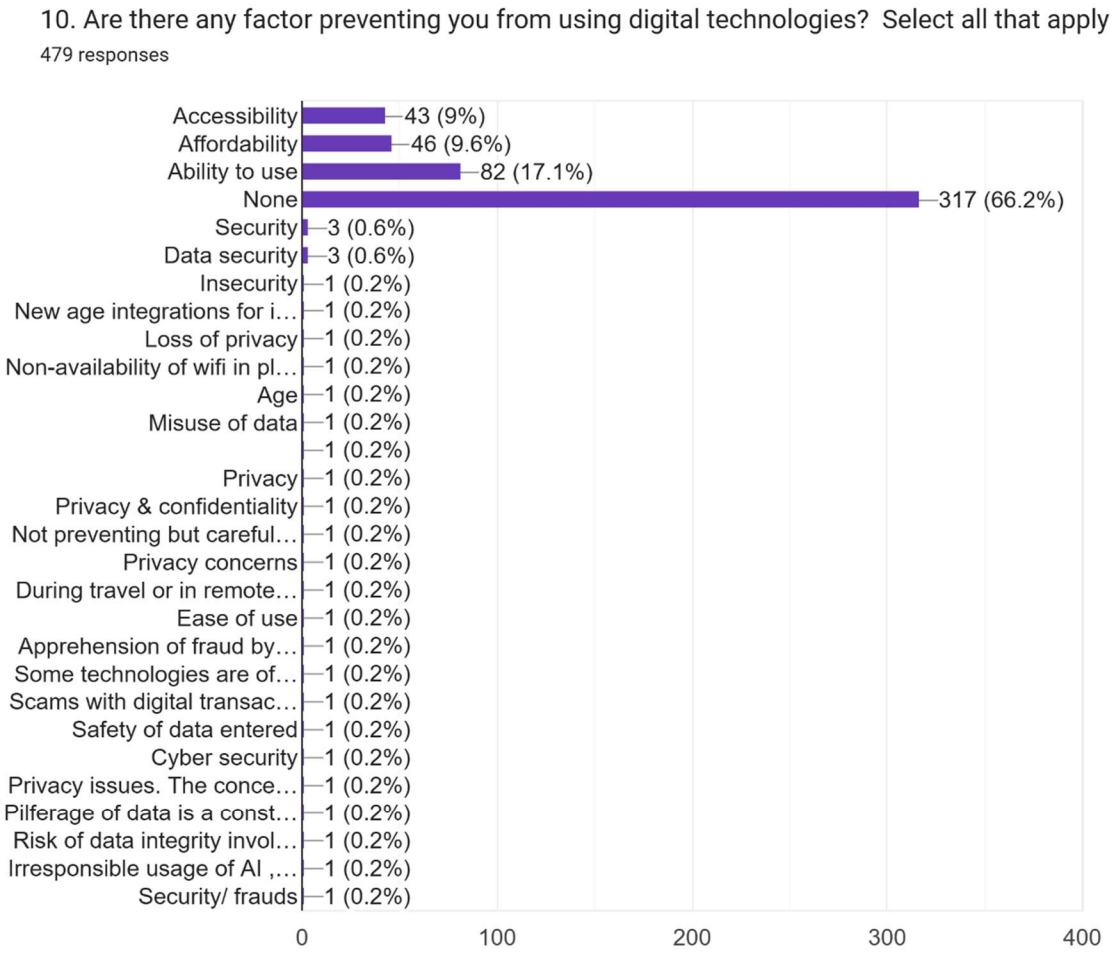
Nearly half of the respondents (48.4 %, n = 232) rated themselves as highly confident, with an additional 32.6 % (n = 156) selecting a confidence level of 4. Combined, 81 % expressed a high degree of comfort with technology use, indicating widespread digital familiarity.

Moderate confidence was reported by 12.9 % (n = 62), while lower confidence levels—scores of 1 and 2—were reported by 3.8 % (n = 18) and 2.3 % (n = 11), respectively.

These figures suggest a small but important group that may benefit from additional support or training.

Overall, the data point to strong confidence in technology use among the majority of respondents, while highlighting opportunities for targeted interventions to support those with limited proficiency.

Figure 33: Challenges faced in using digital technologies – Insights from respondents (Residents of India)



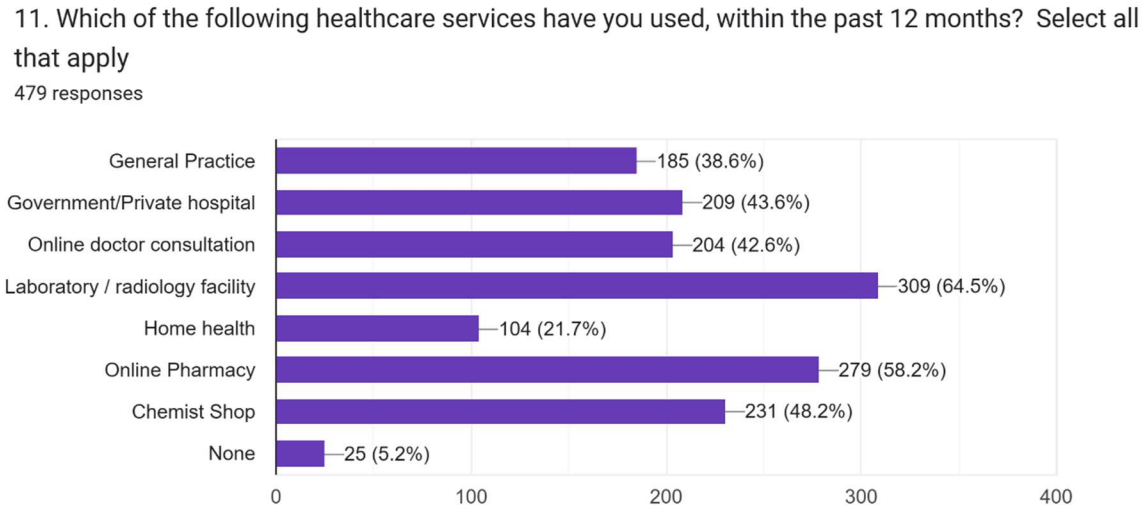
This bar chart presents findings from 479 respondents regarding perceived barriers to using digital technologies, with multiple responses allowed.

A majority (66.2 %, n = 317) reported no barriers, indicating high levels of digital readiness and comfort with technology. However, 17.1 % (n = 82) cited difficulties in using digital tools, pointing to gaps in digital literacy that may hinder broader adoption.

Affordability (9.6 %, n = 46) and accessibility (9 %, n = 43) were also noted as constraints, reflecting financial and infrastructural challenges among a smaller segment of the population.

A few respondents (~0.2 %) mentioned other concerns, including data security, privacy, poor Wi-Fi availability, and apprehension about new technologies or digital fraud.

Overall, while most participants appear well-positioned to engage with digital tools, the presence of skill-based, economic, and trust-related barriers underscores the need for inclusive strategies to support equitable access and safe adoption of digital technologies.



This bar chart summarises the healthcare services used by 479 respondents over the past year, based on multiple response selections.

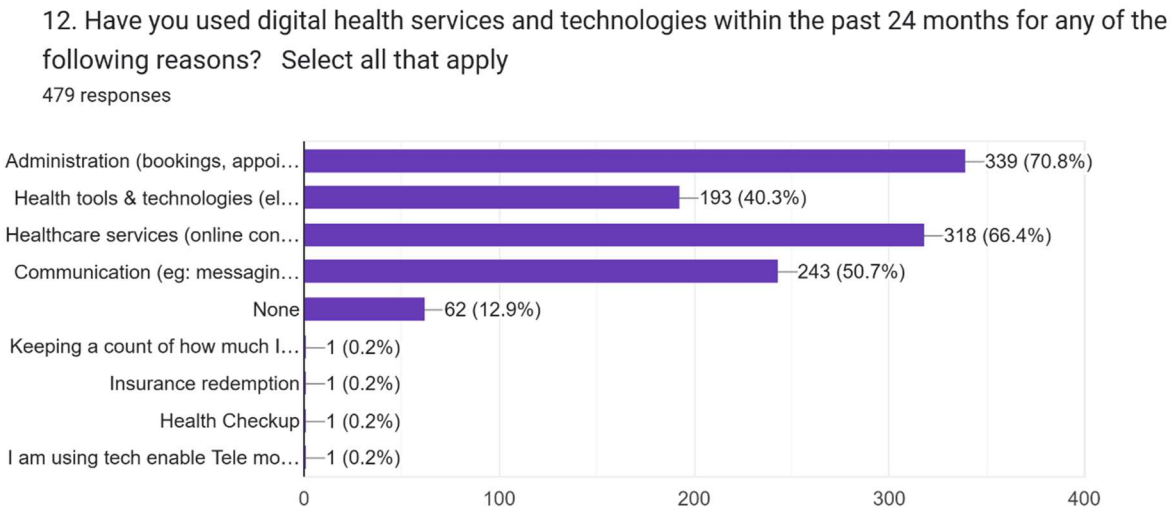
Laboratory and radiology services were the most frequently accessed (64.5 %, n = 309), indicating a strong reliance on diagnostic testing. Online pharmacies followed closely (58.2 %, n = 279), reflecting growing trust in digital platforms for medicine procurement, while 48.2 % (n = 231) still used traditional chemist shops, suggesting continued dependence on in-person access.

Hospital services (43.6 %, n = 209) and online doctor consultations (42.6 %, n = 204) were both widely used, demonstrating the coexistence of conventional and telehealth approaches. General practice visits (38.6 %, n = 185) remained common, reinforcing the role of primary care.

Home health services were used by 21.7 % (n = 104), indicating more limited uptake, likely restricted to specific populations such as the elderly or those with chronic conditions. A small minority (5.2 %, n = 25) reported not using any healthcare services.

Overall, the data highlight diagnostic and pharmacy services as the most accessed, with digital platforms increasingly supplementing traditional healthcare. In-person care remains essential, while the modest use of home health services points to potential areas for expansion.

Figure 35: Reasons for using digital health services in the past 24 months- Insights from respondents (Residents of India)



This bar chart presents the reasons cited by 479 respondents for using digital health services within the last two years, with multiple responses permitted.

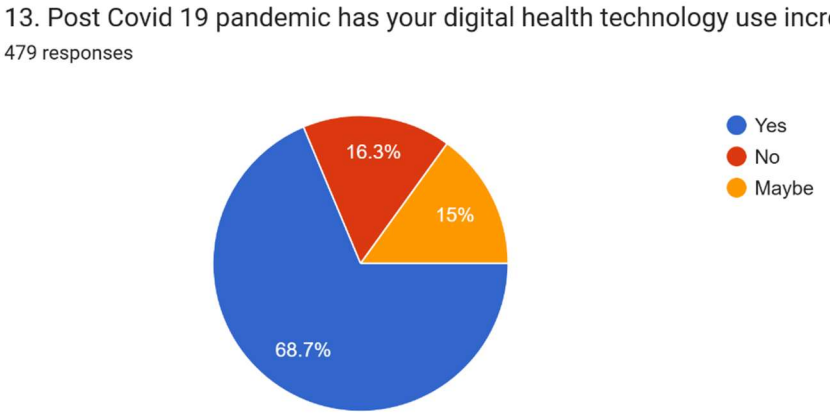
Administrative tasks such as bookings and appointments were the most common use (70.8 %, n = 339), highlighting the role of digital platforms in streamlining routine healthcare interactions. Accessing healthcare services—including teleconsultations—was also widespread (66.4 %, n = 318), reflecting growing acceptance of digital care delivery.

Half of the respondents (50.7 %, n = 243) used digital tools for communication with providers, emphasizing the need for efficient and remote engagement channels. Additionally, 40.3 % (n = 193) reported using digital health tools and technologies, such as wearable devices and electronic records, pointing to an emerging trend in self-monitoring and data-driven health management.

A smaller group (12.9 %, n = 62) reported no digital health usage, suggesting possible barriers related to awareness, access, or user confidence. Minimal responses (~0.2 %) included niche uses such as insurance redemption, health metric tracking, and telemonitoring.

Overall, the data indicate that administrative efficiency and service delivery are the leading drivers of digital health adoption, while communication and personal health tools are gaining momentum. Non-users highlight areas where outreach and support may be needed to bridge digital divides.

Figure 36: Respondent (Residents of India) insights on post-pandemic digital health usage



This pie chart captures the responses of 479 participants regarding changes in their use of digital health technologies following the COVID-19 pandemic.

A majority (68.7 %) reported increased use, indicating the pandemic's strong role in accelerating digital health adoption. In contrast, 16.3 % noted no increase, likely reflecting continued barriers such as limited access, digital literacy, or a preference for traditional care. Another 15 % were uncertain, suggesting either gradual or unrecognised shifts in usage patterns.

The findings underscore COVID-19's influence as a catalyst for digital health uptake, while also highlighting that a subset of the population remains underserved or unconvinced by digital solutions.

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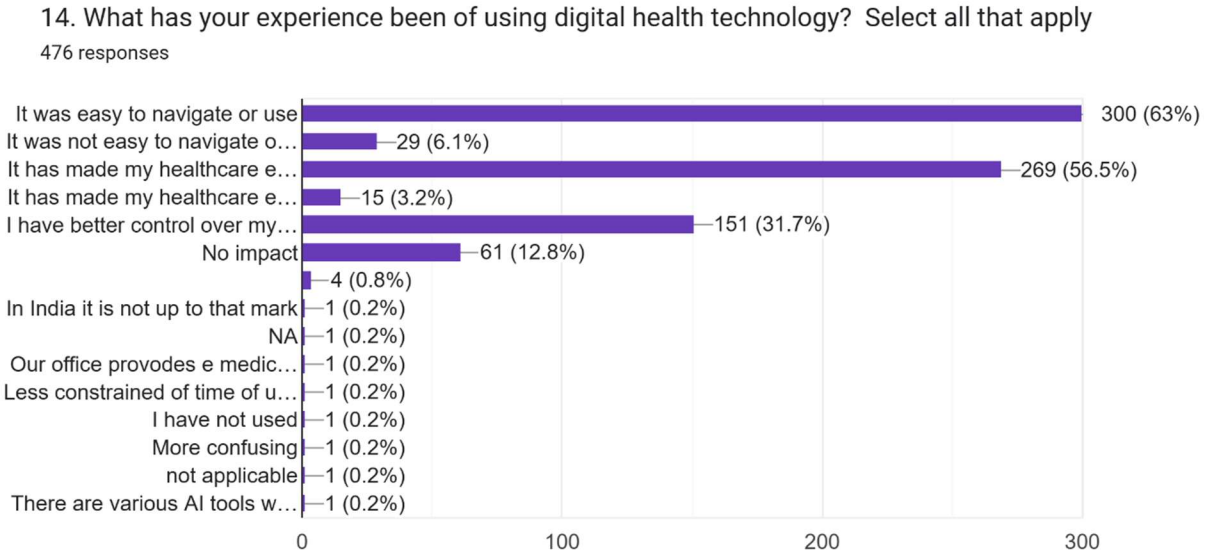
Figure 37: Respondent (Residents of India) experience on using digital health technology



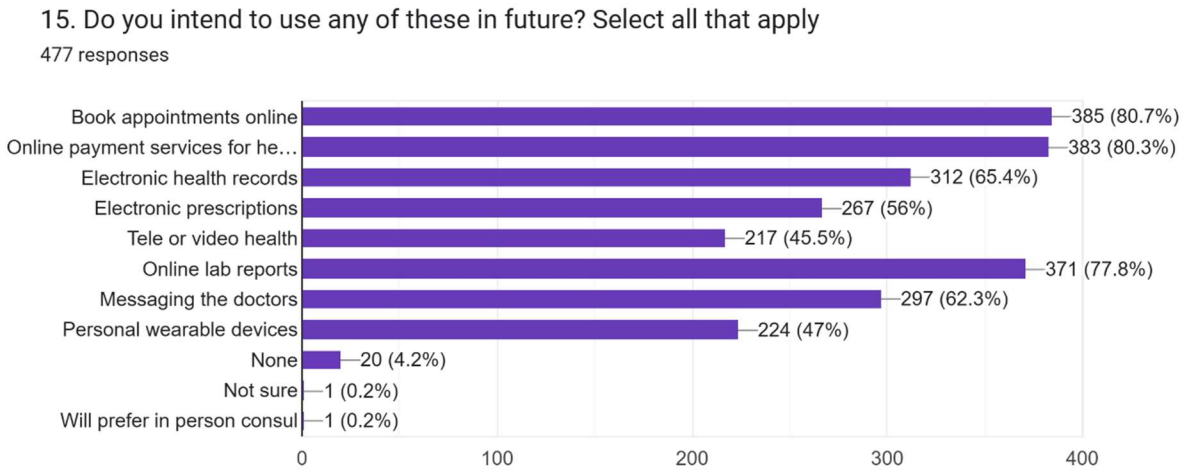
This bar chart summarises the experiences of 476 respondents with digital health technologies, based on multiple response selections.

A majority (63 %, n = 300) found these technologies easy to use, and 56.5 % (n = 269) reported improved efficiency in their healthcare experience. Additionally, 31.7 % (n = 151) felt they gained better control over their health management, such as scheduling and monitoring.

A smaller share (12.8 %, n = 61) noted no impact, while 6.1 % (n = 29) encountered difficulties with navigation or usability. Isolated responses (~0.2 %) referenced issues like confusion, poor localisation, or non-use.

Overall, the findings reflect a largely positive user experience, with strong perceptions of usability and efficiency. However, a minority still faces challenges, underscoring the need for inclusive design and ongoing user support.

Figure 38: Which digital health services do respondents (Residents of India) plan to use in future?



This bar chart illustrates the future intentions of 477 respondents to adopt various digital health services, based on multiple selections.

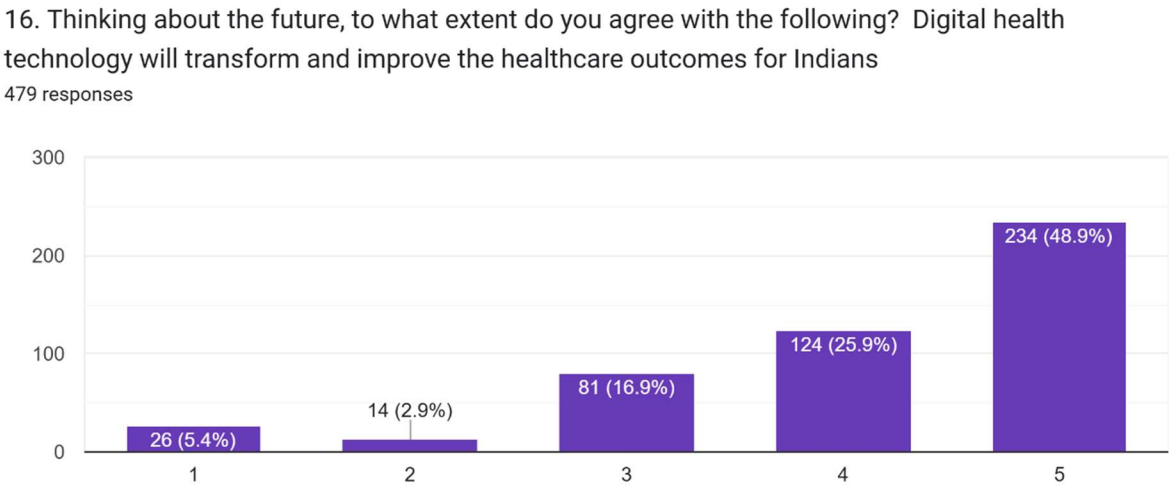
Online appointment booking (80.7 %) and digital payment services (80.3 %) are the most preferred, followed closely by accessing online lab reports (77.8 %). Interest in electronic health records (65.4 %) and doctor messaging services (62.3 %) further underscores the growing demand for convenience and integrated care.

Over half of the respondents expressed willingness to use electronic prescriptions (56 %), while fewer intended to adopt wearable devices (47 %) or tele/video health services (45.5 %), suggesting these technologies are still emerging in mainstream use.

A small minority (4.2 %) reported no intention to use digital services, possibly due to barriers such as digital literacy or personal preference. Isolated responses reflected continued preference for in-person consultations.

Overall, the data indicate a strong inclination toward digital solutions that enhance efficiency and access, particularly for administrative and information-sharing tasks. Moderate interest in newer technologies suggests room for expanded adoption through awareness and usability improvements.

Figure 39: Will Digital Health Improve Healthcare Outcomes for Indians? - Insights from respondents (Residents of India)



This bar chart presents the perspectives of 479 respondents on the statement: "Digital health technology will transform and improve healthcare outcomes for Indians."

A majority (48.9 %) strongly agreed and an additional 25.9 % agreed, indicating that approximately 75 % of respondents are optimistic about the transformative potential of digital health. Meanwhile, 16.9 % expressed neutrality, suggesting uncertainty or limited exposure to such technologies.

Only a small portion disagreed (2.9 %) or strongly disagreed (5.4 %), indicating minimal scepticism. Overall, the responses reflect strong confidence in the future of digital health, while also highlighting the need to inform and engage those less certain of its benefits.

4.2 Summary & Findings

INSIGHTS FROM HCP SURVEY

The adoption of digital health technologies among healthcare professionals in India reflects a growing confidence in their use, with 73.8% of respondents rating themselves as confident or highly confident. However, despite this positive inclination, significant challenges remain. Notably, 61.1% of respondents identified inadequate training as a key barrier, while 57.1% reported issues with the lack of integration between digital tools and existing healthcare systems. Although nearly half (48.4%) of the participants agreed or strongly agreed that digital technologies have improved patient outcomes, a substantial proportion (34.1%) expressed neutrality. This suggests that while optimism

exists, the perceived impact of digital health interventions may not yet be fully realized or substantiated by outcomes in practice.

Barriers to adoption persist at both provider and patient levels. For healthcare providers, additional obstacles include privacy concerns (54.8%) and the perceived complexity of digital tools (49.2%). On the patient side, limited awareness of digital health services (64.3%), challenges in using technology (58.7%), and issues related to accessibility (50.8%) represent critical impediments to equitable utilization. These findings underscore the need for targeted interventions to enhance digital health literacy and reduce infrastructural and usability barriers.

Patient engagement is further hindered by a pronounced digital divide, particularly among vulnerable populations. Respondents identified geriatric patients (66.7%), individuals from lower socioeconomic backgrounds (65.1%), and rural residents (56.3%) as groups facing the greatest challenges in accessing digital healthcare. Mobile devices and apps (77.6%) and internet connectivity (61.6%) were recognized as crucial enablers of accessibility. However, limitations in affordability and infrastructure continue to restrict widespread and inclusive adoption.

Cybersecurity emerged as a paramount concern, with 92.9% of respondents agreeing or strongly agreeing that it is essential for healthcare. This reflects heightened sensitivity to data privacy and the protection of personal health information, which are vital for building trust in digital health systems.

The COVID-19 pandemic has served as a catalyst for digital transformation in healthcare. A majority of respondents (78.4%) reported increased use of digital health technologies since the onset of the pandemic, and 66.7% observed a rise in patient expectations for digital engagement. These trends highlight an enduring shift toward virtual and technology-enabled care, necessitating sustained investment in infrastructure, training, and trust-building measures to ensure the long-term success of digital health initiatives.

INSIGHTS FROM RESIDENT SURVEY

The study findings reveal a strong sense of optimism surrounding digital health technologies, with a majority of respondents perceiving them as the future of healthcare delivery. Participants expressed particular enthusiasm for the transformative potential of telemedicine and artificial intelligence (AI), especially in areas such as diagnostics, remote monitoring, and personalized treatment. The widespread use of digital health tools in urban areas is largely attributed to greater accessibility, convenience, and the proliferation of services such as online appointment booking, teleconsultations, wearable health devices, and electronic access to laboratory reports.

Despite these advancements, a pronounced urban–rural divide persists in digital health adoption. Respondents from rural regions reported significantly lower levels of engagement with digital tools, citing barriers such as inadequate internet infrastructure, limited digital literacy, affordability constraints, and general unawareness of available digital health services. In contrast, urban respondents demonstrated greater digital

readiness, highlighting unequal access to technology and healthcare modernization across geographic regions.

Concerns related to trust, privacy, and usability remain prominent. Respondents voiced apprehension about data privacy and the potential misuse or unauthorized sharing of sensitive personal health information. Additionally, skepticism was expressed regarding the quality and reliability of digital consultations, with some participants indicating a preference for face-to-face interactions due to the perceived lack of personal connection and comprehensiveness in virtual care.

A recurring theme across responses was the call for better integration and centralization of healthcare services. Many respondents emphasized the need for a unified digital platform that could consolidate various healthcare functions—including appointment scheduling, prescriptions, diagnostics, and payments—into a single interface. There was also support for linking patient records to national identifiers such as Aadhaar to facilitate continuity of care and improve data accessibility across healthcare providers.

Barriers to digital health adoption were multifaceted. Digital literacy gaps, particularly among older adults and rural populations, continue to impede effective use of technology. Affordability concerns were also significant, with the high cost of devices and digital services posing a substantial obstacle for economically disadvantaged groups. Furthermore, some resistance was noted among healthcare providers, especially with regard to using digital technologies for initial consultations or complex

diagnostic evaluations, reflecting a degree of inertia or skepticism toward digital transformation in clinical practice.

In terms of service delivery preferences, respondents overwhelmingly supported a hybrid model of care that integrates digital health technologies with traditional, in-person services. While digital tools are recognized for their convenience and efficiency, many participants emphasized the enduring value of human interaction in healthcare, particularly for complex cases requiring personalized attention and holistic evaluation. This hybrid approach is viewed as essential to ensuring inclusivity, trust, and quality in the evolving digital health landscape.

An integrated analysis of survey responses from both healthcare professionals (HCPs) and residents of India reveals several converging perspectives on the adoption and future of digital health technologies. A prominent theme emerging from both cohorts is a shared optimism regarding the transformative potential of digital health in improving healthcare delivery. Respondents from both groups widely endorsed the integration of telemedicine, online consultations, and digital innovations such as electronic health records (EHRs), wearable health monitoring devices, and artificial intelligence (AI)-driven diagnostic tools. These technologies were perceived as essential for enhancing the efficiency, accessibility, and overall modernization of India's healthcare system to better address the needs of its diverse population.

Despite this enthusiasm, both groups underscored persistent challenges in accessibility, particularly in rural and remote areas. Infrastructural limitations, including unreliable

internet connectivity and limited access to digital devices, were cited as major barriers to the equitable implementation of digital health solutions. Affordability emerged as a cross-cutting concern, with economically disadvantaged populations facing significant hurdles in accessing and utilizing digital health services.

Concerns about data privacy and cybersecurity were also prevalent among both HCPs and residents. The potential for data breaches, misuse of sensitive health information, and lack of robust data protection mechanisms were noted as key deterrents to the widespread adoption of digital platforms. These apprehensions point to a broader need for regulatory assurance and secure digital health ecosystems.

Furthermore, both groups identified gaps in digital literacy as a critical constraint, especially among older adults and rural populations. The lack of awareness and skill in navigating digital health platforms was seen as a major impediment to their effective use. Healthcare professionals additionally highlighted the need for ongoing training and upskilling to ensure confident and competent use of these technologies in clinical practice.

Interestingly, both cohorts expressed a preference for a hybrid model of healthcare delivery, emphasizing the complementary role of digital and in-person care. While digital tools were recognized for their utility in streamlining routine healthcare interactions and follow-ups, respondents asserted the continued importance of face-to-face consultations for initial diagnoses, emergencies, and complex conditions.

Finally, the issue of trust—both in digital platforms and the responsiveness of healthcare providers operating within these systems—emerged as a shared concern. Skepticism about the reliability of digital health services and the perceived impersonality of virtual consultations were identified as barriers that could hinder user engagement and sustained adoption.

Collectively, these findings underscore the complex interplay between technological readiness, socio-economic realities, and cultural perceptions, pointing to the need for a patient-centric, inclusive, and secure digital health strategy tailored to India's unique healthcare landscape.

While there are several shared views between healthcare professionals and residents regarding the promise and limitations of digital health technologies, notable differences also emerge in their perceptions, priorities, and challenges. These differences reflect the unique roles, experiences, and expectations each group holds within the healthcare ecosystem.

One of the most significant divergences pertains to the perception of telemedicine. Residents generally regard telemedicine as a valuable innovation, especially for routine check-ups and follow-up consultations. Its convenience, time-saving nature, and ability to overcome geographical barriers are key drivers of its popularity. In contrast, healthcare professionals exhibit a more cautious stance. Many physicians express reservations about using telemedicine for initial consultations, primarily due to

concerns about diagnostic accuracy and the absence of physical examinations, which they deem essential for comprehensive clinical assessments.

Awareness and familiarity with digital tools also differ considerably between the two groups. Healthcare professionals demonstrate greater exposure to and understanding of advanced technologies, including artificial intelligence (AI)-based diagnostics, wearable health monitors, and integrated digital platforms. Conversely, residents—while generally optimistic about digital health—tend to engage more with basic functionalities such as appointment scheduling, online payments, and accessing test reports. This reflects a more utilitarian approach, rooted in immediate needs and ease of use rather than technological sophistication.

Another point of divergence lies in expectations around integration and infrastructure. Healthcare professionals emphasize the need for unified digital health platforms that consolidate patient records, diagnostic results, and treatment histories. Such integration is seen as critical to improving care continuity and clinical decision-making. On the other hand, residents place greater importance on the affordability and availability of basic digital health services, showing comparatively less concern for systemic integration. This indicates a practical orientation driven by access-related constraints, particularly in underserved communities.

Finally, barriers to adoption are perceived differently by each group. For residents, the principal obstacles include limited digital literacy and the prohibitive cost of devices or data access, particularly among economically vulnerable populations. In contrast,

healthcare professionals point to institutional and behavioral challenges—most notably, resistance to change and insufficient training in digital health tools. These factors hinder their readiness to embrace and effectively implement new technologies within clinical workflows.

These distinctions underscore the necessity of adopting a differentiated strategy for digital health implementation—one that simultaneously addresses the structural, educational, and behavioral needs of healthcare providers while ensuring that digital solutions remain accessible and user-friendly for the broader population.

4.2 Conclusion

The insights from both healthcare professionals (HCPs) and residents provide a comprehensive view of the current landscape of digital health in India. The findings underscore the transformative potential of digital health technologies while highlighting key barriers that need to be addressed to ensure equitable access and widespread adoption.

1. **Adoption and Optimism:**
   Both HCPs and residents are optimistic about the potential of digital health technologies to revolutionize healthcare delivery in India. Tools like telemedicine, wearable devices, and AI-driven solutions are seen as key enablers for enhancing accessibility, efficiency, and patient outcomes.
2. **Barriers to Adoption:**
   Despite widespread optimism, significant barriers persist. Key challenges include inadequate training for HCPs, digital literacy gaps, affordability issues, and the urban-rural divide in infrastructure and access. Trust, privacy, and usability concerns further hinder adoption.

3. **Hybrid Healthcare Model Preference:**
   A common theme across both surveys is the preference for a hybrid healthcare model that combines digital solutions for routine tasks with in-person care for critical and complex cases. This approach balances the convenience of technology with the essential human touch in healthcare.
4. **Digital Divide:**
   The digital divide remains a critical issue, with rural populations and vulnerable groups such as geriatric patients and lower socioeconomic communities disproportionately affected. Bridging this gap is essential to achieve equitable healthcare access.
5. **Cybersecurity and Trust:**
   Data security is a universal concern, with strong consensus on the need for robust cybersecurity measures to build trust in digital health platforms.

CHAPTER V:

DISCUSSION

5.1 Discussion of Results

India's digital health landscape is rapidly evolving, driven by progressive policies, technological advancements, and increasing investment. The regulatory framework, anchored by initiatives like the Digital India Campaign and Ayushman Bharat Digital Mission (ABDM), has provided a robust foundation for innovation and business growth. Policies such as the Digital Personal Data Protection Act (2023) and Telemedicine Practice Guidelines (2020) ensure data security, interoperability, and accessibility, fostering trust among stakeholders. The market, valued at USD 3.88 billion in 2023, is projected to grow at a CAGR of 29.5%, fueled by rising healthcare expenditure, increasing internet penetration, and consumer awareness. Segments such as e-pharmacies, telemedicine, wearables, and B2B healthcare supplies are transforming healthcare delivery, with startups like PharmEasy, Tata 1MG, and Pristyn Care leading the charge.

Despite challenges like infrastructure gaps and data security concerns, government-backed initiatives, such as the ABDM Sandbox and UHI, support innovation and scalability. Advanced technologies, including AI, blockchain, and robotics, are enhancing efficiency and patient outcomes, positioning India as a global leader in digital health. This synergy between policy and business underscores the potential to revolutionize healthcare access and delivery across the country, bridging the urban-rural divide and empowering stakeholders with a patient-centric healthcare approach.

5.2 Discussion of Research Question One

Analysis of the impact of government initiatives on digital health adoption in India

Regulatory and Policy Framework: Enabling Growth and Trust

India's regulatory and policy environment has played a pivotal role in shaping the digital health landscape, offering a structured pathway to scale innovation while safeguarding public interest. These frameworks not only address prevailing systemic challenges but also lay a robust foundation for sustained growth and digital transformation across the healthcare continuum.

A series of government-led initiatives have been instrumental in this evolution. The Digital India Campaign, launched in 2015, marked a strategic pivot towards leveraging technology to enhance healthcare accessibility, particularly in rural and underserved regions. Building on this momentum, the Ayushman Bharat Digital Mission (ABDM), introduced under the 2017 National Health Policy, aspires to establish a fully digitalized healthcare ecosystem. Central to the ABDM are foundational tools such as unique Health IDs, the Healthcare Professionals Registry (HPR), the Health Facility Registry (HFR), and interoperable Electronic Health Records (EHRs), all of which empower patients while enabling seamless information exchange. Complementing these initiatives is the Unified Health Interface (UHI), which fosters patient-centricity by integrating services such as teleconsultation, diagnostics, and ambulance bookings within a unified digital platform.

In parallel, the regulatory approach to data security and privacy has evolved significantly. The Digital Personal Data Protection (DPDP) Act of 2023 emphasizes the principles of informed consent, data minimization, secure data handling, and mandatory breach notifications. These provisions are critical to building public trust

and ensuring regulatory compliance among digital health service providers. The Health Data Management Policy (2020), under the aegis of ABDM, reinforces this foundation by offering a framework for secure storage, access, and sharing of personal health information. It also promotes data portability and user control, aligning with global best practices in digital health governance.

The expansion of telemedicine and e-pharmacy services has been guided by clear regulatory structures. The Telemedicine Practice Guidelines (2020) standardized the delivery of remote consultations and played a vital role in the proliferation of platforms such as eSanjeevani, Practo, and DocsApp, which have significantly reduced geographical barriers to healthcare. Similarly, the Draft E-Pharmacy Rules (2018) provided legitimacy to online pharmacies by establishing protocols around prescriptions, drug storage, and verification processes, enabling companies like PharmEasy and Tata 1MG to scale operations securely and efficiently.

Infrastructure enhancement has also been a key government priority. Initiatives such as eSanjeevani have integrated over 374,000 Common Service Centers (CSCs) to extend telemedicine access to rural populations. Furthermore, the government's push for EHR standardization has streamlined administrative processes, reduced redundancies, and improved clinical efficiency—thereby optimizing both provider workflows and patient outcomes.

Business Environment: Driving Innovation and Investment

India's digital health sector is experiencing unprecedented growth, underpinned by favorable market dynamics, a supportive policy environment, and expanding private-sector investment. This momentum is reshaping healthcare delivery and catalyzing innovation across various digital health segments.

Valued at USD 3.88 billion in 2023, the Indian digital health market is projected to grow at a compound annual growth rate (CAGR) of 29.5%, potentially reaching USD 39.7 billion by 2032. This growth is driven by a confluence of factors, including increasing consumer awareness, rapid internet penetration, and an upsurge in public and private healthcare expenditure. Core segments such as e-pharmacies, telemedicine, wearable technologies, and chronic disease management are contributing significantly to this transformation.

The sector has attracted substantial investor interest, with over USD 6.5 billion in private capital deployed between 2017 and 2022. Startups such as PharmEasy, Cure.fit, and Pristyn Care have leveraged this capital to scale operations, diversify offerings, and expand geographical reach. Public-sector support, especially through initiatives like ABDM, has created an enabling environment for innovation by fostering public-private partnerships and reducing market entry barriers.

Segment-specific performance further underscores the dynamism of the market. E-pharmacy platforms have experienced remarkable growth; PharmEasy and Tata 1MG reported revenues of ₹5,664 crore and ₹1,968 crore respectively in FY24, particularly bolstered by increased demand during the COVID-19 pandemic. The telemedicine segment, with an estimated market size of USD 250 million, is growing at over 20% annually, acting as a vital bridge between rural patients and urban healthcare providers. Wearable devices and mobile health (mHealth) applications are gaining traction for their ability to support real-time monitoring and chronic disease management, enabling patients to take greater control of their health. Meanwhile, B2B platforms like Entero and Medika Bazaar are modernizing the healthcare supply chain by streamlining procurement processes and improving operational efficiency in hospitals and clinics.

Policy measures have played a critical role in supporting this business growth. The ABDM Sandbox initiative provides companies with a platform to test and validate digital health solutions, thus encouraging experimentation and innovation. Regulatory frameworks such as the DPDP Act ensure that digital health operations are conducted within a secure and transparent environment, helping maintain user trust. Additionally, formal recognition of telemedicine and e-pharmacy sectors by the government has enabled greater legitimacy and accelerated market expansion.

Challenges and Opportunities

Despite the progress achieved, the digital health sector in India continues to face several challenges. Persistent infrastructure deficits, particularly in rural areas, limit the reach of digital services. Inadequate broadband coverage, scarcity of digital devices, and a lack of interoperable platforms present considerable barriers to equitable access. Concerns around cybersecurity, data breaches, and user consent remain prominent, often deterring both providers and users from fully embracing digital health.

Moreover, resistance to digital adoption, especially among healthcare providers in rural settings, coupled with low digital literacy among certain demographic segments, hampers the optimal utilization of existing technologies.

Nonetheless, the opportunities far outweigh these limitations. Rising healthcare expenditures, increasing digital literacy, and sustained policy support provide a strong foundation for continued growth. Emerging technologies such as artificial intelligence, blockchain, and robotics offer new possibilities for improving clinical accuracy, administrative efficiency, and patient engagement. The convergence of public policy and private innovation positions India to become a global hub for digital health transformation, particularly in scalable, cost-effective models of care.

Conclusion

India's digital health landscape represents a rapidly evolving and highly promising ecosystem characterized by progressive policy interventions, technological innovation, and substantial private-sector investment. The regulatory framework—emphasizing data security, interoperability, and equitable access—has fostered a conducive environment for innovation and commercial scalability. While challenges related to infrastructure, trust, and digital literacy persist, the alignment of policy vision with business dynamism provides a strong foundation for a sustainable and inclusive digital health revolution. Going forward, a coordinated approach involving stakeholders across sectors will be essential in realizing the full potential of digital health in transforming healthcare delivery across India.

5.2 Discussion of Research Question Two & Three

The study received a total of 480 responses from the general population and 126 responses from healthcare professionals (HCPs).

Sample Size Justification

These sample sizes are statistically sufficient to support the study's descriptive objectives and provide reliable insights into digital health adoption across these two groups.

General Population (n = 480)

Although smaller than the general population sample, the 126 healthcare professional (HCP) responses are sufficient for analysis due to the relatively homogeneous and expert nature of this group. This sample size supports a confidence level of at least 90% with an estimated margin of error between ±7%

and ±10%, which is considered acceptable for expert populations (Lavrakas, 2008). Given their shared professional background and familiarity with digital health technologies, HCP responses tend to exhibit higher internal consistency, thereby reducing the necessity for larger samples to achieve reliable analytical outcomes. Moreover, existing literature suggests that meaningful insights from HCPs tend to stabilize with 100 to 150 responses, placing this study's sample within the saturation range for drawing valid conclusions.

From a practical standpoint, recruiting HCPs poses inherent challenges due to their demanding schedules and limited availability, making large-scale participation difficult. Additionally, once statistically adequate sample sizes are achieved, further data collection often results in marginal analytical gains while increasing resource requirements. Overall, the sample sizes used in this study reflect a pragmatic balance between statistical robustness and logistical feasibility for both the general population and expert respondent groups.

Insights from HCP Survey

The findings from the healthcare professional (HCP) survey provide a comprehensive view of the evolving landscape of digital health adoption, reflecting both progress and persistent challenges. A substantial majority (73.8%) of HCPs expressed high confidence in using digital health technologies, indicating sector-wide readiness to embrace innovation. However, this optimism is offset by operational hurdles, notably inadequate training (61.1%) and the lack of system integration (57.1%). These challenges suggest that while confidence is high, practical constraints continue to limit effective implementation. Addressing these issues through structured training initiatives and improved interoperability will be crucial for optimizing the benefits of digital tools.

Perceptions of impact on patient outcomes are cautiously optimistic. Nearly half (48.4%) of respondents believe that digital health improves outcomes, yet a significant neutral response (34.1%) suggests uncertainty about its measurable effectiveness. This highlights the need for rigorous evaluations and evidence-based demonstrations of impact to strengthen support and guide future adoption.

Barriers to adoption are multifaceted. From the provider's perspective, poor integration with existing systems continues to hinder workflow efficiency. For patients, barriers such as limited awareness (64.3%), insufficient digital literacy (58.7%), and accessibility challenges reflect deeper structural inequalities. These issues are particularly pronounced among vulnerable groups, including geriatric patients (66.7%), individuals from lower socioeconomic backgrounds (65.1%), and rural populations (56.3%). Targeted interventions—such as digital literacy campaigns, affordable device distribution, and enhanced rural connectivity—are needed to bridge these divides.

Despite these challenges, mobile devices (77.6%) and internet access (61.6%) have emerged as critical enablers, providing scalable and accessible platforms for digital health services. Prioritizing mobile-first approaches and subsidizing internet infrastructure could significantly enhance reach and inclusivity.

Cybersecurity emerged as a near-universal concern, with 92.9% of respondents emphasizing its importance. The potential for data breaches and privacy violations poses a substantial threat to trust and adoption. Mitigating these risks requires not only robust cybersecurity frameworks and regulatory compliance but also ongoing training for healthcare professionals in secure data handling practices.

Finally, the COVID-19 pandemic has significantly accelerated digital adoption. A majority (78.4%) of HCPs reported increased use of digital technologies since the

pandemic, and 66.7% observed greater patient expectations for digital engagement. This momentum presents an opportunity to institutionalize digital health practices, but it also calls for continued innovation, infrastructure investment, and user support to sustain long-term transformation in healthcare delivery.

Implications and Recommendations

1. **Upskilling Healthcare Professionals:**

   Regular training programs on digital tools and integration processes should be mandatory for HCPs. This will not only improve confidence but also enhance their ability to demonstrate the tangible benefits of digital health.

2. **Enhancing Patient Awareness and Engagement:**

   Governments and healthcare organizations must invest in public education campaigns to raise awareness about digital health services. Simple and intuitive designs, along with localized language support, can improve accessibility.

3. **Bridging the Digital Divide:**

   Addressing rural and socio-economic disparities should be a top priority. Initiatives like subsidized devices, free internet zones, and telehealth hubs in rural areas can significantly improve access.

4. **Strengthening Cybersecurity Frameworks:**

   Robust cybersecurity measures, coupled with transparent data policies, are crucial. Regular audits, HCP training on data privacy, and patient education on data rights will help build trust.

5. **Driving Evidence-Based Adoption:**

   Research initiatives to quantify the impact of digital health on patient outcomes

are essential. Evidence-based practices can help convince skeptics and facilitate broader adoption among HCPs.

6. **Sustaining Momentum Post-COVID-19:**

   The post-pandemic surge in digital adoption should be leveraged by institutionalizing hybrid models that combine digital tools with in-person care. Encouraging innovation in telehealth, remote monitoring, and AI-driven diagnostics can further enhance healthcare delivery.

   By addressing these challenges and capitalizing on the identified opportunities, digital health technologies can transform healthcare in India, making it more accessible, efficient, and patient-centric.

Analysis of Survey Results and Policy/Regulatory Framework:

Addressing Challenges and Recommendations for Further Policy Development

Based on the survey results and insights from the attached document, the analysis highlights how the existing policy and regulatory frameworks address challenges in digital health adoption and identifies areas where additional frameworks are needed.

Current Challenges in Digital Health Adoption

The survey results reveal several critical insights into the current state of digital health adoption in India, underscoring both progress and persistent challenges.

Digital literacy and awareness remain major barriers, particularly among patients. A significant proportion (64.3%) lack awareness of available digital health services, and 58.7% struggle with digital literacy, which hampers their ability to engage effectively

with technology-driven healthcare. Among healthcare professionals, confidence in using digital tools is relatively high, with 73.8% expressing comfort with their use. However, this confidence is tempered by systemic issues, such as inadequate training (61.1%) and the lack of integration of digital solutions into existing clinical workflows (57.1%), highlighting a gap between user readiness and institutional preparedness.

The urban-rural divide is another significant concern. Respondents identified notable disparities in access to digital health solutions, with rural areas facing compounded barriers due to limited digital infrastructure, affordability constraints, and lower levels of awareness. These gaps underscore the need for targeted policy interventions to ensure equitable digital health access across geographic and socioeconomic strata.

Privacy and data security concerns are prominent, with 92.9% of respondents emphasizing the importance of cybersecurity. This strong consensus reflects apprehensions about data breaches, unauthorized use of health information, and the need for robust safeguards to maintain public trust in digital platforms.

Interoperability and system integration were also highlighted as critical pain points. Many healthcare professionals noted the fragmented nature of current digital systems, with inadequate integration of new technologies into existing healthcare infrastructure. This lack of seamless connectivity hinders workflow efficiency and limits the potential of digital health tools to deliver coordinated care.

Affordability emerged as a persistent challenge, particularly for economically disadvantaged groups. The high cost of digital devices and services limits access and exacerbates existing healthcare inequalities. Addressing these affordability issues through subsidies, public-private partnerships, and low-cost innovations will be essential to achieving inclusive digital health adoption.

1. Existing Policy and Regulatory Frameworks

Key Initiatives Addressing Challenges

1. **Ayushman Bharat Digital Mission (ABDM)**

Addressing Integration and Interoperability

A critical objective of the Ayushman Bharat Digital Mission (ABDM) is to establish a unified and interoperable digital health ecosystem in India. This is being pursued through the implementation of foundational infrastructure elements such as the Health ID, the Health Professionals Registry (HPR), and the Health Facility Registry (HFR). These components are designed to facilitate seamless data exchange between stakeholders, thereby enabling the integration of patient health records across different levels of care and healthcare institutions. The interoperability enabled by ABDM not only supports continuity of care but also contributes to improved clinical decision-making and operational efficiency within the healthcare system.

Fostering Patient Empowerment

In addition to streamlining provider-side integration, ABDM places significant emphasis on empowering patients through the digitization of health records and the implementation

of a consent-driven data sharing framework. The availability of electronic health records (EHRs) allows individuals to access, manage, and share their medical information in a secure and structured manner. The integrated consent management system ensures that patients retain control over who accesses their health data, thereby reinforcing transparency, informed consent, and autonomy. By positioning patients as active participants in their healthcare journey, ABDM fosters a more inclusive and trust-oriented digital health environ.

2. **Digital Personal Data Protection Act, 2023**

Addressing Privacy Concerns:

This act mandates explicit consent for data collection, ensures secure data handling, and imposes penalties for breaches, thereby bolstering trust in digital health platforms.

3. **National Digital Health Blueprint (NDHB)**

Bridging the Digital Divide:

NDHB provides a strategic roadmap for building infrastructure in underserved areas, addressing rural-urban disparities.

4. **Telemedicine Practice Guidelines, 2020**

Expanding Telemedicine Services:

These guidelines provide a robust framework for teleconsultations, including protocols for privacy, informed consent, and continuity of care.

5. **Health Data Management Policy (2020)**

Standardization and Security:

This policy defines protocols for health data use, ensuring data security while empowering individuals with control over their health information.

Addressing Challenges Through Current Frameworks

Digital Literacy and Training

Current Measures:

Initiatives like ABDM and e-Sanjeevani have created platforms for digital engagement and teleconsultations. However, their success depends on user education.

Urban-Rural Divide

Current Measures:

The NDHB emphasizes infrastructure development in rural areas, and e-Sanjeevani connects remote patients to doctors through telemedicine.

Privacy and Security

Current Measures:

The Digital Personal Data Protection Act, 2023, and Health Data Management Policy provide a framework for secure data handling and patient consent.

Integration and Interoperability

Current Measures:

The ABDM promotes interoperability through standardized digital systems like the Unified Health Interface (UHI).

Affordability

Current Measures:

Telemedicine services like e-Sanjeevani offer free consultations, and government subsidies support public health initiatives.

Recommendations for Additional Policy Frameworks

1. **National Digital Literacy Campaign**

Objective:

Launch a nationwide initiative to educate patients and healthcare professionals about digital health tools and their benefits.

Implementation:

Partner with NGOs, community leaders, and local governments to deliver tailored training programs, particularly in rural areas.

2. **Subsidized Digital Health Devices and Services**

Objective:

Provide affordable digital tools (e.g., wearables, smartphones) and subsidized internet access to underserved populations.

Implementation:

Introduce government grants or public-private partnerships to fund these initiatives.

3. **Enhanced Cybersecurity Standards**

Objective:

Strengthen enforcement mechanisms under the Digital Personal Data Protection Act and establish real-time monitoring for breaches.

Implementation:

Create a national cybersecurity task force for healthcare systems, ensuring compliance across public and private entities.

4. **Incentivizing Healthcare Providers**

Objective:

Encourage healthcare providers to adopt and integrate digital tools through financial incentives and streamlined training programs.

Implementation:

Offer tax breaks or grants for clinics and hospitals implementing ABDM-compliant systems.

5. **Focused Research and Development Policy**

Objective:

Invest in R&D for affordable, culturally sensitive digital health solutions that address local challenges.

Implementation:

Create funding pools for tech developers and academia to innovate in digital health technologies.

6. **Periodic Assessment of Policy Impact**

Objective:

Conduct regular evaluations of initiatives like ABDM and NDHB to measure progress and identify areas for improvement.

Implementation:

Establish independent review committees comprising policymakers, healthcare professionals, and patient representatives.

7. **Integration of Traditional and Digital Care**

Objective:

Develop frameworks to blend traditional in-person care with digital solutions, ensuring comprehensive and inclusive healthcare.

Implementation:

Draft guidelines for hybrid care models emphasizing both physical and digital touchpoints.

The survey results underscore the transformative potential of digital health technologies while highlighting persistent barriers such as digital literacy gaps, privacy concerns, and affordability issues. Current frameworks, particularly the Ayushman Bharat Digital Mission, Telemedicine Guidelines, and the Digital Personal Data Protection Act, address these challenges to an extent. However, gaps in implementation, enforcement, and outreach remain.

By introducing additional policies focused on education, affordability, cybersecurity, and integration, India can overcome these barriers and create a more inclusive, accessible, and efficient healthcare ecosystem. These measures, combined with robust monitoring and evaluation, will ensure the sustainable growth and adoption of digital health technologies, bridging the healthcare divide and improving outcomes across the country.

CHAPTER VI:

SUMMARY, IMPLICATIONS, AND RECOMMENDATIONS

6.1 Summary

This study investigates the digital health readiness of both healthcare professionals and the general population in India, emphasizing the transformative potential of digital technologies in reshaping healthcare delivery. The findings reveal a complex interplay of optimism and structural challenges, highlighting both encouraging trends and areas requiring strategic intervention.

A significant proportion of healthcare professionals (73.8%) reported confidence in using digital health technologies. However, this confidence is counterbalanced by notable barriers such as inadequate training (61.1%) and the lack of integration across digital systems (57.1%), which hinder effective adoption in clinical settings. Among the general population, particularly patients in rural areas, challenges manifest primarily as limited awareness (64.3%) and low digital literacy (58.7%), underscoring the need for inclusive educational initiatives and targeted outreach programs.

The study also brings to the forefront the persistent urban-rural divide, which disproportionately affects vulnerable groups including geriatric patients, individuals from lower socioeconomic backgrounds, and rural communities. These populations continue to face structural barriers such as poor infrastructure, affordability constraints, and limited access to devices or internet connectivity. The digital divide, therefore, remains a critical impediment to equitable healthcare access and utilization, reflecting broader socio-economic disparities within the Indian healthcare landscape.

Government-led initiatives have played an important role in laying the groundwork for digital health integration. The Ayushman Bharat Digital Mission (ABDM) and the National Digital Health Blueprint (NDHB) have established essential infrastructure and policy

direction for the creation of a unified, interoperable digital health ecosystem. The ABDM, in particular, seeks to connect patients and providers through standardized digital systems, facilitate seamless data exchange, and promote patient empowerment via consent-based data sharing models.

Privacy and cybersecurity emerged as areas of widespread concern across both respondent groups. There was a clear consensus on the necessity for strong regulatory frameworks to mitigate data-related risks and build public trust in digital platforms. The Digital Personal Data Protection Act, 2023, is a notable response in this direction, reinforcing consent-driven data governance and the legal obligation of service providers to ensure robust data protection.

The impact of the COVID-19 pandemic on digital health adoption was also evident. The majority of respondents reported a marked increase in the use of telemedicine services, wearable devices, and mobile health applications during the pandemic. However, while the crisis catalyzed adoption, it also raised expectations from both healthcare providers and patients, presenting challenges for the sustainable scaling of digital health solutions in the post-pandemic era.

Collectively, these findings suggest a dual narrative of progress and persistent gaps in digital health readiness. They highlight the need for coordinated, multi-stakeholder action to bridge the divide between digital potential and ground-level realities.

6.2 **Implications**

Policy Implications

India's digital health strategy, anchored in the Digital India Campaign and operationalized through the ABDM, has laid a substantial foundation for nationwide digital transformation in healthcare. However, gaps in implementation remain, particularly in rural areas where digital infrastructure is lacking. To address this, future policies must prioritize:

1. Investment in rural digital infrastructure, including broadband connectivity and the deployment of digital health tools at the community level.
2. Strengthened regulatory frameworks, such as the Digital Personal Data Protection Act (2023), which codifies data rights, mandates explicit consent, and imposes breach notification requirements, thereby addressing growing concerns around privacy and data security.

Healthcare System Implications

1. Interoperability and data integration across healthcare systems will be key to reducing redundancies and enhancing clinical efficiency. The adoption of EHRs and standardization across platforms will facilitate seamless care delivery.
2. Technological innovation—including AI-driven diagnostics, wearable devices, and teleconsultation platforms—can expand access to quality care in remote and underserved regions, improving service delivery and health outcomes.

Social and Economic Implications

1. Equitable access to digital health services is essential to reduce health disparities. Tailored interventions such as subsidized digital devices, digital literacy campaigns, and culturally sensitive content can enable inclusive participation.

2. Economic growth opportunities exist through the expansion of the digital health ecosystem, particularly in areas such as health tech startups, digital infrastructure, and workforce development. Public-private partnerships (PPPs) can foster innovation while generating employment and strengthening the healthcare economy.

Technological Implications

1. User-centric design must be prioritized to ensure digital health tools are intuitive, accessible, and aligned with local cultural and linguistic contexts, thereby encouraging broader adoption.
2. Collaborative innovation between government, private sector, and academic institutions can support the development of scalable, sustainable digital solutions that meet the diverse needs of India's population.

6.3 Recommendations for Future Research

1. Demographic Representation:
   Future studies should include a much broader representation of India's population, encompassing diverse age groups, socio-economic backgrounds, and diverse geographic locations to provide a holistic understanding of digital health readiness.
2. Long-Term Impact Assessments:
   Evaluate the sustainability and scalability of digital health interventions over time to understand their impact on patient outcomes and healthcare efficiency.
3. Technological Usability and Acceptability:
   Assess the usability of specific tools, such as wearable devices, mobile health applications, and telemedicine platforms, to identify areas for improvement.

4. Cultural and Behavioral Studies: Explore how cultural norms and societal attitudes influence the adoption of digital health technologies, particularly in rural and traditional communities.
5. Effectiveness of Government Initiatives: Analyze the outcomes of programs like ABDM and NDHB, identifying challenges in their implementation and areas for enhancement.

6.4 Conclusion

The research underscores the transformative potential of digital health technologies in addressing India's healthcare challenges, including accessibility, affordability, and quality of care. While optimism is high among stakeholders, systemic barriers such as infrastructure gaps, privacy concerns, and digital literacy deficits must be overcome.

The government's initiatives, such as the Ayushman Bharat Digital Mission, have provided a strong framework, but effective implementation requires collaboration between policymakers, healthcare providers, technology developers, and the public. The Digital Personal Data Protection Act, 2023, highlights the importance of addressing trust and privacy concerns in building confidence in digital health systems.

A balanced approach combining digital innovation with traditional healthcare delivery can ensure equitable access, particularly for vulnerable populations. Future efforts should focus on evidence-based research, sustainable policy interventions, and technological innovations that prioritize inclusivity and patient-centric care.

In conclusion, this study serves as a roadmap for enhancing digital health adoption in India, emphasizing the need for a collaborative, multi-stakeholder approach to achieve a modernized, efficient, and equitable healthcare system.

APPENDIX A

SURVEY QUESTIONNAIRES

Sample of Digital Health Technology Readiness Survey for Health Care Professionals & General Public.

Digital Health Technology Readiness Survey- Health Care Professionals

1. Your Specialization

   Select all that apply

   - MBBS
   - MD/MS
   - MRCP/FRCS
   - DNB
   - Others

2. What is your age group?
   - >35 years
   - 35-50 years
   - 50 + years

3. Where do you work?

   Select all that apply

   - Government set up
   - Private set up
   - Urban location
   - Semi urban/rural location

4. What technologies do you use to communicate with your patients?
   Select all that apply

- Telehealth-Audio
- Telehealth-Video
- Text Messages
- Email
- Mobile devices
- Do not use technology to communicate with patients.
- Other_____

5. How effective are these technologies in enabling you to complete communication tasks associated with your role and to serve patient needs?
   1-Not Effective, 5-Highly Effective

	1	2	3	4	5	Not applicable
Telehealth-Audio						
Telehealth-Video						
Text messages						
Email						
Mobile devices						
Other_____						

6. What technologies do you use to deliver healthcare (digital health)

   Select all that apply

- Electronic medical record
- Patient identification booking and registration system
- Digital clinical information system
- Electronic prescription
- Electronic laboratory and diagnostic management system
- Mobile phones

- Health apps
- Wearable devices for patient monitoring
- Video conferencing
- Do not use technologies to deliver healthcare.
- Other_____

7. How effective are these tools in enabling you to complete tasks associated with your role and to serve patient needs?

   1-Not Effective, 5-Highly Effective

	1	2	3	4	5	Not applicable
Electronic medical record						
Patient identification booking and registration system						
Mobile phones						
Health apps						
Wearable devices for patient monitoring						
Video conferencing						
Other_____						

8. Post Covid 19 pandemic has your digital health use increased?
   - Yes
   - No

9. Post Covid 19 pandemic have you seen an increase in patients expecting you to use digital health
   - Yes
   - No

10. How would you describe your adoption of digital health?

    - Active adopter- one of the first to actively adopt digital health solutions.
    - Early supporter- early supporter of using digital health solutions.
    - Early majority- adopter to digital solutions after a brief trial period
    - Late majority- adopter to digital solutions after a long trial period
    - Laggard- one of the last to use digital health solutions

11. To what extent do you agree that cyber security in healthcare is important?
    1-Strongly Disagree 5- Strongly Agree
    - 1-2-3-4-5

12. How confident are you at incorporating technology in day-to-day activities?
    1-Extremely Unconfident 5- Extremely Confident
    - 1-2-3-4-5

13. When it comes to incorporating digital health in your day-to-day activities what barriers do you face?

    Select all that apply

    - Cost
    - Lack of integration with existing systems
    - Complexity
    - Unreliable performance
    - Poor interface/user experience
    - Privacy concerns
    - Inadequate training and education of patients
    - Access to latest digital health tools
    - Others_____
    - No barrier faced.

14. What group do you provide services for that may face barriers to healthcare access through digital media?

    Select all that apply

    - Geriatric patients
    - Paediatric patients
    - Lower socioeconomic group

- Patients of rural background
- Other_____

15. What technologies may increase healthcare accessibility to these groups?

    Select all that apply

    - Computers, laptops, tablet
    - Mobile devices & apps
    - Wearable devices (eg: smart watches)
    - Internet access
    - Video conferencing/online consultation
    - Others_____

16. Why do you think that some patients choose not to engage with you digitally?

    Select all that apply

    - Accessibility
    - Affordability
    - Data security & privacy
    - Ability to use
    - Don't want to use
    - Unsure if services exist
    - Other_____

17. Thinking about today, to what extent do you agree with the following statement?

    The use of digital health has led to improved patient outcomes

    1-Strongly Disagree 5- Strongly Agree
    - 1-2-3-4-5

18. Thinking about the future, to what extent do you agree with the following?

    Digital technology will transform and improve the healthcare outcomes for Indians

    1-Strongly Disagree 5- Strongly Agree
    - 1-2-3-4-5

19. Is there a particular area of healthcare, where you see the greatest potential for digital health to improve outcomes?

    Select all that apply

    - Primary prevention
    - Asthma
    - Diabetes
    - Cardiovascular health conditions
    - Arthitis & musculoskeletal conditions
    - Mental health
    - Dementia
    - Obesity
    - Cancer
    - Geriatric care
    - Child health
    - Reproductive health

20. Looking five years ahead, what would you expect digital health to achieve in India?

    Select all that apply

    - Data led population health management
    - Patient empowerment through enhanced access to health information
    - Patient self-management of ongoing conditions
    - Prevention and wellbeing
    - Reduced duplication of services
    - Integrated and high-quality health care services
    - Customized patient care

21. Thinking about your previous answer, what changes to digital health need to be made to achieve these benefits?

    Select all that apply

- Models of patient care
- Capacity building for health care providers
- Digital health literacy among general public
- Penetration of digital health solutions at primary health centres in rural areas
- Regulatory framework
- Business investment in digital health solutions
- Research & innovation in digital health
- Governance models

22. How can progress in digital health and its integration across the patient care journey be monitored and measured over time?

    Select all that apply

    - Development of digital health indicators
    - Digital health technology uptake & use reporting

23. Is there anything else that you would like to share regarding the future of digital health in India?

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Digital Health Technology Readiness Survey- Residents of India

1. What is your age group?
    - >18 years
    - 18-29 years
    - 30-39 years
    - 40-49 years
    - 50-59 years
    - 60-69 years
    - 70 + years

2. What is your gender
    - Male
    - Female
    - Non-binary
    - Others____
    - Prefer not to say

3. In which region of India do you stay at?
    - North
    - South
    - East
    - West
4. What kind of setting do you stay at?
    - Urban location
    - Semi urban/rural location

5. What is your education level?
    - No formal education
    - Secondary (10^{th})
    - Higher Secondary (12^{th})
    - Graduate & above
    - Others_____
    - Prefer not to say

6. Which of these best describes your employment status?

    Select all that apply

    - Full time work (service or self-employed)
    - Part time work
    - Retired

- Unemployed/Looking for work
- Home maker
- Student
- Others_____

7. What digital technologies do you use in your daily life?

   Select all that apply

   - Computers, laptops, tablet
   - Mobile devices & apps
   - Wearable devices (eg: smart watches)
   - Internet
   - Video conferencing/online consultation
   - Others_____
   - Don't use

8. What do you use these digital technologies for?

   Select all that apply

   - Banking
   - Social
   - Public transport (cabs/autos etc)
   - Air/rail travel
   - Healthcare
   - Online shopping
   - Managing household
   - Employment related work
   - Information collection
   - Don't use
   - Other_____

9. How confident are you at incorporating technology in day-to-day activities?

   1-Extremely Unconfident 5- Extremely Confident
   1-2-3-4-5

10. Are there any factor preventing you from using digital technologies?

Select all that apply

- Accessibility
- Affordability
- Ability to use
- None
- Other_____

11. Which of the following healthcare services have you interacted with, within the past 12 months?

    Select all that apply

    - General Practice
    - Public/Private hospital
    - Online doctor consultation
    - Laboratory / radiology facility
    - Home health
    - Online pharmacy
    - Chemist shop
    - None

12. How do you currently access personal health information for yourself and for others?

    Select all that apply

    - Mobile
    - Wearable devices
    - Computers, laptops, tablet
    - Email
    - Face to face interaction with health care professionals
    - None

13. Have you used digital health services and technologies within the past 24 months for any of the following reasons?

    Select all that apply

    - Administration (bookings, appointments, payments etc)
    - Health tools & technologies (electronic health records, e-prescriptions etc)

- Healthcare services (online consultation, online lab reports)
- Communication (eg: messaging with doctor/nurse/physiotherapist/ dentist etc)
- Others_____
- I did not use digital health

14. Post Covid 19 pandemic has your digital health use increased?
    - Yes
    - No

15. What has your experience been of using digital health?

    Select all that apply
    - It was easy to navigate or use
    - It was not easy to navigate or use
    - It has made my healthcare experience more efficient and accessible
    - It has made my healthcare experience more difficult and inaccessible
    - I have better control over my healthcare decisions
    - No impact
    - Others_____

16. Do you intend to use any of these in future?

    Select all that apply

    - Book appointments online
    - Online payment services for healthcare
    - Electronic health records
    - Electronic prescriptions
    - Tele or video health
    - Online lab reports
    - Messaging the doctors
    - Personal wearable devices
    - Other_____
    - None

17. Thinking about the future, to what extent do you agree with the following?

Digital technology will transform and improve the healthcare outcomes for Indians

1-Strongly Disagree 5- Strongly Agree

1-2-3-4-5

18. Is there anything else that you would like to share regarding the future of digital health in India

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