Penetration of digital services in Health Care Service Ecosystem in Indian Context

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Abstract: This study has been undertaken to understand the penetration of different digital services in the health care service ecosystem in India. To determine the penetration of different digital services, the systematic literature of the existing literature was carried out. A total of 100 peer reviewed articles were studied during the research which were aimed towards topics like 'digital services', 'mHealth', 'wearables', 'digital and social connectivity', 'telemedicine' and 'remote diagnosis'. A total of 12 articles were studied in depth which provided in depth information about the topic. The study highlighted that there are majorly five digital services. These include mHealth, wearables, digital and social connectivity, telemedicine and remote diagnosis. The governments have been more proactive in terms of providing digital services within the Southern states of the country. There are apps like mDiabetes and mTobacco which are aimed towards reducing tobacco consumption and making people aware about diabetes and how it can be prevented. The governments in Kerala have taken special measures using social media which played a pivotal role in reducing spread of Covid 19 during the year 2020. The penetration of digital services is seen in limited pockets of the country. Wherever there has been Government intervention, the penetration of digital services have been more prominent. Thus there Is a need for more Government intervention in the country across all states for better digital penetration to improve the level of health care services in the country.

IndexTerms – **Digital services, health care, mHealth, Telemedicine, Remote Diagnosis, Social connectivity, Wearables.**

I. INTRODUCTION

The health care ecosystem in India includes not just the infrastructure but also includes health insurance, clinical trials, medical devices and equipment, telemedicine and medical tourism. Out of these, the hospitals comprise 70% of the total health care market, which is followed by pharmaceuticals at 30%, closely followed by medical technology at 10%. The hospital industry in India is such that it is being offered huge investment opportunities from both global as well as domestic investors.
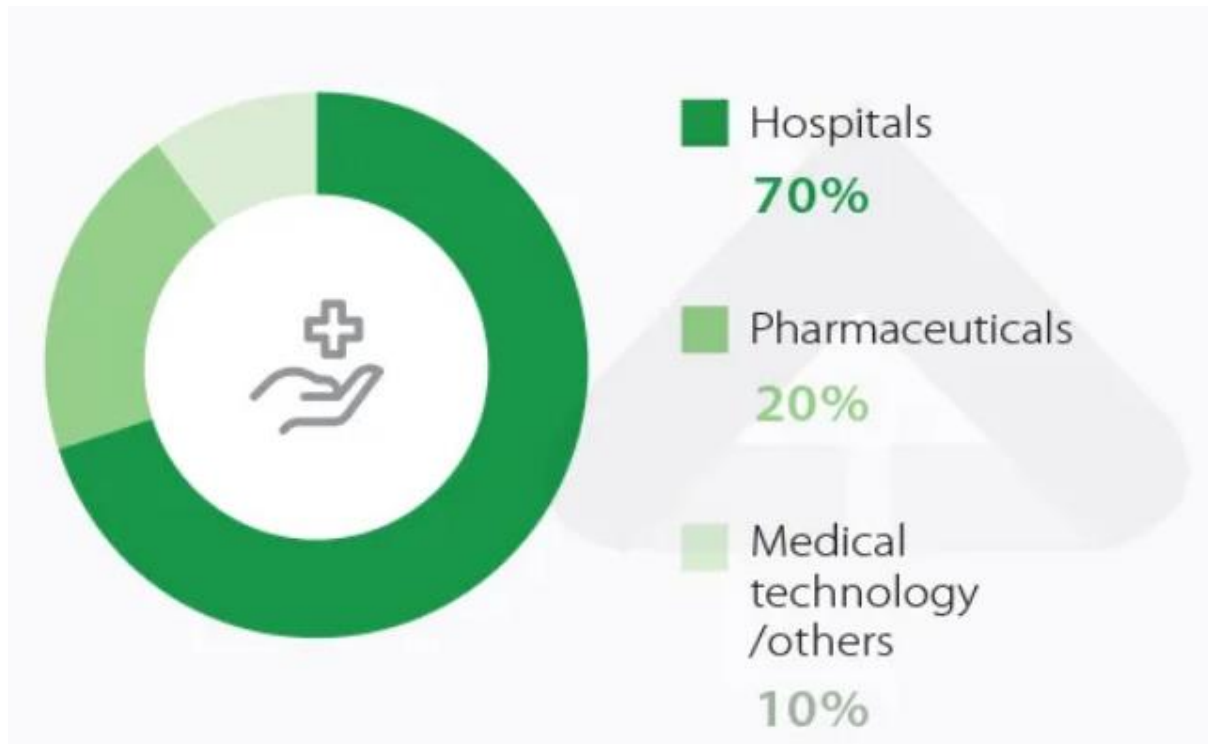
Figure 1: Share of Market Segments of the Health Care Sector in India in FY 2021

If the revenue of all the hospitals is taken into account, one can clearly see that Apollo hospitals contributed a total of INR 112.47 billion. The next best revenue contribution was by Fortis which was less than 50% compared to the revenue contributed by Apollo hospital. The medical devices and equipment industry faces less barriers to entry and thus the Indian medical device can be considered to be a sunrise sector, which is projected to reach US $50 billion by the end of the year 2025. There are four classes of medical devices that are manufactured in India. These four classes are A, B, C and D. Categories C and D comprise of the high end medical devices which are majorly driven by imports. Classes A and B include technologically less advanced medical devices which are produced by the domestic manufacturers.

There are different factors that have led to growth in the health care sector in India. These include an increase in the income, rise in the life expectancy, and lifestyle disorders. The studies have shown that health care infrastructure in the emerging economies is largely concentrated In the Urban areas. With that, the digital penetration in India is also on the rise, not just in health care sector, but also across. With world becoming more and more connected due to a digital revolution, it has the potential to promote information collaboration and information sharing. The speed at which the digital penetration is happening has also increased substantially. The pace at which telephone was able to reach 50 million users, took a total of 75 years while Facebook was able to reach the same user base in a much shorter time frame of 3.5 years. Thus even within the health care sector, it is important to understand the level of penetration of digital services in the health care sector.

 The research work addressed in this paper is aimed towards understanding the extent of penetration of different types of digital services in health care ecosystem in India. The different types of digital services include mobile applications/m-health, digital and social connectivity, wearables, telemedicine and remote diagnosis. The research is aimed towards understanding how these services are being used in the health care ecosystem in India. The extent of digital adoption in any country is driven by connectivity, collaboration, increased accessibility and personalization of products and services.

Within India, health care is one of the fastest growing industries. The healthcare CAGR for India is 11%, which is second after China (17%). Upon analysis of the population in general, one can clearly see that affordability and accessibility are two major barriers to digital penetration. Out of the total population of more than 1 billion, only 295 million are covered by Insurance. Further India only spends 4.7% of the total GDP on health care, out of which 1.4% is from the public sector, which is one of the lowest in the world. The number of doctors, nurses and hospital beds in India is way lower than what is recommended by WHO. WHO mandates 1 doctor per 1000 population, 2.5 nurses per 1000 population and 3.5 hospital beds per 1000 population. The current number for India in doctors, nurses and hospital beds is 0.65, 1.3 and 1.3 respectively. Thus the condition of health care in India is quite deplorable. With the digital revolution coming in and touching upon different facets of health care in India, some digital technologies that have the potential to create major changes in health care include M-health, Remote diagnosis, telemedicine, digital and social connectivity and wearables.

M-Health: M-health was expected to rise to INR 5,184 crores by 2020. Within the emerging markets, 68% of the doctors use m-health. Mobile apps help connect doctors with patients and thus even enable remote consultations.

Remote diagnosis: Remote diagnosis refers to a low cost portable innovation so that it can help promote access to health care for rural and remote population by providing for teleconsultation and e prescription.

Telemedicine: Telemedicine involves using the technology for remote diagnosis. It plays an important role in bringing down patient costs as well as provide for care for the patients in the remotest of areas.

Digital and social connectivity: Social connectivity is an upcoming trend and hence with an average Indian spending 25% of his time on social media, it can help provide the required support to patient communities and allows medical professionals to share their knowledge which allows them to connect with patients for a second opinion.

Wearables: Wearables initially could allow the patients to keep track of their diet or fitness but currently are also being used to measure the basic body parameters like heart rate. There are wristwatches that have a personal emergency response system and thus relay medical data to the server.

II. MATERIALS AND METHODS

The study adopted the preferred reporting items for systematic review and meta- analyses (PRISMA) model. The model is aimed at conducting systematic reviews since it provides flexibility with the synthesis of the existing literature. The steps of the PRISMA model guided the literature search in different electronic databases on the penetration of digital services in India in the health care domain.

III. STUDY SELECTION AND ELIGIBILITY CRITERIA

I selected published peer reviewed journals available from the journals from the time period of 2020 till 2024. A total of 100 articles were retrieved from the electronic databases. The articles were then screened and selected based on the title, abstract, and the complete text. The articles that were included were articles that were specific to India and focused on the digital services in the health care domain.

3.1 Data Extraction

The papers that were excluded were those that were either incomplete, non peer reviewed or articles that did not have their English translations available. To ensure that all the relevant articles were part of the research, a citation chain was created for each of the articles that was retrieved. From a total of 100 articles that were studied, 50 articles were removed for duplicacy and 20 articles were found to be non relevant to the research and hence were removed. The abstracts of the articles were studied in detail after which further 11 articles were removed. There were further 10 more articles that were related to low and middle income countries and were not specific to India and hence they were removed. Thus only 12 articles were considered for the study. The included summaries were then reviewed independently wherein full text was examined and the data collected was also analyzed.

3.2 Data and Sources of Data

Previously published studies were analyzed in the following electronic databases: Springer, Annual Review of Public Health and Therapeutic Advances in Endocrinology and Metabolism. The literature search was done based on search terms like "m-health penetration in India" or "wearables penetration and usage for health care in India". The literature search included terms like "penetration of digital and social connectivity In health care in India", "penetration of wearables In health care in India, "penetration of remote diagnosis In health care in India", "penetration of telemedicine In health care in India" and "penetration of mHealth In health care in India".

IV. RESULTS AND DISCUSSION

4.1 Results analysis and discussion

The papers that were excluded were those that were either incomplete, non peer reviewed or articles that did not have their English translations available. To ensure that all the relevant articles were part of the research, a citation chain was created for each of the articles that was retrieved.
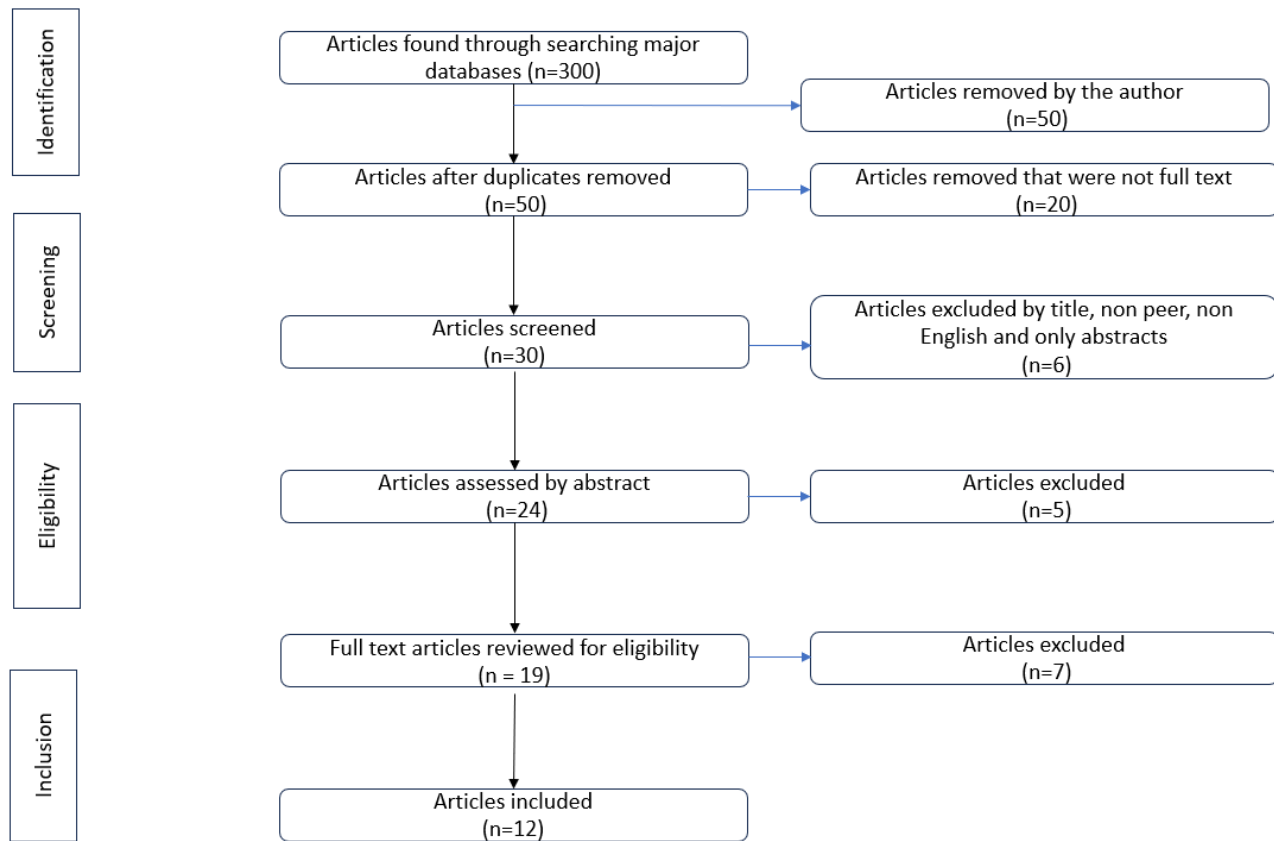
Figure 2:Selection and extraction flow diagram

The articles that were selected were synthesized in line with the research objective. The study was mainly directed towards five digital services, that included m-health, telemedicine, social media, wearables and remote diagnosis.

M-Health: In India, within the year 2018, 2.1 million people had signed up for mCessation program, which was launched to scale up the mHealth initiatives and prevent people from using Tobacco. Different services under MCessation include mDiabetes, mTobacco, mAging and mCervical Cancer. Only a total of 8.6 million people signed up for mDiabetes (McCool et al., 2022). Further there are many companies like 1mg that provide an extensive range of services that include online pharmacy and lab testing services being directly given to the consumers. The platform has close to 160 million users. Similarly, another application mMitra was launched by the Government to help women during pregnancy so that their health could be maintained and they would be able to keep track of their vitals and overall health during pregnancy. The women saw an improvement in their knowledge of health after using mMitra. But the call logs indicated that close to 50% of the women did not answer their calls (Murthy et al., 2020). Thus mMitra was able to bridge the gap between health awareness and its application but it targeted a very small segment of the female population.

S.No.	Title	Utilization	Year of publication	Summary
1	Mobile Health (mHealth) in Low- and Middle-Income Countries	m-Health	2022	The aim of the article was to understand the digital health services in low and middle income countries. Indian Government launched helpline and mobile app to curb the use of tobacco, to prevent diabetes and deploy preventive care for cervical cancer. But the penetration has been quite low. Even for apps like 1mg which provide convenience at affordable cost, the penetration is less than 12%.
2	Effects of an mHealth voice message service (mMitra) on maternal health knowledge and practices of low-income women in India: findings from a pseudo-randomized controlled trial	m-Health	2020	Due to limited access to health care and poor living conditions, women and children in India often die from preventable causes. Thus mMitra was launched which was aimed towards providing improved antenatal care and maternal self care. The program was intended to reach over to 2 million women in Mumbai, who were the target audience for the application. The messages were designed to be delivered two times during pregnancy. The study saw

				improvements in terms of the knowledge of women and increased need for medical support. But 50% of the total calls were left unanswered. 60% women saw improvements in their health awareness with the help of mMitra.
3	Multichannel Delivery In Healthcare: The Impact Of Telemedicine Centers In Southern India	Telemedicine	2023	The study carried out by Delana et al. (2023) indicated the telemedicine penetration in South India. Aravind Eye Care Hospital has been able to set up telemedicine centres for primary care which have become substitutes for the patient visits to the hospitals. This also led to a net increase by 31% and out of that 62% were new patients. Thus Aravind Eye care was able to provide facilities even in remote districts of Madurai. Out of total, 83.5% saw an increase in the patient use of the health care services.
4	Telemedicine: Transforming healthcare in India.	Telemedicine	2022	There are multiple telemedicine projects that have been set up in India. These include projects like tele oncology services in Trivandrum, surgical services in Lucknow and one in Sri Gangaram Hospital. Even in South India, Sankar Nethralaya have set up telemedicine in ophthalmology. It was during the Covid 19 that telemedicine was implemented at scale within the private sector. It has thus become an important stepping stone to achieving Universal Health Coverage. But lack of broadband infrastructure, low internet penetration and lack of in person interaction remain some of the barriers.
5	A survey of awareness, knowledge, attitude, and skills of telemedicine among healthcare professionals in India	Telemedicine	2023	Authors Datta et al. (2023) carried out a study to understand the awareness about telemedicine among health care workers in India. The study highlighted that majority of the participants were aware and had knowledge about skills related to telemedicine. Thus basic awareness exists in the industry with respect to telemedicine but there is a need to train and educate the professionals further about the telemedicine practices.
6	Remote health diagnosis and monitoring in the time of COVID-19.	Remote diagnosis	2020	Authors Behar et al. (2020) carried out a study to understand the remote diagnosis facility present in countries like China, India and Singapore, specially during the time of Covid 19.
7	Digital health and diabetes: experience from India.	Remote diagnosis and telemedicine	2021	Authors focused on the digitization and its use for health care in India. The main focus of the study was on informing urban and rural population about diabetes and how it could be prevented. There are many initiatives that have been taken by the Government of India which are aimed towards health promotion, prevention and primary care. Continuous Glucose Monitoring Systems are a good example of absorption of digital technology. Telemedicine has also played an important role in controlling diabetes cases in the country by way of preventive care.
8	. Harnessing the Digital Revolution: A Comprehensive Review of mHealth Applications for Remote Monitoring in Transforming Healthcare Delivery.	Remote diagnosis	2023	Authors tried to understand the impact of different mHealth applications on remote monitoring in India. There are many telemedicine platforms like Practo which connect patients with the health care providers with the help of video consultations. There are applications for chronic condition management which send reminders to the patients about taking medication and also provide personalized

				feedback. These lead to fewer hospitalizations and also reduce the cost.
9	Connecting the dots: Kerala's use of digital technology during the COVID-19 response.	Digital and social connectivity	2021	Ummer et al. (2021) focused on the model of Kerala and how it was able to use social media to spread awareness about Covid 19. There were many Whatsapp groups that were used to share information about the pandemic. There were also many different kinds of videos and memes being posted by the Government on social media at the time of Covid 19 to spread awareness to reduce the spread of the pandemic in the state.
10	Telemedicine in India: A tool for transforming health care in the era of COVID-19 pandemic	Telemedicine	2020	Authors highlighted how telemedicine has been used in India for a long time. There are many noteworthy examples of telemedicine in India that include mammography services at Sri Ganga Ram Hospital, Delhi; oncology at Regional Cancer Center, Trivandrum; surgical services at Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow, and many more. There are many private sector hospitals that have also shown key interest in the same.
11	Has Covid-19 accelerated opportunities for digital entrepreneurship? An Indian perspective.	Digital and social connectivity	2022	Covid 1 has provided many challenging opportunities for businesses and health care sector has been at the receiving end of it. There are many AI platforms that have been able to automate the customer journey. The organizations have also developed a sustainable ecosystem in the health care domain
12	The changing narrative in the health insurance industry: Wearables technology in health insurance products and services for the COVID-19 world.	Wearables	2020	Covid 19 and the associated lockdown was able to bring about major changes in the health care industry. The health insurance firms tried to enter into interfirm collaboration with the wearable technology firms so as to be able to track social distancing being practiced. The case of data usage permission along with data security were considered to be the prime responsibility of the health insurance firms.

Table 1: Systematic Literature Review

Telemedicine: Telemedicine is being used increasingly across the globe since it helps improve the outcomes and also reduce costs. One of the common models is telemedicine centres used in Southern India wherein there are small primary care facilities that are being run by the providers for preliminary examination. A telemedicine centre is seen to increase the overall network visit rate by 31%, from which 62% are new patients (Delana et al., 2023). This indicates a substantial increase in the access. This not only helps reduce the direct cost but also reduces the indirect cost. For example, Aravind Eye Care System operates a total of 77 primary care telemedicine centres and was one of the early adopters of telemedicine in India. These centres reduce the patient hospital visits by 5.1%. Thus a total of 16.8% of the total visits to the telemedicine centres have become substitutes for the hospital visits. Apart from Aravind Eye Centre, telemedicine services have also been set up in Sankar Nethralaya. Before Covid 19, the penetration of telemedicine was only in public sector but it increased to private sector after Covid 19. With telemedicine penetration prominent in South and North India, some of the barriers to telemedicine and its penetration include low internet penetration, lack of broadband infrastructure and lack of in person interaction (Pandve et al., 2022). Telemedicine has also seen a substantial rise with applications like Practo which allow patients access to online consultation. The app even saw a five fold increase in the two months from March till May 2020 when Covid 19 started to peak in India. The telemedicine approach has also been helpful for the country in screening as well as managing diabetes. The approach is used to also spread awareness about diabetes and its prevention among rural and urban population. The Chunampet Rural Diabetes Prevention Project (CRDPP) is an excellent model for making use of telediabetology in cost effective manner so that it can help support health care (Kesavadev et al., 2021).

Remote diagnosis: Remote diagnosis took off in India at the time of Covid 19. India relied on contact tracing completely at the time of Covid 19 to monitor and tackle the earlier outbreaks at the time of Covid 19. The importance of digital tracing was specifically realized during the time of Covid 19. Aarogya Setu app was set up for digital tracing wherein people who were tested positive were expected to manually put in their test status, which could thereby raise an alert for people in the vicinity (Behar et al., 2020). The app had more than 75 million downloads. There are many mHealth applications that are being used for remote diagnosis. These lead to improved patient outcomes, improved access to health care and reduction in the health care costs. There are many mobile applications for chronic disease management which provide medication reminders and provide personalized feedback.

Wearables: there are two types of RF based sensors for health care monitoring. These are wearable and epidermal sensor and implantable sensors. Their goal is to provide constant vigilance so that it can keep track of the vital physiological parameters of the patients while also allowing them the freedom of movement (Ghosh et al., 2021). There are multiple remote monitoring wearables also being developed. One of the primary solution in this regard is Vincense, which is aimed at monitoring the patients who are suffering from chronic heart and lung diseases. This warns the patient whenever any alert is raised by the system.

Digital and social connectivity: Kerala is one of the states that has seen immense use of technology. Digital tools are being used in the field of communication, surveillance, clinical management and core health system readiness. The state Government of Kerala created awareness videos and circulated them on Social media, which became quite prominent at the time of Covid 19. One such video was seen to have 3.1 million views and 40,000 shares. There were many Civil society organizations that used social media space for communication related to the pandemic. They used their network of 2.2 million neighbourhood group members to disseminate Government orders about information on Covid 19 safety protocols. There were also multiple helplines including DISHA. Telegram was also used to reduce the burden on the health care workers.

Recommendations and Future Work

In India, it can be seen that the penetration of different digital services has been quite substantial. Each of the different digital services, mHealth, remote diagnosis, wearables, digital and social connectivity and telemedicine have proved to be helpful. But the impact is seen to be quite prominent in certain pockets of the country. The Southern States have been able to perform better compared to the Northern states of the country. Within the Southern states, the penetration of all the digital services are being promoted by the Government, which is not seen in the case of Northern States. The penetration of wearables is seen in the states with more severe or chronic cases. Similarly telemedicine is seen to be quite prominent across multiple states. Awareness led to implementation which further led to an improvement in the overall health services. But awareness was found to be one major challenge for the country. Thus it is recommended that the government should be able to make use of the telemedicine centres to raise awareness among the public. It is also required that the Government should also be able to understand how the gap between knowledge and practical implementation needs to be minimized. The mass appeal can be created by camps which need to be set up by the Government across multiple locations. Further the incentive to drive the change is constantly missing. If the Government can decide on the right incentives that would allow the urban and rural population to become more involved, they can ensure that the Governmental measures can be improved.

For the current study, future work is required in terms of understanding the penetration of the digital services across all the states in the country. This would help understand how the digital services are spread across the country and the actions that need to be taken to further improve the digital services in any particular part of the country. The penetration of digital services in the country can further be studied from the perspective of public vs private intervention. This would be helpful in understanding the extent to which the State and Central Governments are taking measures to improve the overall state of health care in India.

Conclusion

The health care industry in India is still lagging behind compared to that of other developed and developing countries. Digitization would further prove to be helpful for the health care sector. Different digital services in the health care domain are mHealth, telemedicine, remote diagnosis, digital and social connectivity and wearables. Within India, many applications have been launched by the Government to raise awareness about prenatal health, diabetes and tobacco. The penetration rate of these applications has been quite low. But the response rate among the impacted population has been quite high. Among wearables, most of the measures are taken by the private sector, both for wearable sensors and implantable sensors, due to the high cost involved. Governments in Southern States of India have taken measures for telemedicine and digital and social connectivity, which proved to be immensely helpful during the Covid 19 pandemic. Future work is required in the study in terms of understanding the exact penetration of digital services across different states of the country.

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