



Preventive Health 4.0

The future model of care for

a Digital India

A Position Paper



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Introduction

The Indian Healthcare market is expected to grow at a CAGR of 23% to USD 280bn by 2020 from USD 100bn in 2015. This is mostly a result of changing disease patterns, rise in lifestyle diseases, ageing population, increase in disposal income, rising awareness and access to health insurance.

There are some key indicators that show that Healthcare is poised to grow

- Health spending will be 6.13% as percentage of GDP in 2021 (in US this figure is around 17%). Currently its around 4.5%. ¹
- Both govt. and private health spend in India will almost double by 2021.

This rapidly increasing need and demand for healthcare services puts immense pressure on the existing infrastructure and stakeholders to efficiently manage the scarce resources while managing the increasing cost burden on patients and families while simultaneously improving care outcomes.

Key Challenges for Healthcare in India

1. Accessibility to healthcare- In India most of our healthcare infrastructure seems to be in the cities. It is estimated that 80% of our doctors also reside in the cities. This means almost 70% of our population in the towns and villages do not have access to them. In order to consult a doctor in the cities a patient would have to travel all the way spending days or weeks in the process. Even in the cities due to traffic conditions, a patient may have to travel for hours for an appointment. Most advanced diagnostic equipment is again centered in the major cities. To compound the problem the lack of computers and internet facility in India further creates barriers to access to healthcare.
2. Rising Costs- Most healthcare costs are borne by the patients themselves. Also due to change in the disease patterns the costs keep going up. A country like India with high population and low per capita income can ill afford to follow existing models of care.
3. Quality of care- Both of the factors above along with the changing disease patterns and aging population are affecting the quality of care. The skewed distribution of healthcare infrastructure is leading to issues like reduced efficiency. This is resulting in reduced quality of care.

While the government and private healthcare systems continue to do their best despite the challenges stated above, there has been a lot of discussion around Connected Care and its potential to become the accelerator in a new healthcare model for India.

Preventive Health is not a new model in India but it has not taken off as envisaged in its previous avatar. The lack of adequate bandwidth and connectivity were major deterrents to the success of these projects. There are numerous examples where the numerous Telemedicine projects that

Preventive health is the key to a healthy India. With focus on mother and childcare, we can create a model that sets up the foundation of a healthy society.

were introduced in the India in the last decade. Though some of them managed to run successfully, most of them have not lived up to their potential. The absence of a nationwide Electronic Health Record has been another reason for Preventive Health, not fulfilling its potential. Today patient records remains in silos, locked away in devices, Hospital Information Management Systems (HIS) and in prescriptions with the patients. Lastly there is no process in place to bring this all together.

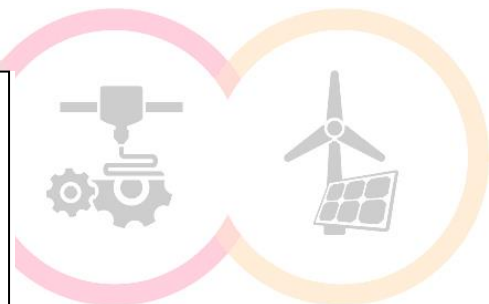
Role of Technology

Technology is going to be a key enabler for this new preventive health model that we are calling Preventive Health 4.0. Our belief is that the healthcare of tomorrow will be delivered on a model supported by Industry 4.0. Technologies like IoT are going to be a key enabler for the healthcare model. It is estimated that 1.9bn devices expected to be connected in India alone, by 2023. IoT and related technologies assume relevance of significant proportions. We will see this transformation across industries including energy, power grids, vehicles, homes, entire cities and manufacturing floors, computers and mobile devices being connected. This will form a very good foundation for Preventive Health 4.0.

The National Health Policy 2017 clearly lays down the provisions for inter departmental cooperation in assuring preventive health based on the use of technology.

The National Health Policy 2017

The policy articulates to institutionalize inter-sectoral coordination at national and sub-national levels to optimize health outcomes, through constitution of bodies that have representation from relevant non-health ministries. This is in line with the emergent international “Health in All” approach as complement to Health for All. The policy prerequisite is for an empowered public health cadre to address social determinants of health effectively, by enforcing regulatory provisions.



Advantages of Preventive Health

The advantages of a Preventive Health ecosystem are evident. For one it would negate the need for patients to travel to cities or within cities for consultations or checkups. Secondly with clinical data available, providers both government and private would be able to develop clinical intervention strategies that would prevent incidents of hospitalizations and reduce the costs tremendously. Finally once we have costs under control and increase in access to care, the efficiency in the healthcare system would go up resulting in increased quality of care.

Today with the forces of Digital Transformation sweeping healthcare we have an opportunity to introduce Preventive Health 4.0. Today most of India is enabled with smart phones. It is estimated that 300 million Indians now have smart phones. With the numbers to rise to 400 million by 2020.²

Smart Phones are now being used to gather health information. There are many startups in India that are using the smart phone based apps to provide doctor consultation. The other big change is the broadband infrastructure in India for connectivity. Today we have close to 420 Million Internet users in India. The overall penetration stands at 32%, with rural penetration at 15% and growing.³ These two factors are combining together and creating an opportunity to increase the access to care.

To add to this many care providers in the government and private space have started leveraging technology like IoT and digital to increase access to care. Hospitals always had access to data, but now they have the technology to drive insights from this data. There is also the exciting prospect of leveraging Artificial Intelligence to further improve outcomes and care

Finally consumers have embraced digital like never before. According to IDC in 2016, 2.5 million Indian consumers bought wearable devices to track their fitness, diet and health parameters. 80% of these devices are at the < \$50 price range and the potential data available from these devices would go a long way in making Preventive Health 4.0 a reality

So to sum it all up we feel that Preventive Health 4.0 would be a combination of Preventive Health 3.0 + wearable devices + Analytics & Artificial Intelligence if leveraged appropriately can help in resolving some of the challenges we listed above.

However the following challenges still remain which need to be addressed by the government with a sense of urgency.

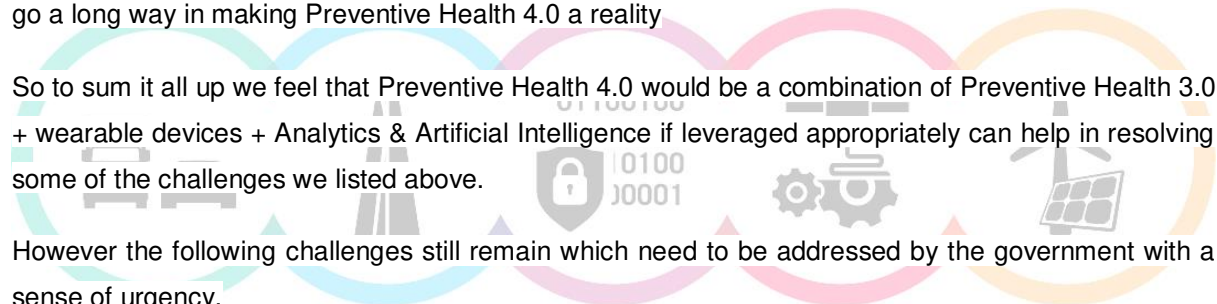
1. Increase in investments for the public health system
2. Investments in connectivity especially in the rural areas to increase the penetration
3. Developing a robust policy on data security and patient privacy
4. Raise awareness through government and public channels on Connected Care
5. Create an environment that facilitates Public Private Partnerships

Here are some of our recommendations for Implementing Preventive Health 4.0

Implementing preventive health – One step at a time

Preventive health initiatives have the potential to deliver value by increasing access to care, improving outcomes, and increasing the standard of health for citizens, patients and healthcare providers.

As we look at the Indian healthcare ecosystem, we clearly see that multiple changes are necessary to the edifice that holds the system together. It is easy to assume that technologies like IoT might solve this problem but in our observation we have seen that the biggest opportunities for change may come with process and people.



Maternal Mortality

Prevention: A study

A pilot study of 656 pregnant women in Padang, Indonesia by Philips Healthcare, assessed the use of remote monitoring through devices and sensors, to facilitate a public-private partnership of midwives and Gynaecologists with regard to five aspects: the ability to improve the detection of high-risk pregnancy, appropriate and timely referral of very high-risk pregnancy to an appropriate healthcare centre, remote monitoring by Gynaecologists of high-risk pregnancies facilitated by home visits of midwives, patient engagement in antenatal services, and improved skills and knowledge of midwives. The three main causes of maternal mortality in Indonesia are preeclampsia, haemorrhage, and infection. The pilot showed that the three factors were screened and women with the higher risks identified. This helped the healthcare personnel to focus the right time and attention to these individuals, helping increase their chances of surviving the pregnancy.

of this basic infrastructure to facilitate customer experience, customer acquisition, and growth. A case in point being how opening a bank account which used to take 5-7 working days has been reduced to a few hours because of Aadhaar. Reliance was able to roll out Jio SIM cards rapidly by validating customers through Aadhaar.

Creating basic infrastructure

The first major change that has to be made is in our understanding of the healthcare system. India is not a monolithic country. We have diversity in language, ethnicity, economic status and political views. To add to this complexity is the fact that we have to cater to 1.3 billion people. Smaller countries like Australia have been attempting a similar system for the last decade but they have yet to succeed in their objectives. One might wonder if a country of 23 million is struggling, is it even feasible to think of such a system for a country of 1.3 billion?

We will therefore have to recognize that there is no single change that needs to be made. We would need a sequence of changes. So in effect, we have to unbundle the problem and refrain from providing a single solution because that is unlikely to work.

The government has already realized this and accordingly taken the 'minimal infrastructure' route to solving some of the other challenges. A good example is Aadhaar. Today 1.2 billion Indians are covered by Aadhaar which is a unique identifier. But it doesn't serve any functionality. For example, a PAN card is a functional identifier. It can be used to understand the financial status of an individual or an entity. But Aadhaar has no similar functionality attached to it. It is a basic infrastructure provided by the government through which an individual can be identified.

However, many organizations have built solutions on top

Technology is changing the game, preventive health delivered on the top of the Industrial 4.0 will involve leveraging the sensor driven technology, improved bandwidth, smart devices, artificial intelligence and reimagining the process for delivering care.

Today the government has introduced guidelines for electronic medical records, standards for medical device interoperability, and infrastructure like Digilocker which can be leveraged as infrastructure to build a connected health ecosystem.

Providing patients access to their medical records

The second change that we might have to tackle is giving the patient access to his own medical records. The patient may need to pay for it but he should have the options of making that choice. In addition to access, there should be provision for the patient to share the data with another provider or hospital for secondary opinion. Such a system is already being piloted in the oncology space and the results so far have been promising. In a sense this is called democratization of data – we set the data free from the confines of a system, device or a hospital – with the patient being the sole owner of his data.

We need a graphic/ chart highlighting all the changes

Understanding process and technology differences

The technology used at the tertiary level is radically different from the technology used at the primary healthcare level. This again established our strong belief that a single solution is not feasible. We would require a federation of solutions – loosely connected, where data is generated, automatically transferred to repositories and accessed.

There have been instances in the past where such a system has been tried and has achieved some level of success. A good example is how this system works in the NHS, the national health system of the UK. Here a patient can access his record across Trust hospitals providing the opportunity for an integrated health management system. An immediate benefit that can be achieved of such a system

An ideal preventive health system should help the doctors and health workers in Primary Healthcare System and not increase their burden

Neeraj Jain, Country Head
PATH

is providing risk stratification scores. This would help a country like India to allocate resources judiciously depending on the risk stratifications. For example, certain parts of the country may have a higher score for an infectious disease and the central and state infrastructure can be moved to prevent and manage that outbreak. But again we understand that any analytics or risk stratification would depend on the efficacy of the data being fed into the platform.

We also feel the incentive systems might have to change. A preventive health ecosystem will provide a holistic approach to managing a patient's health. How the various parts of the system will get incentivized is something that we would need to look at. The other major area that we need to take a very strong look at is the issue of privacy. In this we refer to the case of the Royal Free Hospital in the UK which shared 18 million patient health records with the Alphabet owned DeepMind platform. According to the

Information Commissioner Dame Elizabeth Dunham, they failed to comply with the Data Protection Act of the UK. Such cases need to be avoided because access has to be provided on a need basis.

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It is very important to develop those systems with inputs from end users. We often see technologists and administrators creating healthcare systems, and forcing Doctors to use it. For connected health to be a success, the system has to include doctors. Taking clinical as well as technology inputs from doctors would really help build a very robust system which will increase simplicity.

Who benefits from the preventive health ecosystem?

It is increasingly evident that as a country we would need to make a transition from our current processes, thinking and methodologies to imbibe the true spirit of a connected care ecosystem. But one might wonder what the true benefits of this transition are. While change is good, one must always question change for the sake of change. As we explore the changes that we need to make and pontificate on them, we must also take a hard look at the benefits of doing so.

Doctors, Healthcare Leaders, government officials and experts alike feel that the benefits of a connected care ecosystem can be segmented under three categories

1. Value to citizens, patients
2. Benefits to care provider
3. Incremental gains to the government and others in the ecosystem

Patient is the biggest winner

One might argue that the benefits to the patient far outweigh the benefits to the other two stakeholders in the healthcare ecosystem. We believe that this argument is correct and necessary. The patient is at the centre of the healthcare system. Any changes in the system must first consider the impact on the patient and only then should they consider the impact on other stakeholders.

The patient is the ultimate beneficiary of this system, as he has quality care delivered at his doorstep.

A Preventive Health Ecosystem can provide the patient with many benefits. The most important benefit would be access to their own medical records, across hospitals, doctors, states and healthcare systems. In a way access to one's own records and the ability to view them conveniently increases the sense of ownership for the patient. This can enable them to take responsibility for their own treatment and improve patient compliance. Another advantage is having the choice to share their data. This will help patients share

their data with multiple care providers, which is very useful for secondary opinion or if a doctor wants to check their healthcare history as part of a diagnosis.

Today, a patient does not have access to his own digital health records and increasingly patients do misplace their prescriptions and diagnostic files. Due to this tests have to be conducted again, leading to a condition of over diagnosis and over medication.

Paper records are bulky, often fraught with medical errors and compromise patient privacy and data integrity. Adding to this challenge is the lack of education, especially in villages and Tier -3 towns where the patient is unable to read his medical data. But at the same time they own smart phones and are capable of accessing the internet using it for both communication and work.

“Lack of education, especially in villages and Tier -3 towns means the patient is unable to read his data. But at the same time they own smart phones and are capable of accessing the internet using it for both communication and work.” – Ravi Ramaswamy, Sr Director, Healthcare Philips Innovation Campus

Today, if we look at villages about 25,000 primary health centers are catering to most of their healthcare needs. There are many pilots underway – some using basic technology like IoT, other without which are focusing on increasing access and reducing cost.

The other challenge is the referral system from the primary health center to the district hospital, which doesn't exist today. This leads to re-diagnosis and retests increasing the burden of care on the patient.

Another key associated benefit of preventive health is the improved quality of care delivered. The very fact that treatment history may be accessible and on a digital

record, would reduce cases of misdiagnosis, medical errors and non-adherence to hospital protocols like washing of hands by the medical personnel between patients among others. Today misdiagnosis and over-diagnosis is one of the key reasons for inefficiency in the healthcare system which reduces the quality of care delivered and eventually produces sub-optimal outcomes. With connected care those instances can reduce considerably.

Finally, from the patient's perspective there will be transparency. This not only helps the patient but also benefits the care provider and the larger ecosystem. Early diagnosis and intervention will reduce the healthcare expenses which, in India, are borne by the patient in 70% of the cases.

Helping doctors make better decisions

Preventive Health would clearly aid the healthcare providers. Availability of data would ensure that they would be able to make data driven decisions. While this is already in place in many corporate hospitals across India, connected care would give doctors access to a patient's longitudinal history. In addition, they would have data that can help them see the treatment decisions that have been made in the past and the prognosis of those decisions. Clinical care would evolve from experience-based to

evidence-based care. The reliability and validity of clinical data in a connected care ecosystem can improve diagnosis which in turn improves care outcomes.

“Preventive Health will create the right situation to move from Experience-based care to Evidence -based care”

Dr Vikram Venkateswaran,
Founder Healthcare India

For the primary care sector, connected health would clearly be a boon for decision making. As we have discussed earlier in the paper, more than half a million infant deaths in India may have been avoided if the right diagnosis was made at the primary healthcare centre. A connected care ecosystem would provide the general practitioners, ASHA and rural health workers with a Clinical Decision Support system that would help them diagnose issues in a timely manner and save lives.

Better efficiency in government spending

From the perspective of the government, healthcare administrators, and policy makers, there can be many gains from connected health. All the actions by patients and healthcare providers discussed so far would help improve our healthcare parameters. So key health indicators like infant mortality, maternal mortality and under-five mortality can be reduced. This will result in better health rankings for India, which, of late, have been dismal in comparison to our neighboring countries.

Most importantly, based on the data available through connected care systems, government spending can be allocated more effectively. The data available can be used for health risk stratification to ensure that those at risk of disease get the care that they deserve. Like all fingers are not alike, similarly the needs of various parts of the population are different. Like we have elaborated in the beginning, India is a very diverse country and needs many solutions. The same applies to health. Not all parts of the county need similar health infrastructure. This is something that will get a fillip by leveraging insights from a connected care ecosystem. Doctors and hospital beds can be allocated accordingly and we can relook at the traditional parameters of hospital beds and doctors per 1000 population.

Preventive Health would help us move to a value based case ecosystem

Finally, we can have a system by which those who need care would get it, at the right time, place and hopefully the right cost. So, in essence we would move to a model of evidence based care.

References

1 (source: 1. World Health Organization (WHO), BMI (Business Monitor International), 2017)

2(Source: <https://www.statista.com/statistics/467163/forecast-of-smartphone-users-in-india/>)

3 (Source: https://en.wikipedia.org/wiki/Internet_in_India)

4 (Source: <http://www.theiet.in/IoTPanel>)

5 (Source: <http://cdsco.nic.in/writereaddata/National-Health-Policy.pdf>)



About IET India

The IET is one of the world's largest engineering institutions with over 168,000 members in 150 countries. It is also the most multidisciplinary – to reflect the increasingly diverse nature of engineering in the 21st century.

The IET is working to engineer a better world by inspiring, informing and influencing our members, engineers and technicians, and all those who are touched by, or touch, the work of engineers. The IET office started operations in India in 2006, in Bangalore. Today, we have over 13,000 members and have the largest membership base for the IET outside of the UK. Our strategy is to deliver activities that have an impact on overall competency and skill levels within the Indian engineering community and to play an influencing role with industry in relation to technology innovation and solving problems of public importance.

We plan to achieve this through working in partnership with industry, academia and government, focussing on the application of practical skills within the learning & career lifecycles (particularly early career), and from driving innovation and thought leadership through high impact sector activities.

The technologies that we have chosen to focus on are:

- a. The Internet of Things (IoT)
- b. Future of Mobility and Transport

To drive this focus forward, we have created volunteer-led panels for each.

The IET IoT Panel

One of the most important technologies that will connect all sectors will be Internet of Things (IoT). With 1.9bn devices expected to be connected in India alone, by 2023, IoT and related technologies assume relevance of significant proportions. Across sectors we will see energy, power grids, vehicles, homes, entire cities and manufacturing floors, computers and mobile devices being connected.

Leveraging its position as a multi-disciplinary organisation, IET India launched its IoT panel on February 20, 2015 with Dr Rishi Bhatnagar (President – Aeris Communication) as the Chairperson. The panel, being a first of its kind in India, focuses not only on technology but the application aspect of IoT in various segments.

The focus is to facilitate discussions that will help in making the inevitable connected world more efficient, smart, innovative and safe. It will focus on technology, security and regulatory concerns and the need for nurturing capabilities and talent for a quicker adoption of IoT in all spheres. The panel also constitutes sub panels / working groups focusing on the application of IoT in Agriculture, Retail, Energy and Healthcare domains. Each of these sub panels will work towards undertaking neutral pilots and studies and publishing white papers around the application of IoT in the respective domains.

The IET India IoT Panel will provide a platform for stakeholders to participate in becoming an authoritative, but neutral voice for the evolving movement of IoT in India. It aims to enable all the IoT practitioners (including people from the hardware – devices, portables, sensors, software, business) and IoT enablers (including people from regulatory area, training area, investors in IoT, end users) to work together on relevant areas to make this industry efficient as well as robust. The panel envisions laying a solid foundation by supporting policy makers, industry in the next step of adoption of IoT.

The panel works through Working Groups - Healthcare, Social Impact, Telecom, Smart Living, Skills, Standards, Regulatory & Legal, Cyber Security, Ganga Rejuvenation and Energy.

Read more on <http://www.theiet.in/loTPanel>

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