



Health Technology Infrastructure for Universal Healthcare¹

Kanav Kahol, Priya Balasubramaniam

CONCEPT PAPER

Achieving universal healthcare requires a significant amount of investment into the health technology infrastructure. Technologies under the umbrella of health information technology (HIT) enable secure collection and exchange of health data about individuals. This collection and exchange is the backbone of providing quality healthcare and access to all. By empowering individuals and increasing system transparency, enabling pervasive healthcare delivery, developing a robust payment system and enabling epidemiological and scientific research, eHealth has to lie at the core of any major or minor investment in healthcare.

Today HIT is remarkably underutilized. While India boasts of a sizeable talent pool in software and hardware, there is very little development and deployment work in the eHealth space. Private players are taking the lead on certain initiatives but without a government vision and plan, these initiatives can lead to insular silos of information where hospitals do not share information of patients with the healthcare system forcing the patient to avail care only at their facility. This can be limiting to the vision of universal healthcare. While the government has invested in certain disease specific portals and management information systems, the true potential of eHealth will require a significant amount of investment both by the public and private sector. The goal of the government should be to provide strategic support in the eHealth revolution and oversee deployment and use of the eHealth resources. We believe that government should have key goals in the rollout of eHealth infrastructure and the ecosystem to support eHealth investment and use.

We recommend setting up a federally funded state governed organization called Joint Action for Accreditation of Nationally recognized Centres of Health (JAANCH). The organization would be a state level unit that interact with other state level unit through a federal JAANCH Coordination Board (JCB).

Vision of JAANCH: To enable a universal healthcare system that uses information to empower individuals and to improve the health of the population.

Mission of JAANCH: To improve healthcare of all Indians through meaningful use of Health information technology

The goals of the organization are

¹ This technical paper has been supported by the Royal Norwegian Embassy- as part of the PHFI Universal Health Coverage Grant.

Goal I, “Accelerate Adoption of Health IT and create an infrastructure for information exchange”

The true potential of eHealth cannot be realized till the government makes significant investment and policy decision to accelerate adoption of health IT in all levels of the pyramid of healthcare. Electronic Medical Records must be made mandatory for all private and public healthcare systems. This thrust has to be coupled with development of policy and infrastructure that enables information flow across the system seamlessly. This requires investment in architecture for data interoperability, establishment of standards for information sharing and regulations and incentives to inculcate a culture of information flow. Such a system would be critical in providing populations truly universal healthcare and enable a public health program where information on health and diseases would be available to the government and other agencies with minimal effort. It will also enable in the last stage of implementation, the measurement of health outcomes effected due to health IT and other interventions.

The government must pursue a vision of a learning health system, in which a vast array of health care data can be appropriately aggregated, analyzed, and leveraged using real-time algorithms and functions. This future will require technical innovation to build on the foundation of meaningful use, as well as finding new ways to use that foundation in the practice of health care. There is a need for documenting health care innovation and defining strategies to operationalize selected innovation. Strategic investment on affordable health technologies is required to fully justify the use of health IT.

Goal II, “Improve Individual Care, Improve Population Health, and reduce Health Care Costs through the Use of Health IT,”

Health IT has the potential to be revolutionary in delivering quality care at lower costs. By use of Health IT tools such as telemedicine, decision support, mobile phone based reporting, avoiding pharmaceutical frauds etc. there is a huge opportunity in providing increased access, reliability with low costs. Strategic investments must be made in a custom telemedicine network for universal healthcare and the existing resources of IT need to be leveraged for this goal. A state of the art health management information system should be made for financial management that ensures transparency and cost savings.

Goal III, “Protect the Population” Health IT can have significant advantages for the patient but it poses a new set of challenges pertaining to patient privacy and safety. There is a need to design standards to protect patients and ensure their privacy is safe guarded. A significant patient education program is needed on the safe use of IT and legislation needs to be drafted to protect patient privacy.

Goal IV, “Involve the Population,” A healthcare system needs to be personalized and provide individuals with care according to their expectations and standards. health IT policies and programs must meet individual needs and expectations, help facilitate a strong consumer health IT market, and better integrate individuals and clinicians’ communications through health IT. Population should also be provided with necessary tools to provide timely inputs into how health IT can help or hurt them. Portals need to be made that allow public opinion in the design of health IT systems.

Goal V: Create a health IT enabled workforce. Health IT needs to be included as a curriculum in all levels of healthcare. Specialized workforce in health IT needs to be given special emphasis as they will provide the necessary manpower to realise the vision of universal healthcare by 2020. In this goal, it is also imperative to use IT for education to satisfy HR requirements and create a technology savvy workforce.

Goal I: Accelerate adoption of eHealth and create an infrastructure for information exchange

As India drafts a plan for universal healthcare by 2020, there is an urgent need to modernize, equip and digitize the healthcare system. One of the most critical parts of this effort has to be centered around developing an ecosystem that supports eHealth. The government needs to provide incentives and resources for enabling electronic medical records for all healthcare providers by 2017. This would require legislation that would address a few key barriers to electronic medical records. The first barrier is that of lack of resources for the government healthcare system and medium sized and small sized private players in employing technology for delivering healthcare. By giving tax incentives, providing one time grants and strategic and logistical support, government can address this impediment. The second barrier lies in the fact that use of health IT can significantly alter the workflow of patient care and many of the involved institutions can struggle with a new method of delivering care. JAANCH shall aim to provide technical blueprints and strategic help to institutions for delivering a robust eHealth system. Finally information exchange is limited today due to lack of standards that permit easy dataflow. Government needs to mandate eHealth storage and information exchange standards. It is also important for JAANCH to form Regional Exchange Centres (REC) at district levels. REC's functioning in a district will become the data warehousing and data exchange centers for the hospitals and clinics (both public and private) in a district. All healthcare providers below the district level will work on cloud based system that is operated at a district level. This arrangement is compatible with the current model of the HMIS system in place. This would allow for minimization of learning curve for EMR's. The PHC will have a teleclinic incorporated into the system and district level hospitals would be required to participate in eOPD. In these sessions, they will address patients from remote locations. See Figure 1.

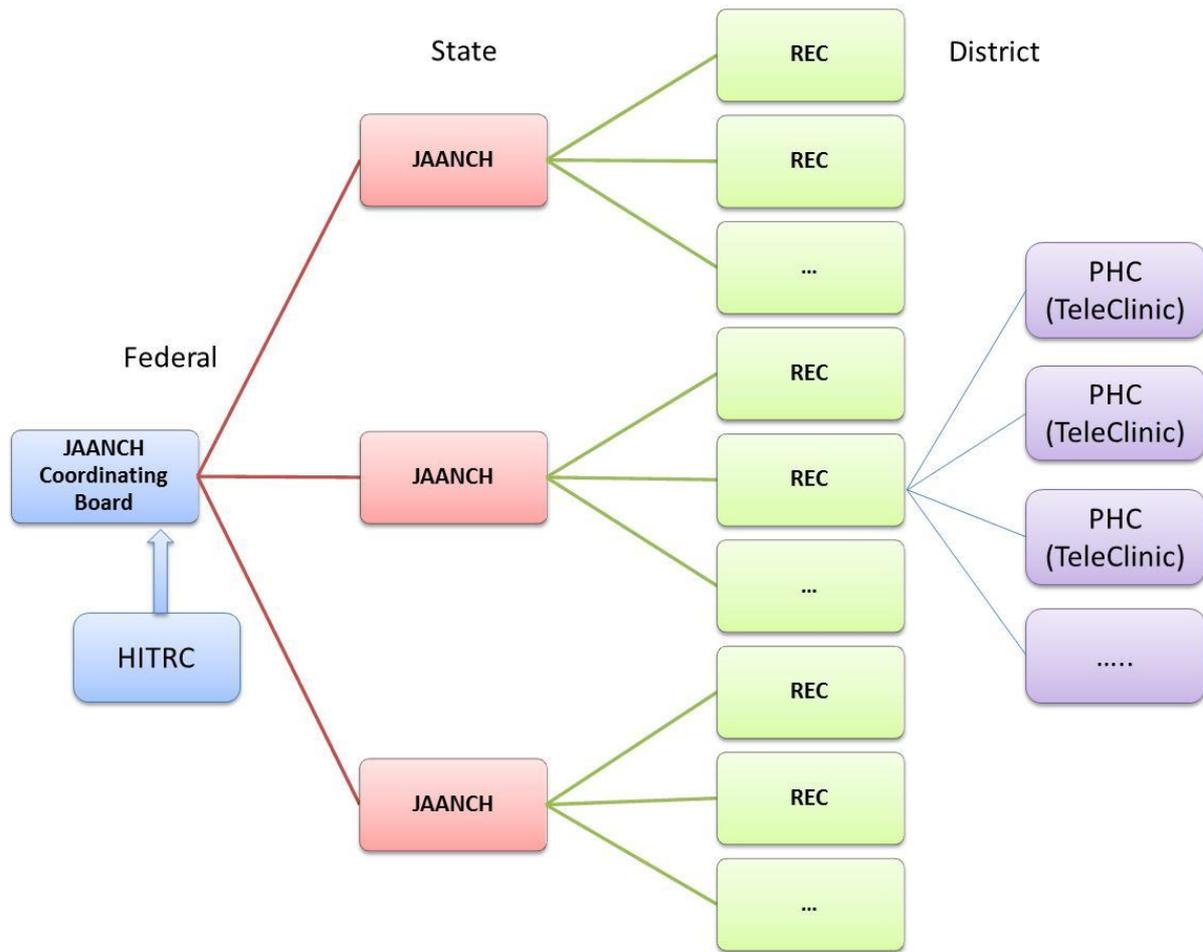


Figure 1. Organizational Structure of eHealth Governance

The three objectives of this goal are elaborated as follows

OBJECTIVE A: Accelerate adoption of EMRs

The strategy here is to entice the user with one time grants and payments to enable a digitized medical records system across the nation. The grants would encourage adoption of EHRs that are certified according to standards, implementation specifications, and certification criteria adopted by the JCB, and meeting certain measures using certified EHR technology based on progressive stages of meaningful use as defined by JCB. Meaningful use would be a set of important criteria to ensure that healthcare delivery institutions use the system and are delivering information that is needed for quality healthcare. Examples of meaningful use would include

1. Fill questionnaires and information required for epidemiological use and focus on national priority diseases
2. Using a software application to inform clinical decisions through electronic workflow of best practices.
3. Entering medical prescriptions electronically.
4. Providing patients with a timely electronic copy of their health information through the UID system.
5. Protecting privacy and security of patient data in EHRs

6. Allowing patients to report issues, complaints and provide suggestions.
7. Enabling local language based communication
8. Retrieve district specific and institution specific information
9. Using community networking and education tools
10. Allowing access through mobile phones for scheduling etc for public.

As the technology matures meaningful use criteria will evolve to focus on health outcomes. Certification of EMR vendors and EMR choices will be done by JCB. The JCB will define a set of certification procedures and certification protocols. The individual JAANCH at state level will actually certify vendors giving states choices in the final implementation. JCB will be requested to work with various agencies to develop the certification process.

An important element of support will be required in Provide implementation support to health care providers to help them adopt, implement, and use certified EMR technology. The Regional Extension Center (REC) Program will provide resources to community health centres to implement health IT, including EMRs. Further support is provided by the Health Information Technology Research Center (HITRC) and office located within the JCB federal structure. HITRC which will work to gather relevant information on effective practices and help the RECs collaborate with one another and with relevant stakeholders to identify and share best practices in EHR adoption, meaningful use, and provider support. HITRC will also have a role in implementation of goal VI which will be discussed later.

All these will have to be coupled with outreach efforts to include public and private partners into the healthcare network. This will include

- Raise awareness among providers about the availability and benefits of EHRs and other health IT
- Educate providers about privacy and security protections as they relate to EHRs and other health IT
- Encourage providers to participate in government universal healthcare programs and other federal initiatives (grants, contracts) in order to take full advantage of EHRs and other health IT
- Increase provider understanding of health IT products and services, so that they may take full advantage of the technologies' benefits

Another important strategy of increasing meaningful EMR usage, is to increase usability of the EMRs. The government should collaborate with industry and researchers to improve the usability of EHRs. The usability of EHRs is considered a key barrier to meaningful use and adoption. Indian Standards Organization can be involved in developing a set of objective and standardized criteria (standards and test methods) that can be used to evaluate and improve the usability of health IT systems. It is important for JAANCH to oversee technology development and ensure it is user-centered cognitive design rather than functional design which can limit the use patterns.

Objective B. Inculcating Information Exchange.

Patient information must follow a patient in the system to allow for critical decision making. We propose that EMR systems be made compatible with the UID project and the UID project be used as a means of storing, indexing and managing information of a patient. With demand increasing, the

government must ensure that exchange standards and infrastructure are in place to meet it. This does not mean constructing significant new national infrastructure from scratch. Rather, the federal government, in close collaboration with state governments should evolve the various current exchange models, so that – taken together – they may serve every health care provider and meet a broader set of health care needs. There are many examples of information sharing that are already occurring in the health care system, and the government should foster the growth and development of these models. Where there are gaps in exchange options, the government will identify the specific barriers to exchange and develop plans to address them. Finally, so that communication and information sharing can take place across various information exchange models – both public and private – the government will advance national adoption of key exchange standards.

A business model needs to be defined for enabling private players to participate in the RECs and JAANCH. One business model will lie in JAANCH accrediting organization and the process of accreditation leading to players being qualified for different levels of the health delivery pyramid. Healthcare facilities will be required to receive JAANCH accreditation every three years to receive a score on how well the facility meets the standards of healthcare set for their level of care. The score will provide healthcare facility with an objective score of performance and comparison to peer facilities. There will also be a process to redefine the universal health entitlement packages as per the needs assessed by structured review of patient volumes and disease burden.

OBJECTIVE C: Ensuring information can be employed for public health

Disease surveillance, epidemiology and addressing national threat from bioterrorism are some of the important impacts that are possible by eHealth. Organizations within MOHFW will have to work with JCB to ensure that REC generate real time and meaningful information for addressing issues of national importance. Scientific agencies such as CSIR should also be involved to ensure that standards allow for broad scientific research.

A key element in this objective would be to track health disparities and address them. A widespread network of information allows for looking at health disparities and then develop delivery strategy that can alleviate the situation. Algorithms and early warning system should be deployed to fully address concerns and help build a preventive strategy to health related issues. Another important element of this is to improve eHealth status for behavioural health and chronic disease care delivery. This can be accomplished by working with the allied health services

GOAL II: Improve Individual Care, Improve Population Health, and reduce Health Care Costs through the Use of Health IT

Improving individual care is a direct result of operationalizing best practices. There is a need to combine more sophisticated uses of health IT and clinical care redesign to achieve better health outcomes and improve health system performance. While accelerating EMR use and technology penetration is important, the most important element is in providing a national network of knowledge that the country can use towards an effective universal healthcare. It is hence important to develop an eHealth program that not only collects data, but analyses it in manners important for the country, population health and individual health.

The first objective would be to support more sophisticated uses of EHRs and other health IT to improve health system performance. As the health IT is rolled out, best practices on use pattern need to be stored and disseminated across the system. The HITRC would play a major role in such innovations. A key also lies in employing clinical decision support systems. Clinical decision support (CDS) systems are tools that leverage EHRs to improve clinical processes. Broadly, these software systems build off of EHRs, giving providers helpful information and analytical support at the point of care. Various clinical decision support rules can help providers analyze patient information, supply them with performance reports against quality measures, and assist them with diagnoses.

JAANCH will also oversee creation of administrative efficiencies to reduce cost and burden for providers, payers, and government health programs. This will be done by providing eportals for information on administrative issues and complete eDelivery of processes. This will be a key recommendation to minimize costs and increase efficiency.

As discussed before development of data driven epidemiology for India is critical and will require organizations to work together and JAANCH and JCB will oversee the efforts. A key element is to define epidemiological measures that are of national importance. JCB and JAANCH will work on defining a list of measures and ensure that certification process includes such measure reporting.

An important use of the national knowledge network that the eHealth allows, would be to better train the healthcare workforce. Often healthcare workforce is allowed only didactic training towards their goals. With the available information on patients and their symptoms, EMR systems and REC knowledge warehouse should be employed to train residents, doctors and allied health services. This is absolutely essential and the technical requirement would be to include a learning core into the data warehousing and EMR systems. Often EMR systems do not allow for availability of such learning systems and it is recommended that EMRs include such system.

The use of electronic information for health promotion has to be supported by the eHealth infrastructure. It is strongly recommended that JAANCH and JCB oversee development of a eHealth promotion portal and develop novel ways to communicate with the patients.

Overall Figure 2 shows information sources that will be recommended to function at different levels of the care. All the portals would have accessibility through mobile phones, sms systems, tablet PC's and conventional computing systems. Development of an eHealth kiosk is recommended to allow for health related access to the populations.

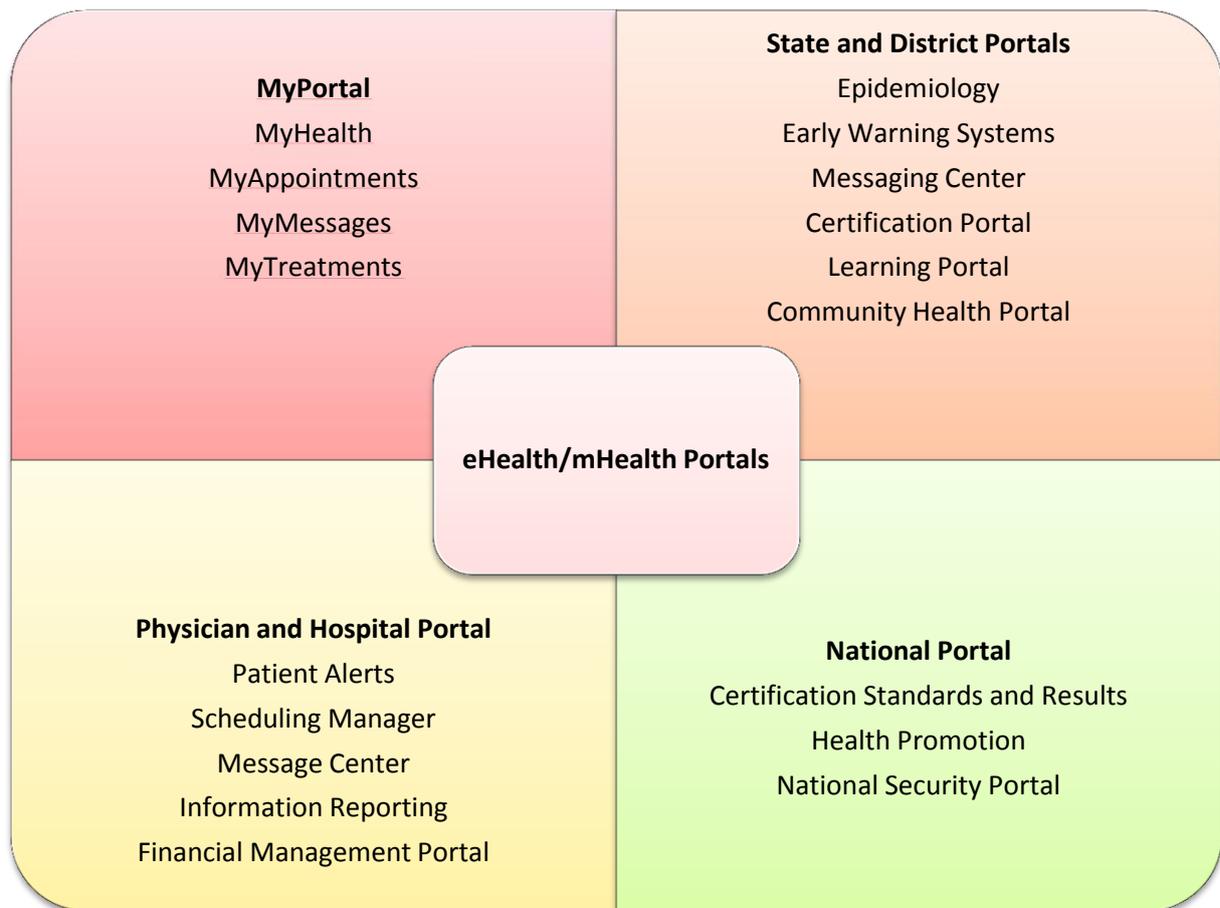


Figure 2. Information Portals

At the first level would lie information for an individual patient. The MyPortal system would allow for patients to review their health information, results of the last few doctor visits, trends of physiological information etc. There will be an online appointment system that would allow for online visit setup. A messages portal would include direct messages from healthcare providers and also messages for health promotion, upcoming health events etc. Finally the system will also include prescriptions, treatment details etc.

At a Physician and Hospital level, there will be access to individual patient portals but also an alert system allowing healthcare providers to follow up on patients. A scheduling manager for clinics and hospitals will help in rapid disbursement of appointments and cases. A message center would function as an offline communication with patients but also as a means of receiving information from the system and from JAANCH etc. An information reporting portal would allow sending information to the RECs. The system will also have a financial management portal that would allow for sending requests for payments, receiving notifications, answer queries and allow for a seamless financial information management experience. The insurance providers would be required to comply with the portals to offer a one stop shop for information exchange.

At state and district levels, the main information would be that of epidemiology. Epidemiology portals would allow concerned officials to see the current health profile and also feed the early warning system. A messaging center is recommended at this level to communicate with other

JAANCH, JCB and RECs. Certification Portal would allow hospitals and healthcare providers to upload their certification applications, receive results about certification, receive personalized strategies on how to better workflow etc. A learning portal for students will be put in place at the district level. This would allow for residents to learn from patients within the district and functionality will also allow logging onto learning portals of other districts etc. There will be a community health portals that will allow community health workers to interact with each other, patients and carry on their administrative functions.

The National Portal in addition to access to information from any district, hospital or patient, would also have a website for certification standards etc. A health Promotion website would be included at the national level and finally a National Security Portal would allow agencies to view health related threats.

GOAL III Protect The Population

This goal is an important element in the national health technology strategy. Protecting the privacy and security of health care information, and ensuring the safe use of health technology, have to be core responsibilities of the government. These responsibilities have needed to evolve constantly with the development of new technologies and the adoption of new health care practices. Health IT – with its potentially dramatic impact on the practice of medicine – requires the government to further evaluate and update policies and programs in privacy and security areas.

Government has to promulgate federal policies to protect the privacy and security of health information. JAANCH and JCB will strive to ensure that federal privacy and security policies, including regulations and guidance are developed. As a first step, JAANCH must craft rules to implement the protect Privacy and Security. Some provisions should be

- Impose direct liability on business associates for compliance with provisions of the Privacy and Security Rules. Lack of following these rules would lead to downgrade in disbursements from the universal healthcare system.
- Establish new restrictions on the sale of protected health information
- Establish new restrictions on disclosing health information for marketing purposes
- Provide increased transparency regarding how health information is disclosed
- Specify the conditions under which covered entities must notify individuals, JAANCH, and in some cases the media, of breaches of their health information

The use of appropriate technology can greatly enhance the privacy and security of health information. JAANCH will encourage the incorporation of privacy and security functions into EHRs and other health IT. JAANCH will require that certified EMRs be capable of:

- Encrypting health information to keep it secure
- Establishing access controls that permit only authorized users to access the system
- Generating audit logs to record certain actions related to electronic health information
- Automatically logging off a user after a set time of inactivity

JAANCH will continue to identify additional security features that may be incorporated into EHR certification and standards in future stages of meaningful use. Best practices with regards to security and privacy need to be documented with HITRC. JCB will work with state governments and State JAANCH to identify and develop best practices to exchange health information electronically among states with varying privacy policies. State Hospitals and care provider both public and private will be required to incorporate privacy and security strategies into their implementation plans. JAANCH will ensure that these privacy and security strategies are strong as part of its evaluation of the states' overall implementation plans and hence contribute to the certification process.

GOAL IV: Involve the Population

Individual participation is a critical, yet currently underutilized, component in improving health and the overall health care system. Health care, which often means initiating medical solutions after something has gone wrong, can only go so far in improving health. Individuals' behaviors, and the ways in which communities foster healthy behaviors, are much more powerful forces for improving population health. But medical solutions, too, can become more centered on the individual: by arming people with knowledge and by giving them and their loved ones greater control over their own care. Empowering community health programs through availability of eHealth and mHealth systems is absolutely essential for universal healthcare. Existing and emerging technologies allow data to flow directly to and from the individual seamlessly. As a result, patient interactions with the health care system are no longer confined by the walls of the clinical setting and may occur frequently in between visits. Personal records on UID system should allow patients to capture their own health observations. Mobile phones with glucometers allow individuals to track their blood sugar levels through their mobile devices. Mobile phones and related applications are being used in mental health to track moods and provide therapeutic interventions with personalized messages, exercises, and coaching. Using these tools, individuals can become more attuned to healthy behaviors, monitor their health.

Any health technology infrastructure needs to have ways and means for personal devices to upload information. The existence of MyPortal will allow users to upload their information and JAANCH should work with personal medical device technology providers to ensure their systems store information compatible with the health exchange systems. Semantic interoperability between devices is critical and needs to be incorporated at the level of personal devices. Consumer health IT is an emerging industry – it is new, fast-growing, and on the cutting edge of technology innovation. The government will remain an active partner to address a number of key steps to collaborate with industry and foster health IT research and innovation. If the government makes more of the data it collects available, technology companies can develop applications and business models that make the information relevant and marketable to individuals. MOHFW institutions directly fund research and development. JAANCH will make to provide deidentified data to industry technology partners to spur growth in this sector.

The benefits of health IT can only be realized if individuals are fully involved in the development of health IT policy and confident that electronic health information is kept private and secure. When including individuals in the health IT policymaking process, JAANCH will seek to participate and organize in on-going public conversations about health IT. These conversations may take place, in online forums serving specific demographics, community-based faith groups, or chronic disease

advocacy groups. JAANCH will participate in these public dialogues with the aim of learning how health IT policy can support individual empowerment.

JAANCH should also convene more consumer listening sessions to augment the Committees and strengthen the individual voice. This is also true when working with the healthcare providers. JAANCH should hold meetings at regular intervals with care providers at all levels of care. This is critical to fully integrate health technology policy with actual health outcomes. It is critical that the healthcare workforce does not see health technology as an extra responsibility but as something they can benefit from. To this effect working decision support tools, getting real time support reaching the maximum number of patients through telemedicine will aid in getting rid of this perception. However there is no substitute to involving folks in focus groups and methods to contribute to national and state level dialogue.

GOAL V: *Create a health IT enabled workforce.*

This is a critical component of any health technology plan. Health technology is only as good as the final user. It is hence important that the healthcare workforce of the future will be and should be proficient in use of healthcare technology.

The first objective within this goal is to create a training program for existing healthcare professionals. Certification on use of Health IT should be created and implemented. These certificate programs should be made mandatory for all healthcare providers and delivered electronically. For healthcare trainees, all curriculums should mandatorily include courses on (1) Health IT fundamentals and (2) Problem Solving through IT. Health IT fundamental course should cover the theoretical foundations and current applications of informatics in health sciences and health care delivery systems including clinical information systems, biological information systems, imaging systems, population health information systems, and health care management and reimbursement systems. It should also cover a practical component of using mobile phones, tablets, computers, internet, basic trouble shooting etc. The second course should focus on medical problem solving through IT. By developing case studies and examples, this course will teach students on how to use technology for their benefit. An important component of this course would be team based problem solving which would give students the theory behind how information flows through the healthcare system and how they can work with peers and agencies to collectively solve individual health and population health issues. This course will also be included in certificate processes. External agencies can be contracted for teaching these courses but JAANCH should develop basic requirements from these courses.

The national Allied Health Services project has already recommended creation of a cadre of health IT professionals. This is a welcome move and JAANCH will be requested to work closely with state level and national level paramedics and allied health services training facilities to create a meaningful curriculum. A key recommendation would be to employ health IT for delivering of education. By using facilities such as simulation centers and telemedicine networks, allied health services training system can deliver quality education in a seamless manner. JAANCH will be required to offer their networks and RECs for such educational efforts.

To summarize JAANCH and JCB will accomplish the following tasks

- 1. Defining standards for healthcare facilities to qualify for different levels of the pyramid and certify healthcare providers:** Healthcare facilities will be required to receive JAANCH accreditation every three years to receive a score on how well the facility meets the standards of healthcare set for their level of care. The score will provide healthcare facility with an objective score of performance and comparison to peer facilities. There will also be a process to redefine the universal health entitlement packages as per the needs assessed by structured review of patient volumes and disease burden.
- 2. Oversee adoption of health information systems and define standards of meaningful use of resources and health management systems infrastructure.** JAANCH will promote use of health systems management information systems and will define stages of meaningful use with stages organized over time. Stage I meaningful use will cover 1-2 years after introduction of health management information systems, Stage II will cover 2-5 years after introduction and stage III will cover criteria after 5 years of introduction of health information management systems. Monitoring protocols and surveillance protocols will be developed and implemented. JAANCH will oversee use of health systems management portal and its meaningful use.
- 3. Provide implementation support to health care providers to help them adopt, implement, and use certified health systems management technology.** JAANCH will gather data and conduct research to identify best practices on implementations of certified health systems management technologies and provide templates for effective use to healthcare facilities.
- 4. Establish criteria and a process to certify vendor HSM technology that can support meaningful use criteria.** JAANCH will work on defining a process for vendor certification according to meaningful use criteria and the vendor product applicability to diseases of national priorities.
- 5. Oversee information documentation, use and exchange between healthcare centers.** JAANCH will develop a standards and interoperability framework (S&I framework) to harmonize existing standards and improve sharing of standards across different organizations and federal agencies, making it easier to broaden interoperability through shared standards for data and services.
- 6. Ensure clinical interoperability of information to enable seamless transition of patient data between healthcare facilities.** Best practices will be defined and disseminated to ensure optimal use of HSEC.
- 7. Define and promote standards of patient privacy and ethical use of patient data.** JAANCH will develop an accreditation process, standards and monitoring protocol to ensure patient privacy and ethical use.
- 8. Ensure that allied agencies can send and receive information from healthcare facilities.** JAANCH will develop procedures to monitor exchange of information with public health agencies, research organizations, regulatory authorities and educational institutes.
- 9. Work with other JAANCH facilities to enable information analysis, coordination of healthcare strategies and work towards real time epidemiology.** JAANCH will serve as a regional information exchange hub to allow for epidemiological analysis and real time surveillance services.
- 10. Promote and document healthcare innovations in healthcare facilities.** JAANCH will be mandated to document innovations in the healthcare delivery seen in different healthcare facilities and develop a national database of healthcare innovations within the healthcare

systems. JAANCH will also conduct surveys of technology innovations in their area and exchange this information with other JAANCH facilities.

- 11. Create a curriculum for courses to educate healthcare workforce on use of health technology infrastructure.** JAANCH should oversee the training of professionals in using health IT and also create curriculum for such training.