Technological Trends in Healthcare an Overview of Technology in Healthcare

Chaitra Hegde

Department of Electronics and Communication Engineering, RV College of Engineering, Bangalore, India

Abstract: In recent times the healthcare industry has been booming. This is mostly due to advances in technology. Technology is playing an important role in improving access to healthcare facilities, reducing costs and improving the overall experience. Technology can be used to improve accuracy of diagnostics, provider faster attention to patients in cases of emergencies, educate people about basic healthcare practices, help people continue medical education, predict ailments and epidemics before they occur and in many other ways. This paper discusses a few emerging trends in technology used in healthcare and introduces some ideas that can be used to further improve healthcare practices. It also discusses some shortcomings of these ideas.

Keywords: Information technology, telemedicine, healthcare, cloud

1. INTRODUCTION

Healthcare is a huge industry in most countries. It involves processes of general checkups, diagnosis, treatment and medication. Technology plays a major role in all these processes. Machines like MRI scanners and X-Ray machines are used for accurate diagnostics. Operation theatres are filled with sophisticated instruments to perform surgeries. Equipment like the heart rate monitor tell whether a patient is in stable condition. Even small devices like a stethoscope and portable BP monitors are technological inventions.

Technology already plays a big role in the healthcare industry. Some latest technological developments can further boost the efficiency in healthcare sector. This paper outlines some technological concepts that are being used and that can be used to improve the quality of healthcare services. The following section discusses some technology which are being used and which can be used in future of healthcare. The section succeeding that mentions some specific applications of technology. Finally, a few drawbacks of over-dependence on technology are mentioned.

2. TECHNOLOGIES IN HEALTHCARE

2.1. Information Technology in Healthcare

Information technology can boost effectiveness of diagnostics and treatment by many-folds. This is the era of big data. Massive amounts of data are being produced and traditional data processing techniques are insufficient to handle this amount of data. But making use of this data can provide many beneficial insights that can possibly revolutionize the healthcare sector.

The large amount of data that we can gather now can be used to monitor health trends world wide. Based on different patterns, occurrences of possible epidemics can be predicted. The areas vulnerable to the outbreak can also be identified and preventive measures can be taken. For example, diseases and symptoms of people in a region can

be recorded and analyzed. The condition in which people live in can also be taken into account. Unhygienic places are usually more susceptible to diseases. The local's lifestyle can also play a role. Based on all this data, the likelihood of an epidemic outbreak in the region can be estimated. Intervening steps can be taken to prevent any outbreak. This idea is being debated to be used in prevention of further outbreak and spread of Ebola.

Similarly, on a more individual level, wearable devices can be used to monitor patient data like heart rate, pulse, amount of exercise, stress levels, etc. and transmit it to the doctor. The doctor can predict future risks that the patient may face, taking into account his current life style, past medication and family medical history and nip the problem in the bud. The wearable device can continuously monitor the patient and record the data. It can be transmitted to the doctor using wireless transfer from a mobile application or using Wi-Fi at home to transmit the data to hospital servers via the home LAN connection, only when it is connected to the home Wi-Fi. The device can be programmed to send the data periodically, like at the end of each day.

This method can also be used to monitor patients who are rehabilitating at home after a surgery or are undergoing some form of medication. The doctor can monitor the patient's progress without the patient having to repeatedly meet the doctor in person.

2.2. Telemedicine

Telemedicine is defined as "The delivery of healthcare services, where distance is a critical factor, by all healthcare professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for continuing education of healthcare providers, all in the interests of advancing the health of individuals and their communities" by the World Health Organization.

For people who cannot continue medical education due to

reasons like lack of medical institutes close by and a need to stay home, telemedicine can be used for medical training up to a certain level. This will be very useful in developing countries like India. Telemedicine centers can be setup in different localities. People from the locality can use this center to continue medical education through distance learning courses. The centers can also be used for healthcare awareness campaigns and for people to communicate with doctors who are geographically distant.

In case of emergency surgeries, if the patient cannot reach the hospital in time, surgery can be performed via telemedicine. There have been instances where a surgeon in a big hospital has guided a semi-trained professional to perform the surgery. The specialist can also control a robot to perform surgeries.This has saved many lives. The Amrita Telemedicine Program in India reports that on 13 January 2003, the program's first remote tele surgery procedure was performed. The Amrita Emergency Care Unit at Pampa, a place in India, saved the life of a pilgrim by a tele surgical procedure using the local telemedicine facility. The cardiothoracic surgeon guided the paediatric cardiologist at Pampa remotely, using telemedicine technology, to perform the procedure.

As mentioned above, patients can use telemedicine to consult doctors and specialists in hospitals in different cities or countries. This will reduce expenditure on travel and accommodation and will provide timely service.

Telemedicine networks can also be used to share research information between different institutions in and outside the country involved in medical research.

2.3. Radio Frequency Identification

RFID tags can be used to keep track of patients in hospitals. The RFID tag can be strapped to the patient's wrist. Every time a doctor or nurse is in the vicinity of the patient, he can access all information regarding the patient's health. The tag can be paired with an electronic pad which will display the information to the doctor or nurse. This allows for accurate and instant acquiring of data.

Wearable devices can be used for patients in ICUs. The devices can monitor different vital signs and in case of certain anomalies it can signal for a doctor or nurse to attend to the patient and also change the controls of certain machines to return the patient to a stable state. For example, if the amount of oxygen inflow to a patient reduces or becomes insufficient, the device can pick up signals which indicate this, like increase in heart rate. The device can then send a control signal to increase the amount of oxygen inflow.

2.4. Electronic Storage

Storing all patient records on a server, instead of maintaining hard copies, can aid the above mentioned RFID process and also ensure more data security and integrity. Authentication will be required to access data, thus unauthorized access of data can be controlled. Changing the data in the records can be done with certain permission only. Software can ensure this is not done without consent. Updating medical records also becomes an easier task, and not to forget the amount of paper and storage space that will be saved.

2.5. SMAC-I

SMAC is a new, emerging IT concept. It integrates four popular technologies, mainly social media, mobile, analytic and cloud computing. Social media and mobile applications are used to connect with and interact with customers. Huge amounts of data is collected from these interaction and is analyzed to figure out a general trend. These huge amounts of data are stored on clouds.

SMAC has not been implemented in the healthcare sector yet, but the idea is being discussed.

(S) Social media - Social media can be made use of to make initial contact with patients. It can be used to spread awareness about healthcare and cleanliness, and it can be done at very nominal prices. It can be also be used as a means to enable people to learn self-diagnosis and treatment for basic ailments and first aid. Social media can be used to collect information about local health of people. This will produce a lot of data all over the world. Studying these trends, outbreaks of epidemics can be predicted as discussed in earlier sections . Data can be collected in the form of surveys or just by studying popular articles and "posts" of social media users.

(M) Mobile smart phones are used by almost everyone. Their prices are coming down by the day. Apps can be made to check the basic health of individuals. There are apps to check heart rate, fitness level, etc. Doctors can track patients using mobile applications. In case the doctor feels there is something wrong with the patient's health, the patient can be informed and further action can be taken. If a patient tries self-medication that can harm him, the doctor can intervene. Smart phones can also be used to collect data which can be aggregated to predict trends in healthcare and used to prevent epidemics.

Analytic - This data obtained from social media and mobiles can be monitored by hospitals. As mentioned above, a general trend can be obtained and using these analytics hospitals can operate more efficiently. Data of individuals can also be monitored and solutions can be given over the phone or internet. Studying all these analytics properly could also possibly prevent outbreaks of deadly epidemics such as Ebola. Based on the of health of people in a place and other factors like life style and surrounding environment, specialists can predict possible outbreaks. Based on this information, necessary action can be taken.

Cloud - All the data collected by above processes has to be managed efficiently. Cloud computing is a good option. Each hospital can have its own cloud, instead of having stacks of paper or their own servers which can prove to be expensive. Previous records of patients can be accessed when and where needed. Also, changing of data without permission or without being identified is harder, therefore the data stored will be authentic. As mentioned earlier, storing of data electronically offers many advantages. Cloud computing provides an even better solution to data storage. Some data can be shared across hospitals and medical centers to get a holistic view of healthcare worldwide.

Internet of Things – SMAC is now evolving into SMACI, the "I" standing for internet-of-things. Devices like MRI scanners, BP monitors, etc. can be connected to the hospital network or the internet. Data is obtained directly from these devices and it can be stored on clouds. Data of individuals can be stored, and general trends can also be observed.

3. SOME SPECIFIC APPLICATIONS

Emergencies like accidents can also be attended to in a more efficient manner using technology. The staff in the ambulance can contact a doctor at the hospital before the ambulance even gets there. The staff can convey the type of injury that the victim has suffered, based on which the right specialist can be assigned to attend to him. The specialist will be ready to attend to the patient as soon as he arrives, thus doing away with unnecessary and possibly costly delays. The ambulance staff can also get instructions, if needed, from doctors at the hospital using telemedicine or some form of wireless communication. A map in the ambulance can point to the nearest hospital. It can also be used to guide the ambulance driver to take the path with least delays (which can be caused due to traffic signals or traffic). A communication system can be established between the ambulance and traffic signal which will ensure shortest time on the road. This system will communicate to the traffic signaling system about the route of the ambulance. The signaling system can accordingly time its signals to allow the ambulance to pass through without and red lights. This can be accomplished using a combination of a smart network between the traffic signals and wireless communication, like RFID, between signal controls and ambulances. Patients can get multiple opinions, not just second opinions, from many doctors just by sitting at home and only visit them if required. This can be done using apps, many of which already exist. They can consult multiple doctors for second opinions and make a more informed and satisfied decision, especially when it comes to big decisions like surgery.

4. DRAWBACKS

Every coin has a flip-side. Technology in healthcare is extremely useful, but at the same time it can cause harm as well. Some drawback are discussed below

With increased access to information, people usually treat themselves and don't consult doctors until a critical stage is reached. They may find solutions to their problems online. But these solutions may not be accurate and the patient might not be knowledgeable enough to recognize subtle symptoms. This could further complicate his situation. Doctors have to be very precise while performing procedures on patients. A small mistake can cost a lot.

Therefore performing surgeries via telemedicine is very risky. There could be problems if concepts are misunderstood during training over telemedicine networks, or if there are communication lags between the doctor and the place where patient is being treated. Due to the massive amounts of data transfer that might take place, using the internet for this purpose might deny other users of bandwidth for their needs. The normal internet might not even provide the required speed and bandwidth. To address such problems the Indian Space Research Organization (ISRO) has introduced the ISRO Telemedicine Network. It has linked hospitals and healthcare centers in rural parts of India with specialty hospitals in cities through INSAT satellites. With technologies like telemedicine and concepts like SMACI, amount of data being shared will increase. Since many of these technologies use satellites for wireless communication, it increases the radiation levels in the atmosphere. This can have severe effects on the environment and our body. The effects are already visible in smaller animals, the population of sparrows and crows has decreased alarmingly in cities in India.

Technology has also caused a shift in lifestyle from preventive medication to curative medication. People are taking their health for granted because they feel that present technology in healthcare can solve any of their problems completely.

5. CONCLUSION

Technology has radicalized the healthcare system and can improve it's services exponentially in the future. Technology developed for different purposes are gradually being used for improving healthcare experiences for users. Even though there are many positives, there are a few negatives side effects of high dependence on technology. These problems can be solved by using technology judiciously as well as enlightening people about the pros and cons of technology in healthcare, and how to use the technology effectively. Technology should be used to guide the healthcare trends of people around the world from curative to preventive. This will ensure long and happy lives. After all, prevention is better than cure.

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