

The Future of Health Care Delivery and the Experience of a Tertiary Care Center in Saudi Arabia

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Five major technological changes will herald a new era in health care delivery around the World: digitalization of the personal health record, sharing of health care digital data across different platforms, applications and institutions, delivery of patient services via the internet, use of the digital media and social networking as a medium for education and preventive medicine and introduction of smart applications as counselors to prevent medical errors. The implications of such changes are huge. Saudi Arabia is not isolated from such important developments. This article explores the future of health care delivery with a special focus on the experience of a tertiary care center in Saudi Arabia that has led the wave in such changes regionally.

The electronic health record (EHR) is simply a digital format of the personal health record of a patient. So far, there are no universal standards that govern such a record, nor are there well developed legal rules that govern its use, but attempts in this area go back as early as 1993.¹ The digitalization of the record has paved the way to several possibilities, including the ability to share detailed medical information between health institutions in a fast and reliable way. It enables encryption of data to maintain confidentiality and security. Recently, it has allowed institutions to grant access to patients to view their records online. The EHR has paved the way to online patient services, online health education, targeted preventive medicine using digital media and social networking and use of medical errors preventive applications. Ultimately, with more applications being introduced to utilize the wealth of data generated by the EHR, health care delivery will undergo such a major change that so far, current predictions fall short of what lies ahead.

Sharing Data

Attempts to create a national personal health record have been attempted in several developed countries,

but such attempts have been hampered by legal issues. The most important factor is the need to access data at geographically widely spaced health care delivery units around the clock. The ability to fulfill this condition was impossible with the paper format of the personal health record. However, the EHR has opened the way to the possibility of a real national personal health record. Such a record must first be linked to the National Civil Identification Number System like the Social Security Number in the United States to achieve a unified method of identification. Debates about such an issue have already started² and within certain closed health care delivery systems, it is now implemented with success and improved quality.³

In Saudi Arabia, implementation of a national digital personal health record has an added value. The citizens of the Kingdom are now being registered using an advanced National Civil Identification System. The project will hopefully register all citizens within the next 5 years. Registration centers have been launched all around the country. Linking the EHR to the Civil Identification Number will ensure the uniqueness of that record to a certain patient. Moreover, the National Civil Identification System has already utilized biometric identification tools in the registration process

and these are of paramount importance as another modality of personal identification. The creation of a national digital personal health record and the infrastructure that will govern it, is a major decision that many countries to this day struggle with, but the implications are huge. It will definitely allow enormous cost savings as hospitals will not create their own extensive information technology departments. It will also allow hospitals that are too small or remote to have their own technology departments to outsource the management of their HERs to one reliable national infrastructure. The data that will be generated from such a national digital health record will be of paramount importance to future planning and solid scientific research. This will probably be the most important factor in pushing clinical research in this country to a whole new level.

King Faisal Specialist Hospital and Research Centre (KFSHRC) is a tertiary care center based in Riyadh and is the main hospital that provides cancer and transplantation treatment in Saudi Arabia. KFSHRC uses an EHR and has entered the Civil Identification Number in its registration process. Moreover, patients treated by KFSHRC are now allowed the ability to access their record online and share their records with their treating physicians at the local hospital. This process is a form of data sharing that would not have been possible without implementation of the EHR, but it is complicated. KFSHRC is currently enrolled in an initiative to develop national standards for the EHR that will be applicable all across Saudi Arabia through the electronic government program called "Yesser". The standardization of protocols will allow seamless transfer of information across the different hospitals and clinics. Moreover, KFSHRC has launched a pilot program in collaboration with the regulating body of the Civil Identification System which will allow identification of patients using biometric data especially for organ transplantation. Another unforeseen outcome of a pilot program that has tested the reliability of the Civil Identification Number linkage to the EHR at KFSHRC is the identification of multiple personal health records for single patients at different tertiary health care facilities. The pilot program will pave the way to collaboration among hospitals to prevent hospital shopping within the governmental sector.

Increased accessibility through "Online Patient Services"

It is envisioned that all communication and media devices will utilize the Internet for communication. Television and radio as we know them today will be replaced by internet television and radio. Landline

telephones have already been replaced to a substantial extent with mobile phones and it is expected that all phones will eventually communicate via the internet rather than separate airwaves.⁴ The role of the internet as a medium for communication cannot be isolated from health care. Use of electronic mails to communicate between patients and physicians was reported as early as 2004.⁵

With the creation of the EHR, this communication was taken to a completely new level. It is now possible to extract all appointments from the EHR to be viewed as an electronic mail. Moreover, alerts can be built into the system to alert patients to these appointments. These alerts can be customized according to the needs of the patient. The means to send these alerts are countless, but in a country where Internet penetration is around 41% and mobile penetration is 186%, i.e. 1.9 mobile phone per capita; the alerts are routinely sent to the mobile phones recorded in the EHR of the patient.⁶ This has been the practice at KFSHRC since 2008.

In June 2011, "Online Patient Services" was launched at KFSHRC. The Service is granted to the patient through a secured registration process and after signing a legal agreement that governs usage of the record. All actions taken by the patient on the record are confirmed through alerts sent to the mailing address of the user or his mobile phone. The services provided are categorized under the following headings: appointments, social services, patient relation services, medical reports, biographic data, medications and authentication of medical leaves. Under each one of these categories is a number of services that are usually delivered to the patient after a visit to the hospital. However, these services are delivered now to the patient within the confines of his home.

The impact of such an "online patient service" is enormous on the traffic in the hospital. About 5000 visits are made to KFSHRC on a daily basis for appointment rescheduling, request of medical reports, refill of medications and a whole spectrum of other services. If 40% of those requests were made online, this would result in a major drop in hospital car traffic, ultimately leading to less need for car parking, less expenditure on airline tickets to fly patients from outside Riyadh, less usage of hospital sponsored accommodations for patients and their companions, higher patient satisfaction, decreased turnaround time for execution of requests, and ultimately, online services will free more resources for a wider population of patients to be treated in a shorter period of time. Our initial analysis indicated that 1 100 000 online patient visits have been recorded. The hospital active patient population is only

450 000. This means 2.4 online visits per patient in just 5 months. Turnaround time for execution of requests was 48 hours.

Preventive Medicine Revisited

One of the main obstacles to screening strategies for cancer or any disease of significant impact on society is the inability to reach out to the target population. Most health care systems use printed material, opportunistic education during hospital visits or audiovisual media to motivate the population to engage in a certain screening program. All these techniques lack two important factors. They are not individual-specific, i.e. they do not target the specific individual who should be screened. Second, they do not reach all the population at risk. The EHR linked to the National Civil Number in Saudi Arabia will allow identification of the mobile phone number of the patient. By law, the mobile phone number is linked to the National Civil Number. An analysis of the EHR based on a set of criteria will allow identification of all members of the target population to be screened and since their mobile telephone numbers can be identified, they all can be contacted in an automated way with the ability to produce statistics about the success of such efforts. A clear example of the application of this strategy is screening for colorectal cancer. The population at risk in Saudi Arabia who are 50 years and older is 1 841 715.⁷ This huge number of people could never be reached effectively using printed or audiovisual advertisement let alone the enormous cost of such an approach. Analysis of the EHR can generate the mobile telephone numbers for all patients who are 50 years or older. They can be sent alerts or educational messages about screening for colorectal cancer along with the steps to initiate the screening process. Moreover, future screening for colorectal cancer can be automated through the system. In fact, a proposal has been submitted already to the Ministry of Health, Department of Preventive Medicine, to launch such a service by the Saudi Society of Colon and Rectal Surgery.⁸ This could not have been imagined without digitalization of the health record.

Online Patient Education

Most hospitals have capitalized on social networking by creating blogs and social networking accounts to attract patients and increase their appeal. Health education has been added into social networking sites; blogs have been started to help educate the public about different disease entities and explain the different treatment options. Health education to any private sector hospital is a powerful tool to attract patients. However, social

networking coupled with health education has a completely different role and scope if linked to the EHR.

KFSHRC launched an analysis of all EHRs that had a record of a blood glucose above 10 mmol/L and patients have signed an agreement to receive alerts about their health conditions. The aim was to send all patients who met that criteria health education tips about diabetes to encourage them to go to the Diabetes Health Education Clinic for an appointment or counseling. The reason why diabetes is a perfect choice for such a service is the high prevalence of type 2 diabetes in Saudi Arabia; it was reported that 31.6% of the population of the central region of Saudi Arabia suffered from type 2 diabetes in 2011.⁹ Moreover, health education for diabetics need no longer be provided through regular clinics, but through internet TV streaming directly from the hospital to those patients. This is an effective method of education and has been tried in spinal cord injuries¹⁰ and a chronic condition like diabetes. Given that 41% of the population of Saudi Arabia have internet access, this will definitely be a powerful tool for education.⁶ Education can also be customized to subgroups depending on their characteristics in the EHR like their age, gender, degree of blood sugar control and type of diabetes.

At KFSHRC, diagnoses and procedures performed are logged into the EHR using the International Classification of Diseases (ICD) and Current Procedural Terminology (CPT). This allows for disease-specific education and procedure-specific education like education about upper gastrointestinal endoscopy delivered to Barrett esophagus patients. Once a patient has been scheduled for a screening endoscopy, the system will capture from the record the diagnosis as per ICD classification and the type of procedure to be performed as per CPT code, and send the patient pre-endoscopy instructions and post-procedure education about Barrett esophagus in the form of messages on the mobile phone.

Smart Applications As Counselors

In a study by Palchuk et al published in 2010, an electronic prescription system allowed identification of 16.1% discrepancies and out of all the discrepancies 16.8% could have led to severe adverse reactions or death.¹¹ Electronic prescription systems allow identification of drug overdose, incompatibilities, synergies and much more. The new wave of electronic prescription systems will question the use of a drug based on the diagnosis of the patient. It seems that more applications in the future will assume the role of a counselor in the doctor-patient relationship and the physician will

be obliged to provide plausible scientific evidence for his actions to a third party and in this case, to a smart application.

At KFSHRC, an electronic prescription system has been implemented. However, it was felt that the experience should include an online service as part of its "online patient services". The patients were given access to their medication records. They can now print a list of their medications to provide it to their local physicians or keep it for their personal needs. Furthermore, they can request refills of medications online which will be sent via priority mail to their place of residence. Most important, the system will be linked in the future to drug information software to allow the patient access to simplified and detailed information about their medications. All these services will definitely impact the daily

practice of the pharmacy. Currently 5% of prescriptions are filled online at KFSHRC and the numbers are steadily increasing.

Conclusion

These services could not have been possible without the EHR. They are the hallmark of a new era in health care delivery marked by sharing of information across several platforms regardless of geographic boundaries, delivery of health services beyond the physical boundaries of the health institution, use of analytical programs to identify the right patient to be targeted with the right message, and most important, digitalization of the doctor-patient relationship in a way never been experienced before. This has led to the introduction of a third party as an impartial counselor in this relationship.

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