Electronic Health Record utilisation:
Challenges and opportunities in Kingdom of Bahrain

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Abstract: As the situation stands in public health outlets in Bahrain, patients' records are kept in a conventional cabinet filing system. This poses a challenge for health care providers concerning continuity and coherence of information and communication between different stages of the health provision chain. Despite a developing e-government initiative in Bahrain, health care must receive greater focus. An electronic health records (EHR) system is expected to provide health care staff with comprehensive patient information to improve communication and aid clinical decision making. In this article, we propose a nation-wide EHR network connecting all public health outlets. Several key issues are discussed, principally the replacement of the current manual system with electronic accessibility to health records. Another issue is sharing patient history, which is essential for medical decision making, between various stages of health care chain such as physicians, laboratories and appointments; the information shared will include test results, diagnoses, management and medication needs. Barriers to implementation and standardisation are also an issue. Finally, the technical issues of security and malleability are assessed.

Keywords: Electronic Health Record, Healthcare Management, Healthcare Standardisation

1   Introduction

Bahrain has recently taken important steps in establishing e-government. Instead of waiting in long queues, citizens can now finish their transactions online in a few clicks. Government Web sites allow the public to pay bills, renew documents, get information and, pertinent to this paper, make medical appointments at the largest national health care provider, Salmaniya Medical Complex (SMC). The efficiency of such online booking leaves much to be desired, but the existence of this initiative put the present proposal in context.

The authors propose in this article that Bahrain needs an electronic health records (EHR) system. There are 21 public health centres (HCs) and six government hospitals in Bahrain, a large hospital complex (SMC), and a number of other private health care providers of various sizes. The main feature of health-related information, specifically medical history, is discontinuity and lack of cohesion. This is a serious impediment to optimal service in the health care sector.

The situation as it stands currently involves old-fashioned manual handling of paper and files. These are stored in large rows of shelves scattered in the documentation departments of HCs. Each patient is assigned to the HC closest to his residence, where his or her individual file will be kept. New or first-time patients must wait for their files to be opened. In the course of the work day, files must be hauled back and forth from the documentation offices, which results in big delays and long queues. Patients will often wait, on a busy day, from 15 min to 1 h to see the doctor, and nurses can be seen pushing large supermarket-style carts full of files. Any loss or misplacement of the file can cause further delay and can keep the patient waiting for hours. In some cases an important part of the file (such as a test result) may be lost, which has negative implications for the technical aspects of treatment (drug regimens, test results, etc.), and may force a patient to wait days for repeat of tests or renewal of documentation. The cost and wasted effort caused by such delays are immediately apparent.

Many developed and developing countries have already implemented such systems. In this article, we propose a nation-wide, online EHR system tailored to the needs of the Kingdom of Bahrain. This system will document in detail patient history; record vital readings (such as blood pressure and blood sugar) and lab test results; update drug regimens; and for the sake of coherency and continuity, be open to entry of new information on the part of medical health care provider users.

Implementing a health records system will pose several challenges in terms of technical and human resources. The appropriate network system must be chosen for practicality and ease of use. Software has to be specifically designed to fit the needs of health care provision staff, which must be trained to use the system effectively. Maintenance, standardisation and upgrades will have to be addressed, as will the vital issue of security and privacy. And, overall, continuity and cohesion of information will be the main objectives of the system.

2 Background

An EHR is a chronological electronic record of patient health information gathered over the history of a patient's interaction with the health care system. In other words, an EHR preserves in digital format all information concerning a patient's health status. This information includes age/sex, progress notes, problems, medications, vital signs, past medical history, immunisations, laboratory data and radiology reports. Not only does an EHR make patient information coherent by saving it on a database and putting it on a screen, but it also allows the clinician to modify this information. By applying different combinations and permutations to the data, the clinician can reach new insights and made better clinical decisions. The EHR system maintains a comprehensive record of a patient interaction, while also supporting statistical analysis, epidemiological research, quality control and operations chain management. EHR storage and retrieval of individual patient records are accessed through computer terminals, which are usually part of a wider network. This network is usually based on a central database warehouse and connects many terminals in many separate physical locations.

Historically, the first known medical record was developed in the 5th century B.C. by the early Greek physician Hippocrates, also known for the Hippocratic Oath (400 B.C.E) (The Leapfrog Group, 2004). He prescribed two goals: (1) a medical record should accurately reflect the course of disease, and (2) a medical record should indicate the probable cause of disease. Although these goals are still pertinent, modern EHRs systems can also provide the clinician with additional functions that flow from the benefits of efficient and rapid computerisation.

In modern times, the first EHRs began to appear in the 1960. Summerfield and Empey (1965) reported that at least 73 hospitals began used to EHR systems. Many of today's EHRs are based on the pioneering work done in the United States at that time. Significant early projects include COSTAR (the Computer Stored Ambulatory Record), developed by Barnett et al. (1984) at Harvard, which is placed in the public domain in 1975 and implemented in hundreds of sites worldwide. Finally, we mention THERESA developed by Walker, at Grady Memorial Hospital, Emory University, notable for its success in encouraging direct physician data entry. These early projects faced significant technical hurdles, including non-standard terminology and system interfaces, which remain implementation challenges today.

As of 2000, adoption of EHRs and other health information technology (HIT) (such as Computer Physician Order Entry (CPOE)) was minimal in the United States. Less than 10% of American hospitals had implemented HIT, while a mere 16% of primary care physicians used EHRs. In 2001-2004, only 18% of walk-in patient transactions used an EHR system. The Leapfrog Group reported that in 2005, 25% of office-based physicians reported using fully or partially electronic medical record (EMR) systems, an almost one-third increase from the 18.2% reported in 2001. However, less than one-tenth of these physicians actually had a complete EMR system (with computerised orders for prescriptions and tests, test result reports and physician notes). As of 2005, one of the largest projects for a national EMR is by the National
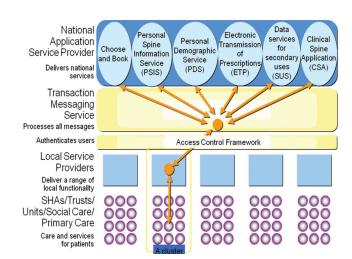
Figure 1 - The NHS NCRS

Source: NHS Connecting for health.

Health Service (NHS Executive, 1998) in the United Kingdom. The goal of the NHS is to have 60,000,000 patients with a centralised EMR by 2010 (illustrated in Figure 1). In the Canadian (Healthcare Infoway, 2007) province of Alberta, the Alberta Netcare project is a large-scale operation, an EHR system.

Many studies have researched the field of EHR and health care systems, in general. In a wide-ranging study by Häyrinen et al. (2008), they reviewed the research literature on EHR systems. The aim was to find out how EHRs were defined, and how the structure of these records was described, and in what contexts are EHRs used. For this purpose, four electronic databases were studied: Pubmed/Medline, Cinalh, Eval and Cochrane. The authors, working from Finland, found that although the concept of EHR comprised a wide range of information systems, very few papers offered descriptions of the structure of EHRs or the terminologies used. EHRs were used in primary, secondary and tertiary care, and data were recorded in EHRs by different groups of health care professionals. This article also looked at information quality and found that in several studies the use of an information system was conducive to more accurate documentation by health care professionals. The quality of information is particularly important in patient care, but EHRs also provide important information for secondary purposes, such as health policy planning.

In a white paper entitled Health Informatics – Requirements for an Electronic Health Record Architecture (2005) published by the Australian Standards Bureau, a complete architecture and methodology for EHRs in Australia is outlined. Organisations such as the Department of Health (South Australia), Engineers Australia, Health Information Management Association of Australia and the Health Insurance Commission were represented in the cooperation committee who wrote the report. The report starts with an interesting note: 'Standards are living documents which reflect progress in science, technology and systems. To maintain their currency, all standards are periodically reviewed, and new editions are published. Between editions, amendments may be issued. Standards may also be withdrawn. It is important that traders assure themselves they are using a current standard, which should include any amendments which may have been published since the standard was purchased'.

The ISO (International Organisation for Standardisation) also has guidelines for EHR standards. The organisation, which describes itself as a worldwide federation of national standards bodies, has the goal of setting all kinds of standards for international application. The ISO approaches the definition of EHR in terms of form on the one hand, and structure on the other. The ISO stresses the 'key' role of interoperability, in that from the viewpoint of standardisation, the single most important characteristic of the EHR is the ability to share EHR information between different authorised users. In technical terms, this requires

interoperability of information in the EHR and interoperability of EHR systems that exchange and share this information. According to the ISO, there are two main levels of share ability or interoperability of information: functional interoperability (ability of exchange of information) and semantic interoperability (consistency of defined concepts). The 'Integrate Care EHR' according to the ISO is defined as 'a repository of information regarding the health status of a subject of care in computer processable form, stored and transmitted securely, and accessible by multiple authorised users. It has a standardised or commonly agreed logical information model that is independent of the EHR systems. Its primary purpose is the support of continuing, efficient and quality integrated health care, and it contains information which is retrospective, concurrent and prospective'.

In their white paper Toward Health Information Liquidity, Penfield et al. (2009) explored the success of integration in existing systems. They concluded that while HIT was indispensable for providing high-quality health care, information technology (IT) alone was not enough and that training and information flow issues need to be tackled. In a study concerning the Danish health care system, Hostgaard and Nohr (2004) explore the spread of implementation of the health information system in Denmark and the importance of the concept of change readiness-research (CRR). In a wide ranging study including questionnaires and development of study models, the research assessed employee inertia and lack of computer skills in relation systems, with immediate implications for work flow. They concluded that such impediments have resulted in the successful adoption of only few of the Danish authorities' recommendations regarding EHR systems, and that employees' fear of appearing stupid left much to be desired.

Gans et al. (2005) surveyed a nationally representative sample of medical group practices to assess their current use of IT. Results showed that adoption of EHRs is progressing slowly, at least in smaller practices, although a number of group practices plan to implement an EHR within the next 2 years. On the other hand, the process of choosing and implementing an EHR appears to be more complex and varied than the authors expected. This according to the article suggests a need for greater support for practices, particularly smaller ones, in this quest if the benefits expected from EHRs are to be realised.

In an interesting study entitled Paper Versus Computer: Feasibility of an Electronic Medical Record in General Pediatrics, by Roukema et al. (2001), the authors stated: 'The implementation of EMR systems promises significant advances in patient care, because such systems enhance readability, availability and data quality. Structured data entry (SDE) applications explained by Roukema et al. (2001) can prompt for completeness, provide greater accuracy and better ordering for searching and retrieval and permit validity checks for data quality monitoring, research and especially decision support. A generic SDE application (OpenSDE) to support document of patient history and physical examination findings was developed and tailored for the domain of general paediatrics'.

Burt and Sisk (2005) looked into the greater use of EMRs, which according to them has the potential to improve the quality of medical care and has become a goal of the U.S. administration at the time. They go on: 'According to the National Ambulatory Medical Care Survey, only an average of 17.6% of physicians reported use of EMRs in their office-based practices. The adoption rate did not increase from 2001-2003. Practices with more physicians and those owned by health maintenance organisations (HMOs) were significantly more likely to use this technology, but use varied little by the characteristics of individual physicians, the practice's scope of services or the practice's sources of revenue'.

Many IT authors have commented on the issue of EHR systems and their implementation. Walsh (2004), referring to the UK healthcare system indicated, 'the clinical usability of electronic records systems is particularly relevant with the recent appointment of service providers to implement the National Integrated Care Record Service for the NHS as usability also affects patient care'. On the issue of usability, Zitner (2006) had this to say, 'Usability concerns whether an information system is structured so that users can get an answer to fit their purpose'. Laerum et al. (2003) comments have direct application to the situation in

Bahrain: 'The effects of introducing an EHR system and removing the paper-based EHR might depend on the size of the hospital, nature of work at the department, functionality in the EHR system introduced and preparedness, ability and willingness of the hospital organisation to adapt to the changes introduced'.

3   Methods

Questionnaires were distributed to physicians, dentists, surgeons, health care technicians and administrators in SMC and Bahrain HCs. A number of health care providers and health administrators were also personally interviewed, and a focus-group was held that included several groups from the health care provision chain. The data analysis and interpretation was carried out on the basis of the information provided. The questionnaire addressed several issues, in the form of both graduated scale questions and open-ended questions. Participants were encouraged to speak freely about the idea and provide input about their attitude regarding the possible implementation of an EHR system and other specific areas like barriers to implementation and their possible role in such a system. It was essential to find out employees' ideas and perception of a proposed EHR. The questionnaire, in addition to exploring the specific needs of Bahrain MOH employees, was supplemented by personal discussion, which resulted in unexpected and valuable insights into the general 'feel' those clinicians, administrators and technicians would have towards such a future EHR.

Interviews were conducted with several clinicians, administrators and health care technicians (e.g. X-ray technicians, opticians and dental assistants) at important junctions in the MOH system. For example, several highly placed Ministry officials and the heads of certain auxiliary medical departments within the health provision chain were asked for their opinions. In addition, filing section employees and some patients were sounded out to hear their viewpoints about the current manual filing system and the benefits gained by implementing new EHR systems.

A sample of the main questions raised was as follows: What are the obstacles do you face of using the manual system? And how does it affect your administrative or clinical work? Is it important to implement new technology? What do you expect from introducing the new system? Who will benefit? What do you think about the cost? If you think the system should not be implemented now, what is the alternative and when should an electronic system be introduced?

4   Challenges

Implementing a new system in a large organisation faces the challenge of resistance to change. EHR implementations follow the 80/20 rule (Pareto's Law, Pareto Principle); that is, 80% of the work of implementation must be spent on issues of change management, while only 20% is spent on technical issues related to the technology itself.

The health care industry has more trained professionals with advanced degrees than any other industry. However, IT skills have not been an integral part of health care training. Most health care professionals know little about databases and networks.

The length time that data will be stored in the EHR will be a challenge, as will methods to ensure the future accessibility and compatibility of archived data with yet-to-be developed retrieval systems, and how to ensure the physical and virtual security of the archives. The records might one day be used longitudinally and integrated across different sites. Although it is currently unknown precisely that how long EHRs will be preserved, length of time will exceed the average shelf life of paper records. The evolution of technology is such that the programs and systems used to input information will likely not be available to a user who desires to examine archived data.

It may be difficult to update records at both locations, providing two different facilities. To satisfy this problem, we can suggest: A centralised data server solution (probably located in the Ministry building), and

a peer-to-peer file synchronisation program. Synchronisation programmes for distributed storage models become useful when standardisation has occurred. Merging of already existing public health care databases is a common software challenge. When EHR systems provide this function, we will improve health care delivery.

Privacy is one of the main challenges that apply to both paper and electronic records. If protection and security are not part of the systems developed, people will neither trust the technology nor will they participate in it. So, we must establish rules for access, storage, auditing, rules on the use, disclosure, collection of personal information and transmittal of EMRs.

Many healthcare providers care about the cost for applying EHR system. If providers do use an EHR system, not only do they have to pay for it, but they also have to pay for the maintenance of the system and classes to train staff. Moreover, repair and maintenance technical is costly.

Failure or damages caused during installation or utilisation of an EHR system has been feared as a threat in lawsuits. When records are centralised, it is often difficult to determine whose responsibility it is to maintain the records. If a company agrees to manage and maintain records but goes out of business, how does that impact the health care provider whose ultimate responsibility it is for record maintenance?

Standardising EHR systems requires network, health care terminology and interoperability standards in all over the world that is difficult because different communication standards are used in different domains. Standard methods of representation and communication make health data universally available to support care, enhance preventive medicine practices and enable population-based interventions.

5 Required System Components

The software involved in the EHR should be especially chosen for the specific needs of the users. Off-the-shelf commercial software in this case will not be sufficient to fit the challenges posited by this system. In the case of EHR, software firms and programmers may be hired by the organisation to design the system based on the results of the research into staff. This design will also fulfill the requirements of flexibility, compatibility with earlier and future systems and ease of use. The Ministry may choose to contract a local company to carry out the programming, which will cooperate with Ministry engineers. This team will ensure that all requirements are met and that resources are used efficiently. The user interface should be simple to use, immediately comprehensible and intuitive. Once inside, the user will have several options. These options will cover patient medical history, personal history, previous appointments, test results, previous treatment, inpatient period if any, drug regimens and patient psychology and behaviour. Further, physicians should be able to modify and add information, without in any way disrupting the continuity of the information. They should also be able to add notes and observations and access past information. Procedures and date will be recorded. All newly prescribed drugs will cross checked against previous drugs and the clinician will assess potential adverse effects of drug cross activity. For the purposes of security, all entries and access of information may be record in a central database log. No information will be printed unless authorisation is given by an administrator entrusted with these decisions.

The platform used for this system will be chosen for flexibility and compatibility with future developments. An Open Standards Web-based EHR system will serve well the needs of MOH employees. Open Standards will mean that continual improvement and evolutionary change in the system will be possible. In other words, any needs or conditions that were not envisaged in the original implementation will be catered for through an open system. Users will be able to create their own parameters that may be shared with others. For this purpose, the implementers might use an openEHR Archetype Editor in addition to constructing a Web-based Java Environment EHR application from the openEHR Archetypes Data
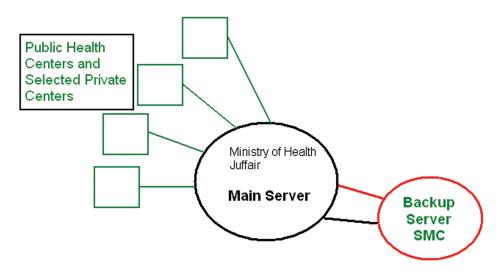
Figure 2 - The network general structure

structures using Eclipse Software for example. For the sake of mobility, the databases might be exported into an XML language format for better remote access.

OpenEHR will also open standard medical data structures and features that provide not only standard interoperability solution, but flexibility as well in constructing a layer in EMR/EHR. In addition, it contains a maximum set of globally common clinical concepts as archetypes data set, while common medical parameters, tags and terminology might be set to global standards.

Java can be implemented over an independent platform, to be used in the role of a platform language. Also, Java is more sophisticated; this comes from its common use as a community language, which is useful for the key goal of interoperability. Interoperability, flexibility and compatibility in different server platforms from Unix, Windows and Linux might be served from the Java platform, which is provided free by the Sun Micro system Corporation.

The data format of choice for the EHR system could be XML. Most mobile browser interfaces now use X-HTML, C-HTML or the original html format. This will allow for easy mapping into a mobile Web browser environment using XSLT an XML processor. A XML data format will provide faster real-time functionality with more simple codes to use compared to database format.

The system will use existing Internet and Intranet connections within the MOH. The Internet will connect public HCs and private health care service providers who are not part of the EHR intranet system. On the other hand, health care outlets already linked up to the EHR intranet system will take advantage of its already existing and underlying infrastructure. Highest security standards must be maintained. Encryption programs will exist on both sides of the EHR interfaces. The heart of the network will be the MOH main building in Juffair city. There, the physical mainframe servers will be housed. However, there will also be contingency emergency just-in-case backup servers, illustrated in Figure 2, preferably in SMC where the bulk of major medical procedures are performed.

The intranet can include firewalls, with a LAN system, so that the system can only be accessed from inside the clinics. Whenever a user requires electronic communications or world-wide useful information, he or she can enjoy all the attractive services of the Internet directly from the workstation using pre-installed client applications, e.g. Mosaic for accessing to WW or Gopher server, e-mail client program communicated with POP3 mail server, telnet application for connecting online MEDLINE services provided by the medical library of the university outside the hospital or the network.
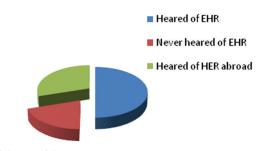
Figure 3 - Familiarity with EHR idea

6   Results

6.1   The Questionnaire

Among the Salmaniya Health Centre clinicians, almost all treated acute cases, with 50% answering that they also treated emergency cases. As illustrated in Figure 3, when asked if they had heard about an EHR system, about 20% replied 'no', while many others said they had only heard of it being implemented abroad. As for how clinicians visualised their role in the use of the EHR would be, most attested that they would either do data entry or had no conception of their role. Almost 30% of physicians and dentists stated that data in EHR would not help diagnosis and that only experienced clinicians can be a good diagnostician, regardless of computerised information.

A question about barriers to the smooth functioning of the EHR has been illustrated in Figure 4, which yielded the most interesting results. The respondents were encouraged to talk at length about their worries, and one of the foremost barriers in the minds of the staff was the lack of time. They thought that the system would be time-consuming, because writing on paper was much more straightforward and flexible. Added to that was lack of training and IT skills, which would make the system more difficult to use and waste more time. Excessive bureaucracy, many stated, was also a major barrier that would hinder both training and maintenance. One clinician stated, 'Maintenance is slow for instruments we have already. What would happen if we had a complex EHR network'? Another said, 'There are committees on committees. The bureaucracy involved in an EHR system would be too big'. Yet another declared the opinion that an external company would have to handle the whole project and 'dictate' its decisions. Technically, most clinicians stated that an intranet would be the better choice for the network, because they did not like the idea of the network being accessed from outside MOH installations.

In the public HCs the results were different in some points yet gave the same overall impression of the SMC results. HC results showed that 30% of respondents had no idea about EHR systems, 56% had a little or average knowledge about it, while only 14% had a clear idea about such system because they were using it in a private HC. Almost all clinicians realised that implementing an EHR system coupled with staff training would result in a more efficient, more organised and less time-consuming record keeping of patient information. That is why many respondents stated that a sufficient training budget had to be considered by MOH administrators.

More than 60% of HC employees partly agreed that essential areas in their daily work will be improved by the implementation of EHR. Many others thought an EHR would have a positive effect on the quality of the health professional work. About 80% of the employees feel that in the long-run implementation of EHR is a precondition for the continued improvement of service.

On the issue of obstacles to EHR functionality, most HC respondents felt that one of the biggest barriers is standardisation, while worries about time constraints and training also figured prominently on the list of staff's concerns. It was also felt that other barriers were privacy and confidentiality, patient information security and other legal issues (such as clinicians hiding their mistakes by changing records after the fact),
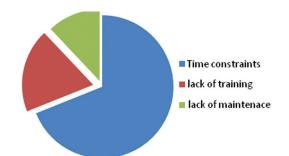
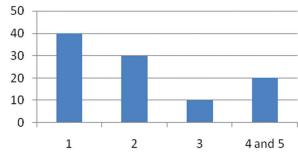**Figure 4 - The perceptions of EHR barriers**

Figure 5 - Percentage of respondents who answered the question 'How much will an EHR help in diagnosis'? on a scale from 1 to 5

in addition to gross technical problems such loss of electricity power. It is interesting to note that during our study, some responds asserted that the MOH is already studying setting up an EHR system and starting to computerise information in some departments at a basic level. Some administrators spoke of a pilot project to be implemented soon in SMC. Asked to comment on the idea of an EHR, many staff members answered that the system should be user friendly and easy to access, that the system can only be as good as its software and the need for parallel manual systems and back-up databases.

The results of the survey shows that first, the employees are interested in the implementation of an EHR system despite the fact that many had no previous information about EHR systems. It is also evident that many of the respondents believe that medical staff generally seem to lack basic computer skills and there is a need for the basic instruction in the use of computers. The results also show that some of the employees worry that the implementation will complicate things, as they believe that the hospital management will not offer adequte support or maintenance.

In general, we can say that most of the stakeholders support the implementation of an EHR system in Bahrain because they believe that eventually the system will improve clinical work and communication between different parts of the health system and because an EHR system is the future of healthcare. In addition, feedback from citizens and residents has shown that they regard health-related services as being among the most important services, which they believe should be improved. The Ministry of Health provides medical services and medication free of cost to Bahraini nationals at public health facilities and pharmacies. To facilitate these services, a seamless integration of all public health facilities, maintaining health records for all patients and an online interface with public pharmacies, is required.

In terms of accessibility, the system that will be implemented at the HCs and hospitals in Bahrain will be designed for easy and quick access by the authorised users such as doctors, nurses and top management

at MOH. Because the records will be available through the Internet and because patient information will be accessible at all times, the system will be open only to password-enabled authorised users. Also, there will be different levels of access specific to different categories of users such as system administrators, health administrators, clinicians, auxiliaries and reception employees. These levels of access give different viewing and editing powers to different user category that will provide more compartmentalisation and therefore security.

The system will provide a suitable manner for the user to interpret information and also to provide the authorised users with the capability to read all the information from different operational and scientific viewpoints. Access to any backup databases must be appropriately maintained and restricted and made available at all times.

As regards security, any EHR system must be designed to be more secure through providing authorised access only to the user by application of internal and external firewalls and encryption technologies. Because the system will be located on the Internet, anti-virus software will be installed on all servers, desktop and laptop computers. User access level will be predetermined and only authorised users, according to a list, will access the system. Moreover, the system will provide a password management function to allow password changes to be announced. Each user will have their own passwords and it will be not possible to eavesdrop upon account authentication.

As far as availability is concerned, the data will be intact even in the occurrence of faults in the network or computer hardware, e.g. due to power outages or a system crash. There will also be high performance to ensure that the system can function and operate even under high loads that may accrue because of emergency situations. Moreover, if something happens, a backup will be stored securely according to strict security and privacy guidelines and so that the stored data will not be lost. Moving on to the reliability of the system, the EHRs that will implemented at the HCs and SMC will be reliable and consistent in fulfilling their objectives. They will use redundant databases or backups of all transactions and change. If the IT system fails, the backup will ensure continuity and access to law enforcement in the case of violations. All IT network systems must have identification procedures and measures. The EHR system will include processes to identify and verify the identities of authorised users who can input, alter and/or transmit information as well as the identity of each person and who is a party to an EHR entry or transaction.

7 Conclusion

The EHRs can have a huge impact on the health care system in Bahrain. IT can make information reliably available and accessible to health care providers and obtainable at every stage of the health care provision chain. In a potentially well-integrated system in a small country such as Bahrain, the smooth flow of patient information will reinforce decision making on the part of all clinicians, contribute to a culture good health care practice and slash time and costs.

Patients, clinicians and health service organisations will derive tangible advantages when health information becomes easily accessible and workable. Patients will be assured that their clinicians will always be on the right track when providing treatment and make informed decisions, based on their medical histories with a minimum of error and oversight. All this will be put into practice while safeguarding information confidentiality and patient privacy. For provider organisations, the coherent and consistent flow of information will mean the ability to make better diagnoses and prognoses, reduce errors and adverse drug events, conduct clinical and population-based research and improve overall health outcomes for their patients and communities. It is clear from the above that any country like Bahrain that is aspiring to modernity and a better standard of living cannot dispense with the implementation of an EHR in the near future. The benefits are overwhelming and tip the balance decisively in favour to establishing a nation-wide system. We hope that this article will have provided and formulated a clear conception of the issue and showed the way towards the next stage of evolution in the health care field.

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