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The Use of Electronic Health Records in Kingdom of Bahrain Hospitals: A National Survey

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Abstract

Objective: Our study investigated the level of implementation and utilization of Electronic Health Record (EHR) systems in all governmental and private hospitals that are registered in the Kingdom of Bahrain under the Health Care Facilities section in the National Health Regulatory Authority (NHRA).

Methods: This is a descriptive cross-sectional study conducted through a quantitative self-report survey. The data was collected from the IT division heads in the concerned hospitals from the 23rd June 2020 to the 27th July 2020. The first part consisted of demographic information of the hospitals and the second part requested the utilization level of items on the EHR comprehensive and basic functions (24 core functions). Only governmental and private hospitals licensed by NHRA in the Kingdom were included in the study.

Results: Nearly 82% of all hospitals agreed to participate, where 89% of responding hospitals owned an EHR system and 55.6% had implemented comprehensive or basic electronic functionality features. Looking at the core functionality implementation in their EHR systems, the decision support had the lowest score with almost 42%.

Conclusions: This is the first nationwide survey to be conducted on hospitals in Bahrain, showing that 89% of hospitals adopted an EHR system and 55.6% implemented a comprehensive or basic electronic system. Among the 24 electronic characteristics in EHR systems, hospitals must focus to improve the decision support functionality application status. The results may contribute to the improvement of the EHR system implementation in Bahrain and in the region.

Keywords: Electronic Health Record; Electronic Medical Record; Bahrain; Hospital System; Public Health Administration.

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1. Introduction

The limitations of the paper health records forced the Institute of Medicine (IOM) to issue two consecutive reports in 1991 and 2001 advocating to introduce information technology (IT) into the medical records and transition from paper to electronic records by the end of the decade [1]. In the literature, electronic medical record (EMR) is also referred to as electronic health record (EHR), and nowadays it is adopted in many developed countries [2]. The World Health Organization (WHO) had produced an EHR manual for the developing countries to encourage its implementation [3]. EHR can be defined as “a record of a patient's medical details (including history, physical examination, investigations and treatment) in digital format.” [4]. EHR provides more thorough documentation, rich quality data, reduction in healthcare cost, easier accessibility and storage of the medical record, accurate and streamlined billing, and information management support tools [5]. A systematic review and meta-analysis on the effect of EHR on healthcare quality showed that an appropriate implementation can lead to enhancement of the healthcare quality, time management, adherence to guidelines, reduction of medication errors and its adverse events [6] and can expedite clinical research [7]. Despite the concern for EHR implementation cost, a survey conducted in five nations showed that many hospital executives selected to invest their institution capital budget in EHR and information technology (IT) if they were given the choice to do so [8].

In 2011, the challenges of adopting EHR systems in the Gulf Cooperation Council (GCC) countries (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates) were described [9], and in the following years the GCC countries had EHR systems established and evolved but at different levels [10]; an exploratory study highlighted the barriers to adopt the EHR systems [11]. A systematic review on healthcare staff perceptions for EHR implementation and use in the GCC countries revealed both positive and negative views, and their views were influenced by personal factors such as “age, occupation, computer literacy and training in EHR”, and system features of “perceived usefulness and perceived ease of use” but not organizational elements such as “management support” [12].

In 2009, the need to implement EHR in governmental hospitals and public health centers in the Kingdom of Bahrain was proposed, highlighting common opportunities and challenges [13]. The Ministry of Health had launched the EHR named I-SEHA through a Portuguese corporation to achieve a centralized electronic health service [14], and later a cross-sectional study examined the factors that affect the satisfaction of the users for I-SEHA [14,15]. The National Health Regulatory Authority (NHRA) established a national “Good Documentation Practice Policy” in 2020, which mandated the minimum expected documentation practice from professionals in both paper and EHR [16].

The aim of our study is to investigate the level of implementation and utilization of the EHR in all governmental and private hospitals that are registered in the Kingdom of Bahrain under the Health Care Facilities section in NHRA [17].

2. Material and Methods

2.1. Design

This is a descriptive cross-sectional study conducted through a two-part quantitative self-reported survey. The first part includes the demographics of the hospitals and the second part includes items on the EHR functions. The items of the survey were mainly derived from the survey that was used by the Office of the National Coordinator for Health Information Technology in the United States (US) [18] and was also utilized in other previous studies [19,20,21]. Only governmental and private hospitals that are licensed by the NHRA in the four governorates of the Kingdom were included in the study [17]. After getting the hospitals' approval to participate in the study, research assistants contacted the IT division heads in the concerned hospitals via telephone to fill in the survey. Informed consent was provided to the participants and emphasized that privacy and confidentiality of data and personal information would be maintained. Participants had a right to withdraw from the study at any period of time. The data collection period started on 23rd June 2020 and ended in 27th July 2020.

2.2. Ethical Approval

The study was accepted by the Institutional Review Board at King Hamad University Hospital (KHUH) and participation in the survey by the hospitals was optional.

2.3 Statistical Analysis:

Descriptive statistics were computed based on hospital characteristics. Data from participating hospitals with each of the individual functionalities were computed.

Chi-square tests (Mantel–Haenszel chi-squared test) was performed to assess relationship between hospital characteristics and adoption of an EHR system: comprehensive, basic with clinicians notes, and basic without clinician notes was calculated. A p-value less than 0.05 was considered statistically significant. Statistical analyses were performed using SPSS v 25.0.

3. Results

The survey invitation was sent to 22 hospitals, where 18 hospitals (81.8%) agreed to participate, and four hospitals declined to join the study. The demographic characteristics of the hospitals are summarized in Table 1. The majority of hospitals were considered small with 0-99 beds (88.9%). Most of the hospitals are located in the capital governorate (77.7%), privately owned (88.9%), and non-teaching hospitals (88.9%). In regard to technical characteristics, the majority of hospitals have an EHR system

procured (88.9%), and their IT team have at least 5 members or more (66.7%). While most hospitals had different EHR systems in place, HOPE and Medinous systems were the mostly used (27.8%).

Table (1) Characteristics of responding hospitals in the Kingdom of Bahrain

Hospital Demographic	Respondents (N=18)	% out of n = 18 hospitals
Size		
Large (400 beds)	1	5.6
Medium(100-399 beds)	1	5.6
Small (0-99 beds)	16	88.9
Region		
Capital Governorate	14	77.7
Muharraq Governorate	1	5.6
Northern Governorate	0	0.0
Southern Governorate	3	16.7
Ownership		
Private (Profit Making)	16	88.9
Public	2	11.1
Teaching Hospital		
Teaching	2	11.1
Non-teaching	16	88.9
Number of IT Department Staff		
≤5	12	66.7
6-9	3	16.7
≥10	3	16.7
Electronic Medical Records (Yes/No)		
No EMR system (Paper Record)	2	11.1
Have EMR system	16	88.9
Names of EMR Systems		
HOPE	3	16.7
Medinous	2	11.1
AKHIL SYSTEM PVT .LTD	1	5.6
Al Baraka Fertility Hospital Management System	1	5.6
Etask	1	5.6
Ifa	1	5.6
Infinity	1	5.6
Invent EMR	1	5.6
I-Seha	1	5.6
MEDCARE	1	5.6
Patient account system	1	5.6
Vida	1	5.6
YASASII	1	5.6

The 24 electronic functionalities have been categorized into four different groups: electronic

clinical information, computerized provider order entry, results management and decision support [18,19,20,21]. Nearly 83% of the Bahraini hospitals have access to electronic clinical information such as patient demographics, physician and nursing notes, problems and medications lists, as well as discharge summaries and advanced directives (Table 2). As for computerized provider-order and results management, 82.2% and 72.2% of Bahraini hospitals have implemented these functionalities respectively, and only 41.6% of hospitals have implemented decision support functionalities such as clinical guidelines and reminders, drug-allergy results and drug-dosing support (Table 2).

Table (2) Selected electronic functionalities and their implementation in Bahraini hospitals.

Electronic Functionality	No	%	Yes	%
Electronic clinical information = 83.32 %				
Patient demographics	2	11.1	16	88.9
Physician notes	2	11.1	16	88.9
Nursing assessments	3	16.7	15	83.3
Problem lists	4	22.2	14	77.8
Medication lists	2	11.1	16	88.9
Discharge summaries	3	16.7	15	83.3
Advanced directives	5	27.8	13	72.2
Computerized provider order entry = 82.22 %				
Laboratory Tests	4	22.2	14	77.8
Radiology Tests	4	22.2	14	77.8
Medications	2	11.1	16	88.9
Consultation requests	3	16.7	15	83.3
Nursing orders	3	16.7	15	83.3
Results management = 72.21 %				
View lab reports	5	27.8	13	72.2
View radiology reports	5	27.8	13	72.2
View radiology images	5	27.8	13	72.2
View diagnosis test results	6	33.3	12	66.7
View diagnosis test images	5	27.8	13	72.2
View consultant report	4	22.2	14	77.8
Decision support = 41.65 %				
Clinical guidelines	12	66.7	6	33.3
Clinical reminders	9	50.0	9	50.0
Drug allergy results	5	27.8	13	72.2
Drug-drug interactions alerts	12	66.7	6	33.3
Drug-lab interactions	14	77.8	4	22.2
Drug dosing support	11	61.1	7	38.9

The electronic characteristics needed for the hospitals implementation of basic and comprehensive EHR system is constructed in Table 3, with clear definitions for both the comprehensive and basic EHR systems covering the categories as recommended by Jha et al. [19].

Table (3) Electronic requirements for classification of hospitals as having a Comprehensive or Basic EHR System.

Electronic Functionality	Comprehensive EHR System	Basic EHR System with Clinician Notes	Basic EHR System without Clinician Notes
Electronic clinical information			
Patient demographics	✓	✓	✓
Physician notes	✓	✓	
Nursing assessments	✓	✓	
Problem lists	✓	✓	✓
Medication lists	✓	✓	✓
Discharge summaries	✓	✓	✓
Advanced directives	✓		
Computerized provider order entry			
Laboratory Tests	✓		
Radiology Tests	✓		
Medications	✓	✓	✓
Consultation requests	✓		
Nursing orders	✓		
Results management			
View lab reports	✓	✓	✓
View radiology reports	✓	✓	✓
View radiology images	✓		
View diagnosis test results	✓	✓	✓
View diagnosis test images	✓		
View consultant report	✓		
Decision support			
Clinical guidelines	✓		
Clinical reminders	✓		
Drug allergy results	✓		
Drug-drug interactions alerts	✓		
Drug-lab interactions	✓		
Drug dosing support	✓		

The presence of specific functionalities was considered necessary in order for an EHR system to be considered as either comprehensive or basic. The implementation of the comprehensive and basic electronic-records systems based on hospital features are represented in Table 4. We found no relationship between size, region, ownership status, teaching status or number of IT staff member and level of adoption of electronic health records. On the basis of comprehensive and basic EHR systems definitions as per Jha et al. [19], the data reflect that 44.4% of all Bahraini hospitals had a “Not Applicable” EHR system or lack the functionalities needed to be considered basic, 16.7% had a comprehensive EHR system, 33.4% had a basic EHR system including physicians’ notes and nursing assessments, and 5.6% had a basic EHR

system without clinician notes.

Table (4) Adoption of Comprehensive and Basic Electronic-Records Systems according to hospital characteristics.

Hospital Demographic	Classification				P-Value
	Not Applicable	Comprehensive EHR System	Basic EHR System with Clinician Notes	Basic EHR System without Clinician Notes	
	N (%)				
Size					
Small (0-99 beds)	8 (44.4%)	2 (11.1%)	5 (27.8%)	1 (5.6%)	0.293
Medium (100-399 beds)	0 (0.0%)	0 (0.0%)	1 (5.6%)	0 (0.0%)	
Large (400 beds)	0 (0.0%)	1 (5.6%)	0 (0.0%)	0 (0.0%)	
Region					
Capital Governate	7 (38.9%)	3 (16.7%)	3 (16.7%)	1 (5.6%)	0.583
Muharraq Governate	0 (0.0%)	0 (0.0%)	1 (5.6%)	0 (0.0%)	
Northern Governate	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Southern Governate	1 (5.6%)	0 (0.0%)	2 (11.1%)	0 (0.0%)	
Ownership					
Private (Profit Making)	8 (44.4%)	2 (11.1%)	5 (27.8%)	1 (5.6%)	0.421
Public	0 (0.0%)	1 (5.6%)	1 (5.6%)	0 (0.0%)	
Teaching Hospital					
Non-teaching	8 (44.4%)	2 (11.1%)	5 (27.8%)	1 (5.6%)	0.421
Teaching	0 (0.0%)	1 (5.6%)	1 (5.6%)	0 (0.0%)	
No. of IT Department Staff Members					
≤5	6 (33.3%)	1 (5.6%)	4 (22.2%)	1 (5.6%)	0.895
6-9	1 (5.6%)	1 (5.6%)	1 (5.6%)	0 (0.0%)	
≥10	1 (5.6%)	1 (5.6%)	1 (5.6%)	0 (0.0%)	

4. Discussion

Nearly 82% of all hospitals in the Kingdom of Bahrain agreed to participate in our national survey and almost 89% of the hospitals were found to own an EHR system. Out of all participating hospitals that have their own EHR system, 55.6% have implemented either a comprehensive or a basic electronic functionality, which indicates that many hospitals are not utilizing their EHR systems efficiently. This gap in utilization may be due to that most hospitals utilize the administrative part of their EHR systems rather than its patient care part [22]. Despite that, the EHR utilization rate in Bahrain is still high when compared to other Arab countries: 25.8% in Jordan [20], and 46.6% in the Eastern Province of Saudi Arabia [23], which increased from 15.8% since 2011 [24]. In South Korea, the EHR adoption rate is about 58% [21], which is very close to the Bahraini rate.

The survey included sixteen small size private hospitals (88.9%), one medium and one large hospitals (11.1%); the last two of which are academic institutions. About 78% of the hospitals were located in the Capital governorate, and 67% had an IT team consisting of at least five members. Thirteen different EHR systems were used in the surveyed hospitals, with two main systems being most frequently used:

HOPE (16.7%) and Medinous (11.1%). No statistically significant relationship was found between the hospital size, region, ownership status, teaching status or number of IT staff and level of adoption of EHR, and such factors do not affect the classification of EHR systems in Bahrain.

Most of the participating hospitals implemented the electronic functionalities in the four categories with the following ranges: electronic clinical information (72.2% to 88.9%), computerized provider order entry (77.8% to 88.9%), results management (66.7% to 77.8%), and decision support (22.2% to 72.2%). After examining the hospitals' adoption of the electronic functionalities in their EHR systems as per the definitions (Table 3), only 16.7% had a comprehensive EHR system and 39% had a basic EHR system.

There are major benefits that the “decision support” functionality can provide in terms of increasing the quality adherence to guideline-based care, enhancing surveillance and monitoring, and decreasing medication errors [25]. However, only 42% of the Bahraini hospitals had an implemented decision support functionality in their EHR systems. Certain level of variation in implementation in the above functionalities were found, with drug allergy functionality reaching up to nearly 72% and drug-lab interactions close to 22%. Other studies also showed a very low application for the decision support functionality use [20,23,24]. The South Korean study had a high rate (86%) for the computerized physician order entry [21]. A challenge that every institution must learn to overcome is to encourage healthcare providers to use the EHR system to its full capacity and functions [26].

4.1 Barriers to adopting EHR Systems:

To improve the utilization rate of EHR systems in the Kingdom of Bahrain, it is recommended that another study examine the barriers and obstacles to hospitals having a successful transformation from paper to EHR systems, and to meet the desired maximum benefits from the EHR systems. A systematic review of the literature highlighted a total of 39 barriers to EHR adoption in the United States (US) and showed that implementation cost, technical support and concerns, and staff resistance to change were among the top barriers [27]. A similar study was conducted in Saudi Arabia and identified 12 key barriers; interestingly, cost was not included as a barrier and other primary barriers were related to healthcare staff deficiency in computer skills, and their lack of awareness in its usefulness and comfort in using the EHR systems [22]. In the GCC countries, the main barriers to adopt the EHR system include: cost, technical support and training, usage issues, lack of time and training, cultural concerns, legal and ethical disputes, individual resistance and expectations [11], and special consideration must be given for healthcare staff perceptions on EHR adoption [12]. The leadership of healthcare institutions must realize that the implementation of any EHR system is a complex process and requires multiple interventions and coordination to achieve an efficient EHR system [28].

4.2 Limitations:

There are a few limitations in the study. First, the survey was conducted on hospitals which are using different EHR systems (13 different vendors), and with the majority being small private hospitals, making data comparison and assumptions a challenge. Second, the majority of the literature on EHR adoption and degree of implementation originated from North America and Europe [28], and hence it is difficult to compare and contrast data as their healthcare system differs from those that exist in the GCC countries. Finally, the study did not look at the obstacles or barriers for implementing EHR system, and a separate study investigating such an issue will certainly help the institutions to facilitate the adoption of the EHR system and maximize its usage.

5. Conclusion

This is the first nationwide survey conducted on hospitals in Bahrain, showing that 89% of hospitals had adopted an EHR system, and 55.6% of them had implemented a comprehensive or basic electronic system. The study also demonstrated the need for increasing the degree of usage and implementation of EHR in some hospitals. Among the 24 electronic characteristics in EHR systems, hospitals must focus to improve the decision support functionality application status. The results may contribute to the improvement of the EHR system implementation in Bahrain and in the region. Further studies should investigate the obstacles or barriers faced by hospitals for implementing an EHR system..

6. Declarations

6.1 Conflict of Interest Statement

- The authors declare that they have no conflicts of interest or potential conflicts of interest as listed in the International Journal of Medical Informatics guidelines.
- This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

6.2 Additional declarations:

- Ethical approval and consent were obtained from the King Hamad University Hospital Institutional Review Board.
- This work has not been published before.
- The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request. All data generated or analyzed during this study are included in this published article.

6.2 Author Contributions:

- 1) Authors who have made substantial contributions to conception and design: Dr. Feras H. Abuzeyad, Dr. Shaikha Sami Aljawder.
- 2) Authors who have made substantial contributions to acquisition of data, or analysis and interpretation of data: Dr. Feras H. Abuzeyad, Dr. Shaikha Sami Aljawder, Ms. Luma Bashmi and Mr. Abdulla Almusalam.
- 3) Authors involved in drafting the manuscript or revising it critically for important intellectual content: Dr. Feras H. Abuzeyad, Ms. Luma Bashmi, Mr. Abdulla Almusalam, Dr. Leena Alqasem, Dr. Stephanie Hsu.
- 4) All authors have given final approval of the manuscript version to be published.
- 5) All authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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7. References

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