Evaluation of EMR Implementation in a Private Hospital from User's Perspective

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Abstract- **Implementation of an electronic medical record system increases efficiency of health services, quality of care and patient satisfaction. Successful implementation depends on multiple factors; one of which is users' response to EMR. This study aimed to assess physicians and nurses' views on the use, quality and user satisfaction with EMR at a tertiary care center in Karachi, Pakistan. Since its inception the Hospital is accredited for being Pakistan's first paperless hospital. A cross-sectional survey was conducted using a self-administered questionnaire to evaluate use, quality and user satisfaction with EMR. The questionnaire assessed: 1) computer related experience; 2) perceptions regarding EMR use; 3) quality of EMR system and 4) level of satisfaction with EMR system. The response rate was 75% nurses and 61% physicians. It was found that 80% of the respondents used EMR to obtain results of patients' investigations and test reports. 81.6% respondents were of the opinion that the EMR System provides the needed information about patients and reported their satisfaction with the accuracy of the system. Concerning user satisfaction with EMR, 94.6% of EMR users believed that EMR is a useful system and 90.8% agreed on its significance for the better care of the patients. Type of respondents emerged as a significant correlate with overall users' satisfaction (p < 0.05). 90% respondents emphasized on a user-friendly EMR system and adequate training on its usage. Besides respondents, gender and computer related experience have also significantly correlated with various aspects of use, quality and user satisfaction with EMR (p < 0.05). We were unable to correlate age with satisfaction with an EMR. EMR implementation positively effects workflow and practice efficiency in a hospital. This study provides a systematic evaluation of various dimensions of EMR and its correlates which is essential to understand reasons and barriers for success, and methods to increase success in EMR implementation. Hospital management should ensure the availability of technical expertise along with adequate training of HMIS staff.**

Keywords-component: EMR; User's Perspective; Quality; User Satisfaction; Private Hospital.

I. INTRODUCTION

Healthcare industry as a whole has made significant investments in technology for diagnostic, clinical and treatment purposes but developing countries has been slow to adopt health information technology as a health management tool. Only recently investments have been made by few for the acceptance and use of electronic medical records [1].

A. Electronic medical records (EMR)

Electronic medical record (EMR) is commonly known as computerized patients' medical record [2-4]. Electronic medical record (EMR) allows medical practices to replace traditional patient charts with computerized system. The EMR system stores physicians' notes, x-rays, prescriptions, and other medical information in electronic format rather than paper files thus make searching for, retrieving, and sharing patient data easier and more efficient. The need for Hospital Information System (HIS) and electronic medical record (EMR) are considered necessary for the efficient delivery of high quality care, proper management of patients and to decrease in medical errors in healthcare delivery [2-7]. Since EMR system has the potential to improve the quality and effectiveness of the healthcare delivery; many healthcare provider organizations in developed countries have invested in its development and use [8]. However, in many developing countries the EMR system is not widely spread or implemented. Published literature shows low acceptance and high failure rate of EMR [9-11]. User resistance has been suspected core factor in the failure of EMR implementation [12].

B. Advantages of EMR

EMR implementation leads to improvement in quality of healthcare, decreased time spent on paperwork, increased patient satisfaction, and financial savings [13-15]. It eliminates the need for handwritten records, thus reducing time spent on record storage, which in turn results in reduced patient waiting time [16]. Similarly, tracking time of previous records is also reduced by accessing the computerized medical records through the computerized central system [3]. Other benefits include accurate medication lists, readable notes and prescriptions and immediately available charts [8]. Despite these advantages, implementation of EMR systems may be resisted if users are not satisfied. Physicians and nurses have concerns about security and confidentiality, time incurred by EMR use, or negative impacts on the quality of patient care [17]. In spite of the reluctance EMR ultimately contributes to development of healthcare delivery.

C. EMR is an important factor for Patient Satisfaction

Besides health care providers, EMR is an important factor in patient satisfaction according to an online survey. A significant percentage of patients take EMR access into consideration when choosing a healthcare provider. Patients are more satisfied and feel a stronger loyalty with their

doctors. EMR's usage improves physician-patient relationship. They express higher satisfaction across different dimensions of care, such as clarity and thoroughness of communication and ease of access to information. They have higher confidence in the quality of healthcare they receive from EMR users. They also believe they receive better quality care. Patients who prefer their doctor to use an electronic chart cited numerous reasons including: access to medical records; accuracy/better record keeping; and coordination of care and information sharing. They quoted that electronic medical records are more accurate than paper charts. Thus those who adopt EMR system are at a competitive advantage since it yields dividends beyond the expected operational efficiencies- namely it enhances patient satisfaction and loyalty. [30].

D. Factors that influence User Response about EMR

Previous publications have shown that many factors influence user response regarding EMR. They include system error, response time, logical and efficient flow of tasks, ability to complete desired tasks, ease of correcting mistakes and data entry, effects on an individual's time, prior computer experience and proper training of the system [18-20]. The involvement and support of users before and throughout the implementation of a new EMR system is important [2]. Systems implemented willingly are received by users better than those forced upon the users. Positive impact on the quality of patient care may be an important factor in user satisfaction with an EMR [15, 21].

E. Development and Implementation of a user friendly Computerized Record System

EMR system has great potential to transform healthcare practice, including the enhancement of healthcare delivery and facilitation of decision making processes. In spite of challenges facing the developing world such as lack of human expertise and financial resource, most studies have shown how feasible it could be to design and implement an EMR system that fits into the environment [22]. Further research regarding specific aspects of EMR systems that contribute to user satisfaction is necessary for successful future enhancement and achievement of effective computerized record systems. With this study, we developed a survey to quantify the endpoints of user satisfaction with the physicians and nurses of private hospital where an EMR system is being implemented.

F. EMR system in Developing countries

Developing countries are in need of electronic medical record (EMR) systems that meet the specific needs. An Internet based study described the benefits of EMRs in developing countries. It focused on the basic EMR information, including types of EMRs, components of EMRs, and already existing EMRs. Based on the results it established which EMR systems would be feasible and effective for specific situations. It concluded that no matter what electronic medical record system is implemented, it is a sure thing that the overall quality of healthcare in the area will increase. EMR systems will eliminate problems; eliminate errors, save time, and save money in the long run. With further research, evaluation, and development, EMR systems will continue to get easier to implement and as a whole cheaper to establish and maintain. EMR systems are a must for both developed and developing countries [25].

A study conducted at a tertiary hospital in India discusses the challenges related to Electronic Medical Record (EMR) adoption and methods and strategies utilized to overcome these challenges and help the system be adopted successfully. One of the challenges that the hospital faced was rejection of EMR system by users that were skeptical and lacked computing skills. Despite these barriers the hospital was able to adopt the EMR system successfully. Issues related to the success of the system-included technical and social features of the system intended to support unconvinced users and those lacking IT skills. The study contributed to overall understanding of the environment at large hospitals in developing countries relating to the adoption of EMR systems. Another study in India describes usage of handheld-based electronic medical record (EMR) in rural settings. The system based on the Linux operating system, allows access to large mobile databases. The system was designed for paramedical health workers serving remote areas in rural India. The paper described the technical challenges and innovation needed in the design, development, adaptation and implementation of the handheld EMR. Lastly study conducted in rural India stressed on the importance of implementing EMR systems in the developing world. The developing world faces a series of health crises including HIV/AIDS and tuberculosis that threaten the lives of millions of people. Lack of infrastructure (power failure) and trained, experienced staff are considered important barriers to scaling up treatment for these diseases. The finders concluded that EMR systems should be validated in the field before deployment in developing countries [26-28].

II. OBJECTIVES

The objectives of the study were to evaluate use, quality and user satisfaction of EMR among physicians and nurses of a private hospital with reference to computer based knowledge and usage.

III. METHODS

A. Setting

A cross-sectional survey was conducted at a private hospital (a 150 bedded tertiary care center) in Karachi, Pakistan that has been implementing EMR system. The respondents of the study were doctors and nurses employed at the hospital. The sample was selected through non-random convenience based *sampling*.

B. Instrument

A 39-itemed self-administered questionnaire was developed to measure the user response on the computerized EMR system at the hospital. To determine use, quality and users' satisfaction with various aspects of their EMR system, we asked respondents to indicate their level of agreement or disagreement with each of the 38 statements, using the scale Never/almost never, Seldom, About half of the time, Most of the time, Always/Almost always and Not at all, Very little, Some, Great, Very great. The questionnaire ended with an open-ended question, which invited suggestions to improve the effectiveness of EMR implementation.

C. Independent Variables

Some questions related to personal information and computer literacy were also included.

D. Dependent Variables

Questions related to the extent a participant (doctor and nurse) uses EMR system for performing tasks, their outlook

on the quality and satisfaction with EMR system were also sought.

E. Data Analysis

The data collected from the questionnaires was tabulated and analyzed on SPSS version 17.0. Descriptive statistics was used to present the data. Chi-square test was used to determine the significance of the relationship between two variables. A p- value of 0.005 was considered as significant to identify variables, which influence use, quality and user satisfaction with EMR system.

IV. RESULT

At the time of research there were 192 physicians and nurses, 130 (68%) returned the survey, 70 nurses and 60 physicians.

Table 1 and 2 shows the demographic profile and computer related experience of respondents respectively. Out of 130-sample size, (53.8%) were nurses and (46.2%) were physicians. The highest percentages of respondents (78.5%) were between the ages 24 and 35 years. Female respondent (51.5%) rate was higher than male (48.5%). Regarding Computer based knowledge (70%) have previous PC experience, (77%) had computer at home, (32%) frequently used computer on daily basis, (81.5%) can input data into computers at ease while (65%) mentioned at having moderate typing ability.

Table 3 represents respondents' view on Use, Quality and User Satisfaction with EMR. It was found that most respondents use EMR to obtain results of medical tests. Regarding quality most respondents agreed that the EMR system provides the necessary patient information with accuracy. EMR is beneficial and essential system for their hospital according to most respondents. . All the physicians (60) use EMR to search for information from patient records and obtain results of tests or investigations. While among nursing staff the number varied. Almost all physicians (90-98%) while among nursing staff most of them (60-71%) agree that EMR System frequently (Most of the time/Always) provides the information or reports they need in time, it is accurate, and are satisfied with the accuracy of EMR System. It was consented that EMR System, majority of the time provides clear information. 73.3% physicians and 61.4% nursing staff members agree that EMR System is user-friendly. 83% physicians and 60% nurses accept that EMR System provides timely information. All the respondents, physicians (n=60) and nurses (n=70) accept that EMR is a useful technology and are contended with the EMR system. All the physicians and nurses value EMR for its use, quality and user satisfaction.

Fig. 1 describes in detail various aspects of EMR that are frequently being use by the respondents. They most frequently (most of the time and always/ almost always) use EMR system to obtain the results of tests or investigations (80%). Using EMR system for capturing patient observations at the bedside (24.6%) was done least frequently (never/almost never and seldom). The responses of physicians and nursing staff regarding quality of EMR system are given in fig. 2. The quality aspect of EMR system the respondents were most satisfied with was that it clearly displays the information they need (81.6%). The EMR system was subject to frequent system problems and crashes (47.7%), making this aspect of EMR least satisfactory (never/almost never and seldom). According to figure 3 94.6% respondents were satisfied (great and very great) with EMR system. All the aspects of EMR system were not being fully utilized due to the staff lack of computer skills according to 30.8% respondents. Similarly insufficient number of workstations especially during emergency slows down the process of electronic medical record keeping (26.9%).

Table 4 describes the impact of Gender on Use, Quality and User Satisfaction with EMR. According to gender, 76% male and 67%female use EMR to review patient's problems. 81% male and 75% female use EMR to seek out information from patient's record. 88% male and 72% female use EMR to obtain results of tests. Similarly, 76% male and 58% female believe that EMR system is user friendly.

Table 5 mentions the Impact of Computer Literacy having a personal computer at home on Use, Quality and User Satisfaction with EMR. Higher percentage of respondents with personal computer at home use EMR to seek information from patient record (84%), are more satisfied with the accuracy of the system (88%), information is more clear to them (84%), consider system as user friendly (71%) and believe that EMR has been successful in their hospital (90%). Similarly a higher percentage of respondents who could input data at ease use EMR to review patient problem (77%), seek information from patient record (84%), obtain results of test (86%), and answer questions to patient (81%). They show higher satisfaction with the quality of EMR system; 90% believe that EMR provides them the necessary information; 86% believe that the system is accurate while 73% believe that it is user friendly. While 50% respondents had no suggestion to give regarding improvement of EMR System in the hospital, almost 50% highlighted the need of EMR training and provision of ongoing support for implementation of EMR.

Table 1: Demographic Profile

Demographic Variable	n	%
Type of respondents		
Physician	60	46.2
Nurse	70	53.8
Age of respondents		
24-35	102	78.5
36-44	21	16.2
45-above	7	5.4
Gender		
Male	63	48.5
Female	67	51.5
Educational qualification		
Intermediate	26	20.0
Graduate	63	48.5
Post graduate and above	41	31.5
Job experience		
Less than a year	49	37.7
1-5 yrs	74	56.9
6 yrs-above	7	5.4
Field of specialization		
Internal medicine	19	14.6
Surgery	21	16.2
Obstetrics/ Gynecology	6	4.6
Other	84	64.6
Duty Shifts		
Morning	50	38.5
Evening	43	33.0
Night	37	28.5

Table 2: Computer Related Experience

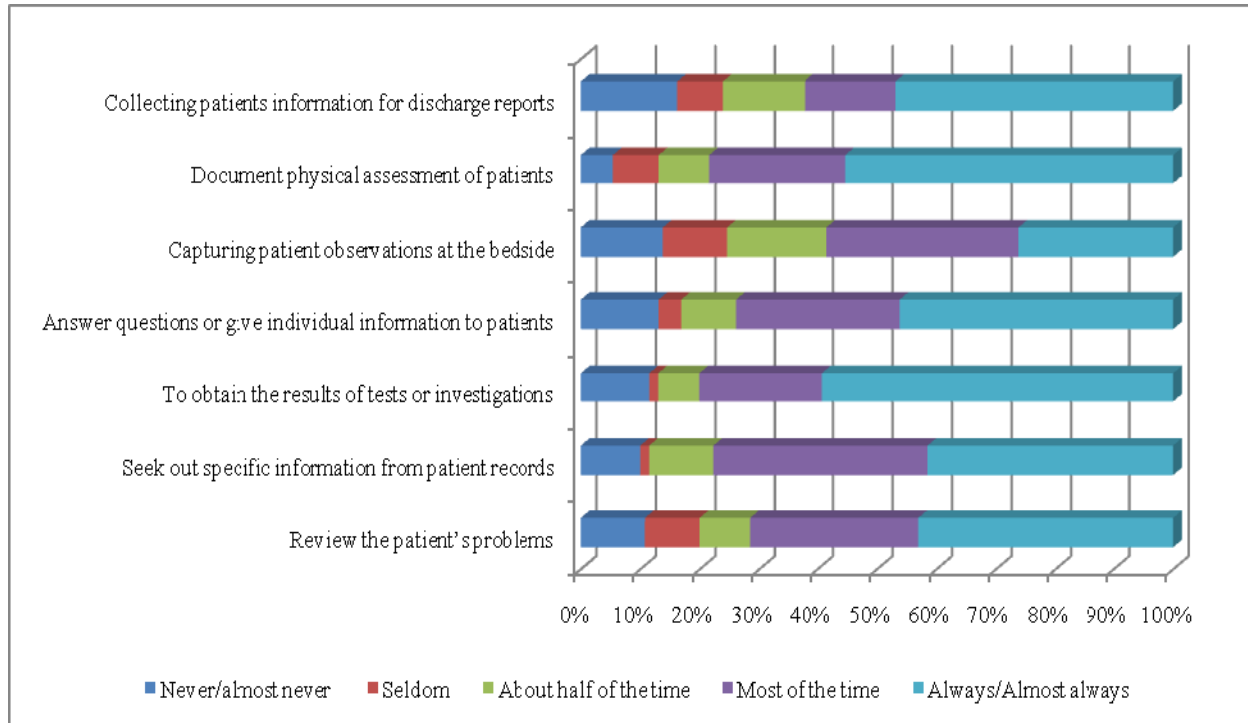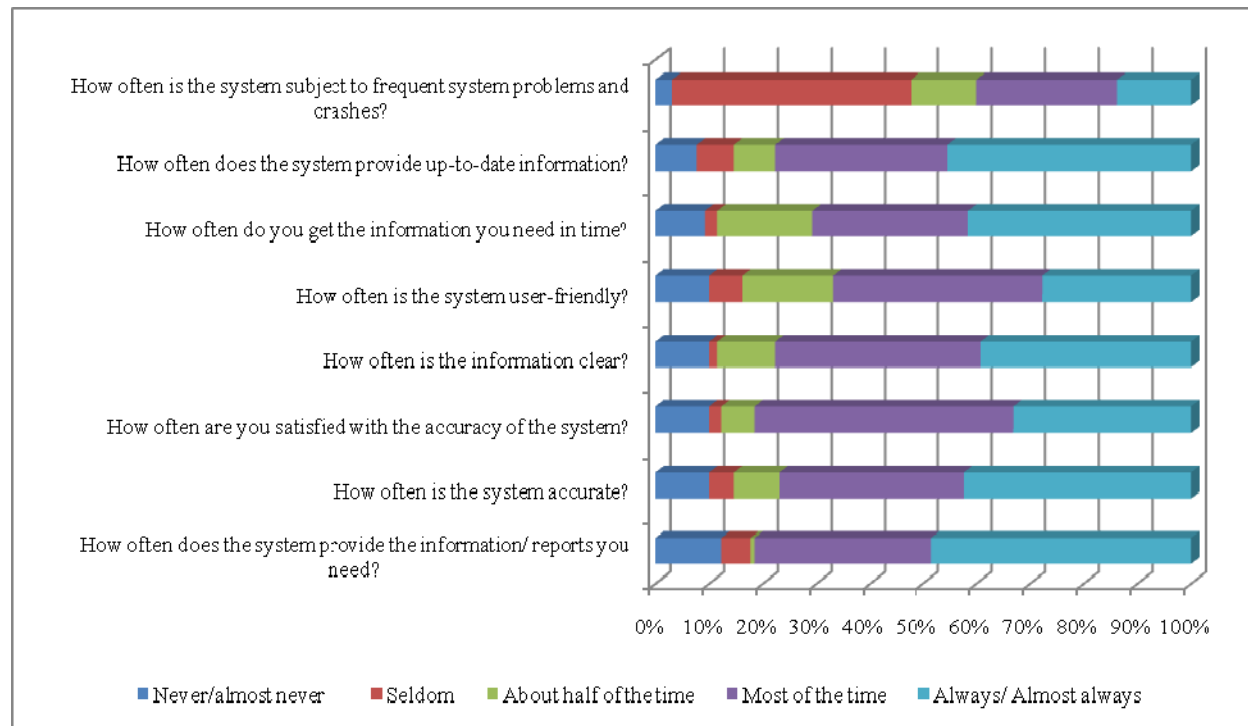| Computer Related Experience	n	%
Previous computer experience		
Yes	91	70.0
No	39	30.0
Availability of computer at home		
Yes	100	76.9
No	30	23.1
Daily use of computer		
No Use	18	13.8
Moderate	70	53.8
Many Times	42	32.3
Entering data at ease		
Yes	106	81.5
No	24	18.5
Typing ability		
Bad	6	4.6
Moderate	85	65.4
Good	39	30.0

Figure 1: Use of EMR System

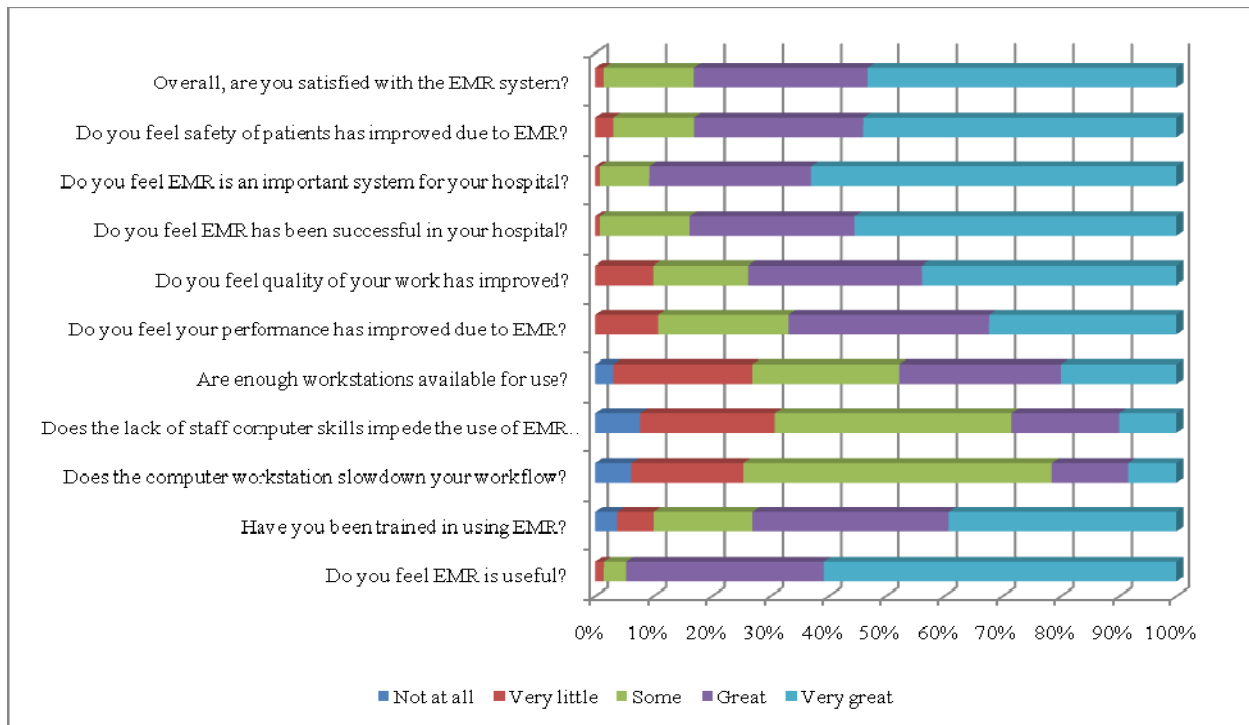

Figure 2: Quality of EMR System

Figure 3: User Satisfaction with EMR System

Table 3: Respondents view on Use, Quality and User Satisfaction with EMR

USE OF EMR SYSTEM	p-Value	Respondents	Most of the time		Always	
			n	%	n	%
To seek out information from patient records	0.001	Physician	20	33	34	57
		Nurse	27	39	20	29
To obtain results of tests or investigations	0.000	Physician	8	13	51	85
		Nurse	19	27	26	37
QUALITY OF EMR SYSTEM						
How often does the system provide the required information?	0.000	Physician	25	42	34	57
		Nurse	18	26	29	41
How often is the system accurate?	0.000	Physician	25	42	32	53
		Nurse	20	29	23	33
How often are you satisfied with the accuracy of the system?	0.000	Physician	28	47	28	47
		Nurse	35	50	15	21
How often is the information clear?	0.001	Physician	32	53	22	37
		Nurse	18	26	29	41
How often is the system user-friendly?	0.000	Physician	27	45	17	28
		Nurse	24	34	19	27
How often do you get the information you need in time?	0.001	Physician	25	42	25	42
		Nurse	13	19	29	41
How often does the system provide up-to-date information?	0.000	Physician	31	52	22	37
		Nurse	11	16	37	53
USER SATISFACTION WITH EMR SYSTEM			**Great**		**Superb**	
Do you feel EMR is useful?	0.002	Physician	29	48	31	52
		Nurse	15	21	48	69
Overall, are you satisfied with the EMR system?	0.000	Physician	28	47	22	37
		Nurse	11	16	47	67

Table 4: Impact of Gender on Use, Quality and User Satisfaction with EMR

USE OF EMR SYSTEM	p-Value	Gender	Most of the time		Always	
			n	%	n	%
To review patient's problem	0.001	Male	14	22	34	54
		Female	23	34	22	33
To seek out specific information from patient records	0.001	Male	17	27	34	54
		Female	30	45	20	30
To obtain results of tests or investigations	0.003	Male	11	17	45	71
		Female	16	24	32	48
QUALITY OF EMR SYSTEM						
How often is the system accurate?	0.005	Male	19	30	34	54
		Female	26	39	21	31
How often is the system user-friendly?	0.002	Male	28	44	20	32
		Female	23	34	16	24

Table 5: Impact of Computer Literacy (PC at home) on Use, Quality and User Satisfaction with EMR

USE OF EMR SYSTEM	p-Value	PC at Home	Most of the time		Always	
			n	%	n	%
To seek out specific information from patient records.	0.005	Yes	36	36	48	48
		No	11	37	6	20
QUALITY OF EMR SYSTEM						
How often is the system accurate?	0.000	Yes	35	35	49	29
		No	10	33	6	20
How often are you satisfied with the accuracy of the system?	0.000	Yes	50	50	38	38
		No	13	43	5	17
How often is the information clear?	0.002	Yes	43	43	41	41
		No	7	23	10	33
How often is the system user-friendly? ***	0.002	Yes	46	46	25	25
		No	5	17	11	37
How often does the system provide up-to-date information?	0.004	Yes	37	37	46	46
		No	5	17	13	43
USER SATISFACTION WITH EMR SYSTEM			**Great**		**Very Great**	
Are enough workstations available for use?	0.001	Yes	34	34	22	22
		No	2	7	4	13
Do you feel EMR has been successful in your hospital?	0.000	Yes	37	37	53	53
		No	0	0	19	63

V. DISCUSSION

This study was conducted to evaluate the effectiveness of an EMR system in a Pakistani hospital. The main objective of the study was to access the use, quality and user satisfaction of EMR system. Usage of EMR System was scored highest (80%) for obtaining results of test and investigations as in other studies [16]. Besides result review, 78.5% use it to document physical assessment of patients while 77.7% use it to seek out specific information from patients' records. As shown in fig. 1 respondent were heavy users of results review, documenting physical assessment and the patient records. In previous literature one of the highest reported (more than 70%) aspects was using EMR to obtain results of test and investigations while documenting physical assessment of patient was scored minimal (52.1%) [16]. Quality aspect of EMR that was rated highest (81.6%) in our study is that EMR provides the necessary information/ reports and that the respondents were satisfied with the system's accuracy. 77.7% respondents agree that their EMR System frequently provides clear and up-to-date information. As shown in fig. 2 the most apt characteristic of EMR system was that it frequently provides needed information / reports and the high satisfaction level with the accuracy of the system. In other study the quality aspect of EMR that was rated highest was that it frequently provides needed information/ reports (67.8%). Similarly a survey conducted from 3,088 family physicians showed that the aspect of EMR with which users were mainly satisfied with were finding information (58%) and documenting patient record (57%) [29]. Our results and corresponding literature shows that adequate information is necessary not only for user satisfaction but for the success of an EMR system since it is highly valued by both type of respondents, physicians and nurses. User satisfaction of EMR system that was rated highest (94.6%) was that users believed it to be a useful system followed by respondents (90.8%) perception that it is vital for their hospital as concluded by other studies as well [16, 20, 29]. While 83% of EMR Users feel that the safety of the patients has improved and they are overall satisfied with the EMR System.

The major demographic variable that was found to significantly correlate (p< 0.005) with different aspects of use, quality and user satisfaction with EMR is type of respondents as shown in the data analysis. Among respondents major users of EMR were physicians as compared to nursing staff especially with respect to using EMR to gather information from patient records and to obtain medical test results. The rate of usage of EMR for gathering information from patient records and to obtain medical test results is higher in physicians because they are primary care providers. Physicians' satisfaction with quality of EMR was higher compared with nursing staff in several aspects such as providing the information or reports they need in time, accuracy, satisfaction with the accuracy, providing clear information, user-friendliness, providing information users need in time and providing up-to-date information. Physicians show less variation with different aspects regarding EMR quality as compared to nursing staff. Published reports show a mixed picture regarding satisfaction with EMR among physicians and nursing staff. Our survey results show higher satisfaction among physicians than nursing staff as adverse to other findings [31, 32].

Respondent, physician and nurses accept that EMR is a useful technology and that they were satisfied with the EMR System [12, 16, 20, 32].

In our study, gender and computer related experience (previous PC experience, having computer at home, frequency of daily PC usage, ease of data input and typing ability) have also significantly correlated with various aspects of use, quality and user satisfaction with EMR. Male showed higher usage and satisfaction with EMR compared to females. Respondents with computer at home and ability to input data at ease frequently used EMR and believed it to be an important and successful system for their hospital. According to published literature, gender (p=0.02) and computer skills (p= 0.01) significantly correlated with overall user reaction. More male than females frequently used EMR to review patient's problem, seek out information from patient record and considered EMR a user-friendly system. According to published report, female respondents tend to be more satisfied with EMR System [24]. Respondents with computer at home and ease of data entry emerged as significant correlates with various aspects of use, quality and user satisfaction with EMR System. Respondents with computer at home were more satisfied with the quality of EMR. While previous PC experience, frequency of daily PC usage and typing ability did not emerge as significant correlates with various aspects of use, quality and user satisfaction with EMR System. Published literature show a mixed picture regarding these relationships as well [2, 14, 16].

Published reports also show that demographic variable age had significant positive relationship with the overall user satisfaction which has not been demonstrated in the present study due to reluctance from senior physicians and less diversity in respondents' age group as most of them (78.5%) were in the age group 24 & 35. Despite that there wasn't any significant relationship between age and the different aspects of use, quality and user satisfaction with EMR. Previous studies have observed that older people are unwilling to accept technology especially computer systems [12].

Most respondents wanted EMR training based on hospital policy and EMR to be user friendly. The implementation strategy identified in previous literature indicates that respondents value a user-friendly system, training and support, and 24-hour I.T assistance as important to success [21]. Similarly ongoing training is essential for reducing error rates and improving patient care. This finding supports the view that EMR implementation positively effects hospital workflow and user satisfaction and they are consistent with the studies conducted in the region [26-28].

VI. CONCLUSION

The medical records have come a long way from just being paper. Various quality assessment methods such as total quality management and continuous quality improvement have helped healthcare professionals focus on process, workflow, quality, completeness of records, timeliness, authenticity, point-of-care observation and documentation. Healthcare professionals are beginning to understand that the quality and completeness of the medical record depends on the collection of data.

Electronic medical records applications are very

complicated. Yet EMR implementation positively affects workflow and practice efficiency in a private hospital. The research provides an evaluation of various dimensions of EMR and its correlates. This study showed that physicians and nurses were overall satisfied with EMR system. Based on the suggestions it is recommended that the higher hierarchy ensure that there is prompt availability of technical help when required along with sufficient training. The findings should also help them to recognize the causes of dissatisfaction with the EMR system among physicians and nursing staff that hinders its successful implementation and regular use.

EMR software development, evolution and implementation will continue. Extensive training and support will make a great effort in EMR success. These results confirm previous literature demonstrating favorable acceptance and support continued adoption of EMR system. Evaluating clinician satisfaction with an electronic medical record (EMR) system is an important dimension for overall acceptance and use. Thus concerned authorities should allocate time and resources to assess user satisfaction and collect feedback for continued improvement of their hospital EMR system.

VII. ACKNOWLEDGMENT

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