Information Technologies Adoption in Medical Education, Research and Advancement Clinical Treatment at King Saud Medical City

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***Abstract*—Although the use of Information technology (IT) systems and applications at medical context by physicians have been studied at many hospitals in advance countries, little attention has been paid to how current medical & health care practitioners staff at Saudi hospitals are applying the information technology and the Internet in their daily clinical practice. This study at King Saud Medical City (KSMC) in Riyadh, Saudi Arabia aims towards assessment of the medical staff proficiency in: using IT based technologies in clinical tasks, in using new E-clinical systems (e.g. CPOE, PAC etc.), and to estimate the adoption rates of IT technologies for enhancing medical knowledge , continuing education and medical research. A questionnaire was developed based on cross-sectional study and was distributed, to medical staff and health care employees of KSMC to get their feedback. Based on various results collected, it can be deduced that the adoption rate of IT technologies among KSMC medical and healthcare practitioners in clinical tasks, use of clinical systems, is comparable to their counterparts in advanced countries.**

***Index Terms*—IT Adoption in clinical practice, E-Health Literacy in clinical practice, Saudi health System.**

I. Introduction

In today modern hospitals, healthcare practitioners utilize various IT tools, devices and systems to collect data, to publish online medical research results, to communicate with their colleagues in Internet communities and to have consultation with other health care practitioners. [1]-[3]. Several recent research studies concluded that high percentage of physicians population are using the on-line services for communication with their patients, to reduce number of clinical visits and to improve managing various diseases [4], [5]. Furthermore, Physicians spends more time online far beyond the average Internet users today [6]-[7].

Studying the impact of advanced IT based clinical systems on healthcare service is currently active area of research. In a recent study, the researchers showed that informatics is under investigated in supporting clinical decisions [8].

Most recently, the advancement in mobile and wireless devices, has also contributed significantly to improvement in health care services and research. In a recent study, it was found that the overall health care practitioners PDA adoption rate for individual professional use is in the range of to (64-85)% in USA[9]-[10]. Another study in mobile health showed strong evidence that physician-patient communication system improves communication between physicians and patients [11].

In Saudi Arabia, a similar mobile health research study found PDA and Smart phone prevalence rate among physicians and dentists is in Riyadh , Saudi Arabia is about 69.1% [12]. At other regions of the country, research study statistics showed that the majority of the selected medical staff had good computer and Internet skills [13].

Based on these studies, it is clear that well-designed research studies are important and still needed for adoption of IT based technologies by health practitioners. The focus of this research paper, at King Saud Medical City (KSMC) in Riyadh, Saudi Arabia is: To estimate the IT technologies adoption rate in clinical tasks, to evaluate the proficiency of the medical staff in using new e-clinical systems and to explore its impact on their work. This research is considered as accompaniment of other research studies related to health informatics research at KSMC [12]-[16].

II. Research Study Setting

King Saud Medical City is located in Riyadh, Saudi Arabia and is ranked as tertiary-care hospitals for and surgery and medicine and consists of several medical centers and three major hospitals namely: General Hospital, Obstetrics and Gynecology hospital and a Pediatrics hospital. KSMC centers include: Dental, Spinal and Neurosurgery and Dialysis Centers. Work force size of KSMC is 1412 health care practitioners and bed capacity is 140 intensive-care unit beds and 1473 ward beds [17].

KSMC has a large data center that supports heterogeneous environment of software, hardware, Internet access, workstations and wireless devices setting to perform various health care clinical tasks.

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The main KSMC application software include a HIS management system and several legacy systems such as: A picture archiving and communication system (RIS/PACS), Computerized physician order entry (CPOE) system and R4 dental system [18].

III. Participants, Research Data Management and Mythology

Our study was carried out in Riyadh, Saudi Arabia at King Saud Medical City. The survey questionnaire instrument consisted of four parts, with questions about (1) Personal background, (2) IT usage in Medical Education, (3) IT adoption in Clinical Tasks and Practice (4) Use of IT Clinical Systems and IT technologies in Medical research and advanced treatment. The questionnaire was organized in a multitude format with two to five choices including yes/no questions or 3-to 5-point Likert scales.

A hundred Participants were selected following a stratified random sampling method in 2014. A total of 47 participants completed the questionnaire and met the inclusion criteria for the study. The demographic distribution of the study sample of 47 participants was 17 (36.1 %) male, 30 (63.8%) female; majority of age ranges were from 25 years old up to 50 years. The respondents' experience varied from 1 to more than 10 years, and has various rank positions (e.g. Internship and post graduate trainees, dental assistant, general practitioner, dental and medical consultants) reflecting the population from which the sample was drawn.

The collected questionnaire data was processed and went through subsequent analysis using the Statistical Package for Social Sciences software (SPSS Inc. Version. 19.0).

IV. Major Statistical Results

In what follows we present major research results (as obtained from the statistical analysis of questionnaire responses):

A. IT for Clinical Tasks and Practice

Using IT technologies in Clinical tasks context has an overall average of 61.68% of all participants. The less used applications of IT technologies in clinical tasks were for: Consultation with colleagues (46.8% never used IT for this task).

The Chi-Square tests for using IT in various clinical tasks and practice showed that Profession specialty rank group correlation is significant with IT -based clinical task and practice at ($P< 0.05$) level (2-tailed).

B. Adoption of IT for Enhancing Medical Knowledge & Education

Statistics of adoption rates of IT technologies for enhancing medical knowledge and Education is summarized in what follows:

The most unavailable IT electronic medical educational technologies at work environment where: web-based multimedia resources, podcasts, and Web Open educational resources (unavailable to 55.3% of the participants). Overall, an average of 50.28% of participants reported that medical educational technologies resources are unavailable to them in their work settings.

The most common medical educational technology resource used by KSMC participants through self effort was Research Databases & On line Journals and books (40.4% claimed using it often and always by their own effort) .

The leased used medical educational resource was Virtual Reality and simulations (17% only often and always used it) .

The Chi-Square tests for using IT based medical education resources with the age group, shows that only for Research Databases & On line Journals and books resource, correlation is significant with Chi-Sq $\chi 2 = 42.65$ at ($P= 0.001$) level (2-tailed).

C. Usage of IT Clinical Systems

Here we investigate how the sample participants regularly use various IT Clinical Systems such as: CPOE, PACS, Laboratory Information Management Systems (LIMS), and Electronic medical records (EMR). The statistics gained for this is as follow:

The most common E-clinical system used by KSMC participants through self effort was the CPOE system (53.2 % claimed using it often and always by their own effort).

The least common E-clinical system used by KSMC participants through self effort was the LIMS system (19.1 % claimed using it often and always), possibly for lack of authorization or being not needed to their regular clinical tasks.

The Chi-Square tests for using IT based clinical systems , shows a P significance more than .05 for all clinical systems for profession specialty rank, number of experience years, age groups and that there is a statistically significant association between participant gender and the use of LIM system at ($P < 0.05$) level.

D. IT Systems for Medical Research and Advanced Treatment

In this section we investigated how the sample participants responded to questions related their usage and familiarity with advanced technologies in medical fields such as: Decision Support system (DSS) , Medical Expert Systems (MES), Wireless Body Area Networks (BAN) , Implantable Electronic Medical Devices (IMD) , Medical Robotics and Tele-surgery (R-TS), Tele-Medicine (TM) etc. Major statistics follows:

Statistic for usage and knowledge about advanced technologies for advanced treatment were very similar for most of questioned advanced technologies. On the average, bout 42.2 % of participants reported that they do not know about it, 9.57% know it but never used it and 48.22% are familiar and have used such technologies.

When using "Pearson Chi-Square" test, for the correlation of advanced treatment technologies with participants years of experience we found that ($P < 0.05$) for most technologies**.** This indicates that the familiarity

with advanced treatment technologies has a significant correlation with years of experience at ($P < 0.05$) level.

V. Discussion of Fin Dings

The findings of this study show that using IT technologies in Clinical tasks context has an overall average (for some-times/often/always use) equals to 61.68% of all participants. When comparing various clinical tasks, the highest average rate for IT usage was for continuing medical education task (65.9%). A relatively high percentage of participants (50.28%) reported that all the survey questioned medical E-resources were unavailable to them in their work settings. For E-clinical systems, the most common E-clinical system used by KSMC participants was the CPOE system (53.2 % claimed using it often and always) , while the least E-clinical system used was the LIMS system (19.1 %).

Other statistics of IT familiarity and usage rate with various IT based advanced treatment technologies shows that (48.22% of respondents) are familiar and have used such advanced technologies. This usage is also statistically significant correlation with participant years of experience.

Based on the above, it can be deduced that the adoption rates of IT technologies among KSMC medical and healthcare practitioners in clinical tasks, use of clinical systems, are comparable to their counterparts in advanced countries. More advanced IT medical education resources (e.g. Virtual reality systems, Web based multimedia .Etc) are however is needed to increase the diffusion of IT technologies in enhancing medical knowledge and education.

VI. Conclusions

This research study at King Saud Medical City in Riyadh, Saudi Arabia, addressed the assessment of the medical and healthcare providers proficiency in: using IT based technologies in their clinical tasks, and for its use to enhance continuing medical education, and medical research

Such studies are needed in an age of rapid IT technological development and new advances in medicine for the enlightenment and guidance that it provides. The results of this study will also direct further research required to enhance the diffusion of various IT based technologies and systems in health care practice that are most appropriate to their use in KSMC hospitals clinical settings.

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