Original Article

Computer literacy of physicians among the hospitals of Makkah region

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ABSTRACT

Background and Objectives: A confidential inquiry by the Directorate General of Health Affairs, Makkah region, Saudi Arabia, found physicians in different hospitals were reluctant to enter patients' related information in electronic medical record systems. One of the major issues raised was that they didn't have the required computer literacy. Our aim, therefore, was to conduct a survey to highlight the computer literacy among the physicians of Makkah region. **Materials and Methods:** This cross-sectional survey was performed from May to July 2009. A structured questionnaire of four A4 size paper was distributed among the physicians of the Makkah region working in seven different hospitals. The questionnaire contained questions on background knowledge of computers, i.e., (a) basic computer vocabulary knowledge (BCVK) (10 questions), (b) basic computer skills (BCS) (22 questions), (c) basic communication and internet skills (BCIS) (12 questions). **Results:** Response rate of 368, i.e., 81.6% of sample size ($n = 451$) was attained. The maximum response came from King Abdul Aziz Hospital (Taif), i.e., 79%. Overall BCVK, BCS and BCIS were the highest among the physicians of Alnoor Specialist Hospital, i.e., 71.3%, 91.4%, 87.7%, respectively. All the hospitals had a satisfactory level of BCVK, but levels of BCS and BCIS were above satisfactory except King Abdul Aziz Hospital (Jeddah) that showed a satisfactory level in BCIS. **Conclusion:** Majority of the physicians had a good or an excellent level of computer background knowledge that gave a prediction toward the issues of their non-promising attitude and beliefs about electronic data entry.

Key words: Computer literacy, computerized medical record, cross-sectional survey

INTRODUCTION

The need for physicians to be computer literate is no longer an issue for debate. It has even been emphasized that medical students should use the computer during their studies. Some medical schools in the United States of America have developed strategies for integrating medical informatics into the medical curriculum.[1]

With the development of the computer and advances made by the internet, information technology (IT) with its medical applications has an encouraging impact on health-care delivery systems throughout the world, mainly in disease control, diagnosis, patient management and teaching.[2-4]

Many factors influence physicians' use of the computer, such as prior computing experience and knowledge, personality characteristics and attitude toward computers, especially medical computing.[5]

Moreover, the use of electronic medical record system (EMR) is a very important means of extracting organizational (hospital) as well as clinical key performance indicators, which help organizations to understand how well they are performing in relation to their strategic goals and objectives. A confidential inquiry by Directorate General of Health Affairs, Makkah region, Saudi Arabia, found that physicians in different hospitals were resistant in entering patient related information in EMRs. One of the major issues raised by the Directorate General of Health Affairs was that the physicians didn't have the appropriate computer background knowledge. To the best of our

knowledge, surveys on the computer literacy of physicians or other health-care providers are very rare in Kingdom of Saudi Arabia or even Middle East countries. We decided to conduct a questionnaire based cross-sectional survey of physicians of the Ministry of Health (MOH) Makkah region, Saudi Arabia, on their background knowledge of computers. This was expected to help in determining their computer literacy, future needs of computer knowledge and influence their beliefs, ideas and attitudes toward the entry of electronic data.

MATERIALS AND METHODS

This cross-sectional survey was, conducted from 1st May to 31st July, 2009, in seven hospitals in the Makkah region, Saudi Arabia, governed by the MOH, which had the EMR for at least 1 year. Makkah region has four districts: (a) "Jeddah" from which, four hospitals named King Fahd Hospital (840 beds), Maternity and Children Hospital (390 beds), Amal Hospital (200 beds), King Abdul Aziz Hospital (559 beds), were selected; (b) "Taif" from which, one hospital named King Abdul Aziz Hospital (691 beds) was selected; (c) "Makkah" from which, two hospitals: Alnoor Specialist Hospital (627 beds), Hera General Hospital (317 beds) were selected.

The study population included all physicians, i.e., consultants, specialists and residents (who dealt directly with patients) irrespective to their nationality, gender, age and specialties, who had been working in those settings for not less than 1 year or with at least a year's experience in health-care services with an EMR.

Sample size determination was calculated as 451 out of total study population size, i.e., 1811, with 4% margin of error, a confidence level of 95% and response distribution of 50% and response rate (RR) of 100%. Selected sample size given the questionnaire was 644 by keeping the RR of 70%. Flexibility of the margin of error from 4% to 6% was kept in mind since with the huge population, multiple study settings, and the busy schedule of participants responses may not be enough.

After determining the sample size of 644, it was divided in strata, i.e., (a) consultants, (b) specialists, (c) residents. Neyman's pick proportionate allocation method was implemented by using a sampling fraction from each of the strata proportional to that of the total population. Similarly, the same method was used to allocate the sample from each stratum for each setting, i.e., hospital. After determining the sample size for each stratum and setting, every physician was given an identification code and the sample was selected by simple random sampling technique by using SPSS version 16 (SPSS Inc., Chicago, IL, USA). By doing this the sample actually represented the entire population. All the subjects in the settings were accessed through computerized central data base [Table 1].

A structured questionnaire of four A4 size papers had been prepared. The first part was designed to collect information on demography, job title, location and some general questions on the availability and usage of the computer. The second part included the comprehensive computer background knowledge and related closed- questions/stems with dichotomous answers (yes/no), to highlight; (a) basic computer vocabulary knowledge (BCVK) (10 questions), (b) basic computer skills (BCS) (22 questions), (c) basic communication and internet skills (BCIS) (12 questions).

Experts from Medical Information Technology Unit of the Directorate General of Health Affairs, Makkah region, verified the content and face validity of the questionnaire. Necessary changes of addition, deletion and substitution of questions were then made.

The questionnaire's stability was measured by inter-rater reliability (Cohen's Kappa) for questions with dichotomous answers by applying kappa statistics. The Guttmann split half was calculated for each stem. Test-retest reliability could not be measured because of difficulties in making arrangements for the subjects to complete the same questionnaire a 2nd time after a period of time. Overall average of stability about computer background knowledge questionnaire was above 0.7, i.e., (a) BCVK, kappa = 0.69

Table 1: Response rate of selected sample size of physicians

Names of hospitals	C (N)	Sa (n)	RR (%)	S (N)	Sa (n)	RR (%)	R (N)	Sa (n)	RR (%)	T (N)	T-Sa (n)	RR (%)
Alnoor Specialist Hospital	87	31	78	141	50	62	211	75	57	439	156	63
Hera General Hospital	32	11	79	66	23	81	154	55	58	252	90	67
King Abdul Aziz Hospital (Taif)	75	27	75	83	30	85	96	34	73	254	89	79
King Fahd Hospital (Jeddah)	101	36	42	160	57	46	212	75	40	473	168	42
Maternity and Child Health Hospital (Jeddah)	54	19	73	105	37	51	124	44	36	283	100	49
Amal Hospital (Jeddah)	0	0	0	2	1	0	7	2	0	9	3	0
King Abdul Aziz Hospital (Jeddah)	22	8	38	36	13	62	43	15	59	101	35	57
Total	371	132	64	593	211	61	847	301	51	1811	644	57

*C: Consultants; S: Specialists; R: Residents; RR: Response rate; T: Total; T-Sa: Total sample; Sa: Sample

and Guttman split-half coefficient = 0.7, (b) BCS, kappa = 0.71 and Guttman split-half coefficient = 0.73 and (c) BCIS, kappa = 0.73 and Guttmann split-half coefficient = 0.71.

The computer background skills categorization was performed by physicians for the interpretation of overall results of the stems. The computer background knowledge was categorized for BCVK, BCS and BCIS as "Weak" if the rate of answer "yes" was from 0% to 25%, "Fair" if 26-50%, "Satisfactory" if 51-75%, "Good" if 76-90%, "Excellent" if >90%.

In each hospital, a pre-planned formal demonstration/lecture was given in the auditorium to the targeted subjects to explain the details of the projects and to distribute the questionnaire. The subjects were given 3 weeks to complete the questionnaires. In order to increase the RR and produce a timely return of questionnaires, instructions relating to the importance of the project were given every 3rd day through the heads of departments in their daily morning clinical conferences.

To attend the formal presentation of the survey, every "on-duty" physician was officially given 2 h time-off by their head of department/medical director. A letter of appreciation was also sent to every subject who returned the questionnaire on time, which is also consistent with RR enhancement techniques. The level of computer background knowledge was determined and compared among the settings, i.e., hospitals.

Data analysis
Data were analyzed using SPSS version 16 and subjected to descriptive analysis. Categorical data, i.e., dichotomous answers were analyzed by using Chi-square test techniques. The alpha level was kept <0.05.

Ethical considerations
A formal approval of the research project was obtained from the Directorate General of Health Affairs of Makkah region after they had been apprised in detail of all the potential of this research. An acknowledgment letter was sent officially to all officials who validated the questionnaire. All respondents were assured of strict confidentiality and protection of their identity since the questionnaire had no option of name, identity card number, Saudi residency card (Iqama) number or Saudi council for health specialties numbers.

RESULTS

A RR of 368, i.e., 81.6% of the sample size was found to have a margin of error of 4.6% with 95% confidence level with a total population of 1811. The maximum response came from King Abdul Aziz Hospital (Taif), i.e., 79% while only 42% from King Fahd Hospital (Jeddah) responded. Not much difference in the RR was found between consultants and specialists, i.e., 64% versus; 61%, but only 51% residents responded. There was no response from Amal hospital (Jeddah) [Table 1].

Overall BCVK was the highest among the physicians of Alnoor Specialist Hospital (71.3%). An overall difference of $P = 0.0001$ for BCVK was found among the hospitals, but there was no difference for stems, i.e., ROM, wide area network, workstation, computer virus and hardware versus software among the settings. All hospitals were found to have a satisfactory level of BCVK [Table 2].

Table 2: Subjects' basic computer vocabulary knowledge stratified into settings

Stems (n=10)	H~1 (n=60)	H~2 (n=70)	H~3 (n=71)	H~4 (n=49)	H~5 (n=98)	H~6 (n=20)	P value
Have you heard about the following terminology?							
Hard drive	80.0	71.4	59.2	71.4	86.7	65.0	0.002
Network drive	76.7	60.0	47.9	63.3	63.3	55.0	0.03
RAM	68.3	70.0	52.1	61.2	75.5	65.0	0.05
ROM	53.3	47.1	43.7	53.1	52.0	50.0	0.8
LAN	70.0	71.4	62.0	71.4	85.7	70.0	0.02
WAN	63.3	51.4	54.9	53.1	62.2	60.0	0.6
Workstation	50.0	44.3	40.8	51.0	50.0	40.0	0.7
Computer virus	88.3	84.3	84.5	91.8	94.9	85.0	0.2
URL address	56.7	40.0	69.0	44.9	57.1	45.0	0.01
Hardware versus software	76.7	72.9	71.8	71.4	85.7	75.0	0.2
Overall	68.3 (S)	61.3 (S)	58.6 (S)	63.3 (S)	71.3 (S)	61.0 (S)	0.0001

H~1: Hera General Hospital; H~2: King Abdul Aziz Hospital (Taif); H~3: King Fahd Hospital (Jeddah); H~4: Maternity and Child Health Hospital; H~5: Alnoor specialist Hospital; H~6: King Abdul Aziz Hospital (Jeddah). Data is expressed in percentage of response "YES" for concerned stem. "n" represents total number of subjects who returned the questionnaire. Chi-square test for unmatched groups (contingency table). Each P value of 0.0001 ≤0.0001; S: Satisfactory; RAM: Random access memory; ROM: Read only memory; LAN: Local area network; WAN: Wide area network; URL: Uniform resource locator

All the hospitals had above satisfactory levels of BCS with insignificant differences in 11 stems, but on the whole there were differences among the settings ($P < 0.0001$). In general, Hera General Hospital and Alnoor Specialist Hospital were found to have an excellent level of BCS while the level for the others was good [Table 3].

BCIS was found to be significantly different among settings ($P = 0.0001$). Alnoor Specialist Hospital had the highest level of BCIS, i.e., (87.7%). All the hospitals had a good level of BCIS, except King Abdul Aziz Hospital (Jeddah) whose level was satisfactory [Table 4].

DISCUSSION

This study was performed mainly to evaluate computer literacy because of the importance of the use of computers in the provision of health-care. A national study carried out in the Kingdom 8 years ago to evaluate the computer skills of the physicians in King Abdul Aziz University, Jeddah, Saudi Arabia, rated their skills as average and unsatisfactory. The study stressed the importance of the development of

the physicians' computer skills in order to improve their efficiency and effectiveness in patient care.[6]

Since the introduction of personal computers into the classroom, either for teaching purposes or for self-study, computer literacy has become a subject for educational research. One of the main reasons is that advances in telecommunication technology in the last two decades have given the general public access to a vast amount of information.[7]

Health-care professionals can no longer ignore the application of IT to health-care because it is a key to e-health. The results of this survey provide a better understanding of the position of MOH physicians of the Makkah region in terms of the BCS, BCVK, BCIS and what they need to do in order to improve their competence with computers.

A survey performed to discover the current use of computers by primary health-care physicians in Croatia revealed poor knowledge and practice. The survey however, found that their attitude toward computer use

Table 3: Subjects' basic computer skills stratified into settings

Stems (*n*=22)	Hospitals						*P* value
	H~1 (*n*=60)	H~2 (*n*=70)	H~3 (*n*=71)	H~4 (*n*=49)	H~5 (*n*=98)	H~6 (*n*=20)	
Do you think that you are able to/familiar with following							
Switch a computer on and off correctly	100.0	97.1	94.4	98.0	99.0	100.0	0.2
Insert, and eject a floppy disk, a CD, or a flash memory card	100.0	94.3	100.0	100.0	100.0	95.0	0.007
Format a floppy disk, a CD, or a flash memory card	90.0	80.0	64.8	73.5	85.7	75.0	0.004
Manipulate a mouse	98.3	97.1	98.6	100.0	96.9	95.0	0.7
Use a printer	98.3	95.7	94.4	95.9	99.0	95.0	0.5
Change the computer settings from the control panel	88.3	74.3	83.1	79.6	83.7	70.0	0.2
Create a file (document) or a folder	91.7	87.1	97.2	93.9	98.0	80.0	0.009
Rename a file or a folder	96.7	87.1	97.2	93.9	96.9	90.0	0.07
Move a file or folder	98.3	82.9	88.7	91.8	98.0	85.0	0.002
Copy a file or folder	96.7	87.1	94.4	95.9	99.0	80.0	0.002
Paste a file or folder	96.7	87.1	91.5	100.0	95.9	80.0	0.007
Can you undo changes in a document?	90.0	74.3	88.7	93.9	93.9	70.0	0.0004
Can you change font size, type, color and style of the document?	88.3	77.1	83.1	95.9	87.8	75.0	0.05
Can you add numbering, bullets and colors to a document?	81.7	77.1	80.3	91.8	83.7	75.0	0.3
Can you use the spell checker?	88.3	75.7	83.1	81.6	78.6	65.0	0.2
Install a software program	73.3	60.0	74.6	73.5	84.7	50.0	0.002
Search for files and directories on a computer	90.0	80.0	80.3	85.7	89.8	75.0	0.2
Minimize and maximize windows	98.3	81.4	83.1	83.7	94.9	75.0	0.001
Can you locate and launch a desired application?	81.7	65.7	62.0	73.5	83.7	65.0	0.01
Can you manage windows/desktop commands?	86.7	65.7	76.1	75.5	86.7	70.0	0.01
Can you search for and find a file by using a computer search function?	86.7	75.7	80.3	81.6	91.8	75.0	0.07
Can you back up the information saved on your computer?	80.0	75.7	74.6	83.7	83.7	80.0	0.6
Overall	90.9 (E)	80.8 (G)	85.0 (G)	88.3 (G)	91.4 (E)	78.2 (G)	0.0001

H~1: Hera General Hospital; H~2: King Abdul Aziz Hospital (Taif); H~3: King Fahd Hospital (Jeddah); H~4: Maternity and Child Health Hospital; H~5: Alnoor Specialist Hospital; H~6: King Abdul Aziz Hospital (Jeddah). Data is expressed in percentage of response "YES" for concerned stem's response rate. "*n*" represents total number of subjects who returned the questionnaire. Chi-square test for unmatched groups (contingency table); E: Excellent; G: Good

Stems (n=12)	Hospitals						P
	H~1 (n=60)	H~2 (n=70)	H~3 (n=71)	H~4 (n=49)	H~5 (n=98)	H~6 (n=20)	
Do you think that you have the ability to do the following							
Receive and read email	98.3	91.4	94.4	100.0	100.0	80.0	0.0002
Send email	98.3	90.0	97.2	95.9	100.0	80.0	0.0003
Send a document as an email attachment	98.3	85.7	88.7	87.8	90.8	80.0	0.1
Set-up a group mailing list	78.3	62.9	84.5	69.4	77.6	65.0	0.05
View an email attachment that you receive	95.0	90.0	93.0	93.9	93.9	80.0	0.3
Save an email attachment sent to me by someone	93.3	85.7	81.7	91.8	93.9	80.0	0.07
Make mailboxes for saving and organizing important email messages	70.0	65.7	59.2	59.2	75.5	60.0	0.2
Manage email messages by creating folders and filtering rules	63.3	57.1	53.5	55.1	73.5	60.0	0.1
Keep copies of email messages that I send to others	83.3	75.7	78.9	69.4	89.8	70.0	0.03
Open a web page by typing in a web address	88.3	77.1	76.1	81.6	87.8	70.0	0.01
Download files from an internet website	96.7	78.6	83.1	85.7	93.9	70.0	0.001
Keep track of web sites using bookmarks	66.7	54.3	69.0	51.0	75.5	45.0	0.006
Overall	85.8 (G)	76.2 (G)	79.9 (G)	78.4 (G)	87.7 (G)	70.0 (S)	0.0001

H~1: Hera General Hospital; H~2: King Abdul Aziz Hospital (Taif); H~3: King Fahd Hospital (Jeddah); H~4: Maternity and Child Health Hospital; H~5: Alnoor Specialist Hospital; H~6: King Abdul Aziz Hospital (Jeddah). Data is expressed in percentage of response "YES" for concerned stem's response rate. "n" represents total number of subjects who returned the questionnaire. Chi-square test for unmatched groups (contingency table); Each P value of 0.0001 ≤0.0001; G: Good; S: Satisfactory

was positive, which indicated that a more proactive role by the management of the health centers would solve this problem.[8]

A Tanzanian study indicated that 50% of the investigated doctors felt that they understood the basic terminology and concepts of computing. Our survey evaluation showed that computer background knowledge ranged from 61% to 91.4% in the different settings.[9]

A study in India showed >50% of health care professional who were knowledgeable about computers. Of them, 22.1% had extensive knowledge and 35.8% had partial knowledge. It was found that the majority of the doctors and nurses used the computer to study. The remaining health-care professionals used it mainly for entertainment, internet and e-mail. More than 90% requested computer training in order to enhance their knowledge of computers and improve their work.[10]

As found in our survey, physicians' knowledge of computer terminology was just satisfactory, but the majority of the selected hospitals had well to excellent level of BCS and BCIS.

It is evident from the literature that quality of data and its completeness are vital to the success of any information system. It is hard to achieve high standards in electronic medical/health system if computer literacy and the experience of the end users are limited. Furthermore, it is important to design user friendly systems with good instructions and training.[11]

CONCLUSION

The majority of our physicians had a level of computer background knowledge that was above satisfactory, which was a pointer to their lack of interest and ideas about electronic data entry. Furthermore, EMRs which are not user-friendly, the limited amount of time available for data entry, heavy workload and busy schedules might be the reasons for their attitude. This survey also provided the basis for further surveys of the end users' opinions, attitude and ideas about EMRs as well as what they require to enhance their computer literacy.

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