

Information and communication technologies in primary healthcare facilities in Egypt

Taghreed M. Farahat¹, Nagwa N. Hegazy² and Maha Mowafy³

¹Professor of Community & Family Medicine, Departments of Family Medicine, Faculty of Medicine, Menoufia University

²Lecturer of Family Medicine, Departments of Family Medicine, Faculty of Medicine, Menoufia University

³Lecturer of Family Medicine, Departments of Family Medicine, Faculty of Medicine, Cairo University

Background: The health sector has always relied on technologies. According to World Health Organization, they form the backbone of the services to prevent, diagnose, and treat illness and disease. It is increasingly viewed as the most promising tool for improving the overall quality, safety and efficiency of the health delivery system. **Aim of the study:** This was to assess the current situation of information and communication technologies (ICTs) in primary healthcare in the terms of describing and classifying the existing work, identify gaps and exploring the personal experiences and the challenges of ICTs application in the primary healthcare. **Subjects and methods:** A mixed research method in the form of sequential explanatory design was applied. In the quantitative phase a cross-sectional study was conducted among 172 family physicians using a predesigned questionnaire. Followed by qualitative data collection among 35 participants through focused group discussions. **Results:** Nearly half of the physicians have ICTs in their work and they were trained on it. None of them developed a community-based research using ICTs technology. Training on ICTs showed a statistically significant difference regarding the availability and the type of ICTs present in the workplace ($P < 0.05$). Focused group discussion revealed that the majority of the participants believe that there is poor commitment of policymaker toward ICTs utilization in the primary care. Nearly 97% thinks that there is insufficient budget allocated for ICTs utilization in the workplace. Almost 88% of the participants demanded more incentives for ICTs users than non-user at the workplace. **Conclusions:** ICTs resources are underutilized by health information professionals. Lack of funds, risk of instability of the electric supply and lack of incentives for ICTs users were the most common barriers to ICTs implementation thus a steady steps toward budget allocation and continuous training is needed.

Key words: family physician; ICT; information technology; primary health care facility

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Introduction

The health sector has always relied on technologies. According to World Health Organization (Kirigia *et al.*, 2005), technologies form the backbone of the services to prevent, diagnose and treat diseases. Information and communication

technologies (ICTs) are only one category of the vast array of technologies that may be of use. Given the right policies, organization, resources and institutions, ICTs can be powerful tools in the hands of those working to improve health and wellbeing (Daly, 2003). Health information technology is in general increasingly viewed as the most promising tool for improving the overall quality, safety and efficiency of the health delivery system (Chaudhry *et al.*, 2006).

ICTs are defined as tools that can facilitate communication and the processing and transmission of

Correspondence to: Dr Nagwa Nashat Hegazy, Lecturer of Family Medicine, Departments of Family Medicine, Faculty of Medicine, Menoufia University. Email: nagwanashat@hotmail.com

information and the sharing of knowledge by electronic means. Health information technologies include the application of health information systems designed primarily to support the management of patient's records such as Electronic Health Record system and to assist medical and healthcare delivery such as clinical decision support system and computerized provider order entry system (Jamal *et al.*, 2009).

The use of ICTs in mining information is expected to improve health issues in developing countries and this hypothesis is based on three resources. The first is their role as a tool for continuing education and lifelong learning. The second is their use as a delivery mechanism to remote areas with a wide variety of services varying from improved public health education to emergency advice. The third source is their potential use as a mechanism to increase the transparency and efficiency of governance which would, in turn, improve the available and delivery of publicly provided health services. Conceptually, this implies that the potential of ICTs in the health area lies in their mediatory role between differentially endowed segments of the health system and between the health system, the health service provider and the beneficiary (Chandrasekhar and Ghosh, 2001). However, there is a scarcity of studies on ICT in primary healthcare in Egypt.

Objectives

This was to assess the current situation of ICTs in primary healthcare (PHC) in the terms of describing and classifying the existing work, identify gaps and exploring the personal experiences and the challenges of ICTs application in the PHC.

Subjects and methods

A mixed research method in the form of sequential explanatory design was applied. The two-phase, explanatory methods were applied and the obtained statistical, quantitative results from a sample were then followed up with a few individuals to probe or explore those results in more details. In the first phase, quantitative research questions had addressed the ICTs descriptive structure in the primary care settings and the

relationship of ICTs practice and utilization, also the general characteristic of the studied group within these places. In the second phase, qualitative focus groups discussions were used to shed the light on the significance of low practice score despite ICTs presence and training among the participants by exploring aspects of the ICTs personal experience with few participants at the study setting (Creswell and Plano Clark, 2011).

Participants

Quantitative

All family medicine postgraduate students including the first and the second parts in family medicine departments in Menoufia University and Cairo University in addition to demonstrators and assistant lecturers in both departments during the academic year 2013/2014 were invited to participate in the study.

Qualitative

The ICTs users among the participant were invited to take part in the study. The sample was a convenience one and the snowball approach to sampling was adopted. Each respondent was asked to recommend to the researcher another physician who might be able to articulate their views about their experience with ICTs.

Instruments

A semi-structured interviewing questionnaire consisted of two parts. The first part includes the socio-demographic characteristics, for example age, sex, educational level, years of experience, etc. The second part contained information's about ICTs in primary care services at the workplace, for example: availability of ICTs in the current workplace, it's type, previous training on ICTs, site of training, the variety of ICTs utilized in the workplace, etc. The third part covers the practice of ICTs in primary care through six questions. It covers the use of ICTs in word processing, medical records handling, Emailing, health education message, research and management plan with a yes or no answer. A score of ≥ 4 out of 6 is considered a good practice while a score of < 4 is considered a poor practice.

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Procedures

Quantitative data

A cross-sectional study among 172 physicians working in primary care settings attending the Family Medicine Departments in Menoufia University and Cairo University for their post-graduate studies during the academic year 2013/2014 were invited to participate in the study.

Qualitative data

Focus groups were chosen due to their ability to elicit unique perspectives on the study subject, originating from interactions between participants within each group. The study included 35 participants. Four focus group discussions were conducted ($n^{1,2} = 8, n^3 = 9, n^4 = 10$). Each session lasted 60 min, facilitated by a moderator and an observer and was recorded. An interview guided questions were used to collect data.

Data analysis

Quantitative data

Statistical program SPSS v. 15.0 (SPSS Inc., Chicago, IL, USA) was used. Continuous data were presented as means \pm standard deviations and range. Percentages were calculated for dichotomous variables. Group comparisons were performed by Pearson's χ^2 test or the Mann-Whitney U test, as appropriate.

Qualitative data

All of the transcripts were read by the researcher and coded in the style of a grounded theory approach to data analysis. Seven category headings were generated from the data and under these all of the data were accounted for. Two independent researchers were asked to verify the seeming accuracy of the category system and after discussion with them, minor modifications were made to it.

Results

The aim of this study was to gain a better understanding of the current situation of ICTs in PHC for health promotion and highlight the factors affecting such communication in a PHC setting.

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Table 1 General characteristics of studied group

Parameter	n (172)	%
Age		
Mean \pm SD	32.8 \pm 5.6	
Range	20 (24–44)	
Sex		
Male	72	41.9
Female	100	58.1
Qualification		
General practitioner (M.B.B.CH)	42	24.4
Family Medicine Board degree	20	11.6
Family Medicine Diploma	70	55.8
Family Medicine Master	40	32.6
Years of experience in family practice		
Less than or equal 5	128	74.4
More than 5	44	25.6
Mean \pm SD	4 \pm 2.1	
Range	7 (1–8)	
Site of work		
Rural primary healthcare	112	65.1
Urban primary healthcare	60	34.9
Type of health service		
Governmental unit	84	48.8
Governmental center	88	51.2
Administrative job description		
General Practitioner	42	93.0
General Director	32	4.7
Family physician	98	2.3
Total	172	100.0

The study revealed that about half of the 172 physicians working in primary care settings and participated in the study (51.2%) had ICTs available in their workplaces.

Table 1 showed that the mean age of the participated physicians was 32.8 \pm 5.6 SD, with mean years of experience of 4 \pm 2.1 SD and around two-third of them (58.1%) were females. The highest percentage of them were GPs (93.0%), working in rural areas (65.1%) that are governmental health center (51.2%), holding family medicine diplomas (55.8%) and had \leq 5 years of experience (74.4%).

The results in Table 2 that all physicians who had an available ICTs at their workplaces mentioned that they had a training experience on ICTs representing (51.2%) for both of them, and one-fourth of them received their training in the Ministry of Health and Population (25.0%). Also, the table shows that the most available type of ICT was computers (29.2%) and Fax was the least available type present in only 4.0% of studied workplaces. Computers were mostly used for evidence-based treatment (72.7%), followed by

Table 2 Current situation of information and communication technologies (ICT)

Parameter	<i>n</i> (172)	%
Availability of ICT		
Not available	84	48.8
1 per 1 personnel	51	29.7
1 per 3 personnel	37	21.5
Type of ICT		
Not present	84	48.8
Computers	50	29.2
Mobile phones and computers	19	11
Electronic medical records and computers	12	7
Fax	7	4
Previous training experience on ICT		
No	84	48.8
Yes	88	51.2
Site of training experience (<i>n</i> = 88)		
MOHP	43	25.0
Local university	25	14.5
Others ^a	20	11.6
Utilization of ICT at workplace		
Not used	84	48.8
Used	88	51.2
Way of utilization of ICT at workplace (<i>n</i> = 88)		
Dissemination of information	12	13.6
Database used by decision makers	32	36.7
Research	37	42.0
Treatment (evidence-based treatment)	64	72.7
Number of FP personnel apply for ICT training last year at workplace		
0	108	62.8
1–3	36	20.9
>3	28	16.3
Total	172	100

MOHP = Ministry of Health and Population; FP = family physician.

^a Private company, international university, etc.

research (42.0%), while the least utilization for ICT was for dissemination of information (13.6%).

Table 3 shows that there is a highly significant relation (with *P*-value < 0.05) between the practice score of the studied group and their qualifications, years of experience and the availability of electronic connections at their workplaces, *P* values 0.008, 0.000 and 0.000, respectively.

From Table 4 we noted that the differences between physicians who received training on ICTs and those who did not get trained was significant for the years of experience, availability of ICTs and their electronic connections at *P* values of 0.007, 0.000 and 0.04, respectively. It also shows that utilization of ICTs by the studied group for producing databases to be used by decision makers, participating in any

activities using ICT, medical records handling, health education, research and in management plans were statistically significant for the trained group in comparison with those who were not trained.

According to Tables 5 and 6, we found that practice scores have positive correlations with years of experience confirming the previous results showed in Table 3, in addition to the utilization of ICTs in health education and research; denoting the importance of using ICTs for these two domains in order to achieve better practice scores in primary care settings.

The results of the qualitative data from the focus group discussions done with 35 physicians revealed that that the budget allocated for ICT utilization in workplaces is not enough (97.1%). Also, the majority of them mentioned (88.5%) that stable electronic supply for ICTs units and incentives for ICTs users as well as maintenance for ICTs equipment should be made available.

Around three-quarters of participated physicians (74.2%) quoted that there is no connectivity to a central network was present at their workplaces and 85.7% of them agreed that there was no maintenance for the ICTs equipment at their workplaces.

It is noteworthy that more than half of the physicians who attended the focus group discussions reported that no activities for preparation of family physician (FP) human resources for ICTs utilization were available and further explained that policymakers had a poor commitment towards ICTs utilization in FP (68.5 and 57.1%, respectively) (Table 7).

Discussion

According to Kreps and Neuhauser (2010), understanding, the context is central to planning of health communication interventions, especially within the healthcare services, where a myriad of individual, organizational and societal factors influence health-related decisions and practice.

Despite a low level of ICTs availability in workplaces of the studied group, where only half of them (51.2%) mentioned having ICTs and being trained on it, 88.5% of them indicated the importance of the use of ICTs in primary care and stated that incentives should be given to ICTs users. This percentage is higher than what was mentioned in one Poland study done by Pędzński *et al.* (2013)

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Table 3 Relation between practice score and general characteristics of the studied group

	Practice score				Total	%	X ²	P value
	Poor (109)	%	Good (63)	%				
Qualification								
General practitioner (M.B.B.CH)	26	61.9	16	38.1	42	24.4	11.9	0.008*
Board degree	18	90	2	10	20	11.6		
Diploma	36	51.4	34	48.6	70	40.7		
Master	29	72.5	11	27.5	40	23.3		
Site of work								
Rural	96	61.6	43	38.4	112	65.1	0.4	0.3
Urban	40	66.7	20	33.3	60	34.9		
Years of experience								
Less than or equal 5	97	75.8	31	24.2	128	74.4	33.2	0.000*
More than 5	12	27.3	32	72.7	44	25.6		
Previous training on ICT								
No	48	57.1	36	42.9	84	48.8	2.7	0.07
Yes	61	69.3	27	30.7	88	51.2		
Site of training								
MOHP	32	74.4	11	25.6	43	48.9	1.6	0.5
Local university	15	60.0	10	40.0	25	28.4		
Others	14	70.0	6	30.0	20	22.7		
Availability of ICT								
Not available	51	60.7	33	39.3	84	48.8	0.5	0.8
1 per 1 personnel	34	66.7	17	33.3	51	29.7		
1 per 3 personnel	24	64.9	13	35.1	37	21.5		
Electronic connection								
Not present	71	84.5	13	15.5	84	48.8	32.3	0.000*
Computers	22	44.0	28	56.0	50	29		
Mobile phones and computers	9	47.4	10	52.6	19	11		
Electronic medical records and computers	4	33.3	8	66.7	12	7		
Fax	3	42.9	4	57.1	7	4		
Dissemination of information								
No	102	63.8	58	36.2	160	93	0.1	0.5
Yes	7	58.3	5	41.7	12	7		
Maintenance of ICT								
Regular	102	63.8	58	36.2	160	93	0.1	0.5
Not regular	7	58.3	5	41.7	12	7		

MOHP = Ministry of Health and Population.

* Statistical significant difference.

where 67% of the surveyed GPs believed that the use of software and information technology (IT) systems improves the quality of healthcare services. Those results were also similar to the European survey on Benchmarking ICTs use published in 2008 (EE, 2008), which showed that, regardless of the degree of implementation of ICTs in the country, most physicians see opportunities to use IT systems to improve the quality of services.

In some studies where the attitudes towards ICTs use were analyzed, the results have shown that physicians who were using the ICTs system were more convinced of the positive effects than those who had never worked with it

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(Leung *et al.*, 2003; Morin *et al.*, 2005; Sequist *et al.*, 2007; EE, 2008; Jha *et al.*, 2009). Findings from the present study go hand in hand with the above mentioned studies; where physicians who received training on ICTs had a significant difference in using it than those who did not receive training before.

This difference was obvious in relation to their practice score, where good scores were achieved with a high statistically significant difference ($P = 0.000$) in primary care facilities with electronic connections. The same pattern was followed when comparing trained studied physician on ICT with non-trained one, where high statistically

Table 4 Effect of training on utilization of information and communication technologies (ICT)

	Training				Total	%	X ²	P value
	No (84)	%	Yes (88)	%				
Years of experience								
Less than 3	56	56.6	43	43.4	99	57.6	9.9	0.007*
3–5	19	50.0	19	50.0	38	22.1		
More than 5	9	25.7	26	74.3	35	20.3		
Availability of ICT								
Not available	60	71.4	24	28.6	84	48.8	33.5	0.000*
1 per 1 personnel	14	27.5	37	72.5	51	29.7		
1 per 3 personnel	10	27.0	27	73.0	37	21.5		
Electronic connection								
Not present	51	60.7	33	37.5	84	48.8	9.6	0.04*
Computers	19	38.0	31	62.0	50	29		
Mobile phones and computers	7	36.8	12	63.2	19	11		
Electronic medical records and computers	5	41.7	7	58.3	12	7		
Fax	2	28.6	5	71.4	7	4		
Utilization of ICT in dissemination of information								
No	80	50.0	80	50.0	160	93.0	1.2	0.3
Yes	4	33.3	8	66.7	12	7.0		
Use produced database by decision makers								
No	84	60.0	56	40.0	140	81.4	37.5	0.000*
Yes	0	0.0	32	100.0	32	18.6		
practice in any activities using ICT								
No	81	57.9	59	42.1	140	81.4	24.5	0.000*
Yes	3	9.4	29	90.6	32	18.6		
ICT utilization in word processing								
No	55	50.9	53	49.1	108	62.8	0.5	0.3
Yes	29	45.3	35	54.7	64	37.2		
ICT utilization in medical records handling								
No	51	56.0	40	44.0	91	52.9	4.1	0.03*
Yes	33	40.7	48	59.3	81	47.1		
ICT utilization in Emailing								
No	40	48.2	43	51.8	83	48.3	0.03	0.5
Yes	44	49.4	45	50.6	89	51.7		
Health education								
No	42	41.6	59	58.4	101	58.7	5.2	0.02*
Yes	42	59.2	29	40.8	71	41.3		
ICT utilization in research								
No	74	54.8	61	45.2	135	78.5	8.9	0.002*
Yes	10	27.0	27	73.0	37	21.5		
ICT utilization in In management plans								
No	59	54.6	49	45.4	108	62.8	3.9	0.03*
Yes	25	39.1	39	60.9	64	37.2		

* Statistical significant difference.

significant difference was found between the two groups in areas of handling medical records, producing database and practicing activities using ICT.

Our study highlight that physicians trained on ICT are using it in health education, research and in management plans with a high statistically significant difference than those who are not using it. This could partly explain the above mentioned

results of good practice scores among ICTs users than non-users in this study.

In the 2008 Benchmarking ICTs study (EE, 2008; Egea *et al.*, 2010), the most important facilitating factors in Europe and in Poland were as follows: the need for e-health inclusion in medical education, the need for more IT training and a better networking of all healthcare in order to share clinical information. These recommendations are in line

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Table 5 Correlation between practice score and general criteria of the participants

Variable	<i>r</i>	<i>P</i> value
Age	0.07	0.4
Sex	-0.1	0.07
Qualification	0.03	0.7
Site of work	-0.05	0.5
Years of experience	0.5	0.000*
Training	-0.1	0.09
Site of training	-0.1	0.2

* Statistical significant difference.

Table 6 Correlation between practice score and utilization of information and communication technologies (ICT)

Variable	<i>r</i>	<i>P</i> value
Utilization of ICT in dissemination of information	0.03	0.7
Use produced database by decision makers practice in any activities using ICT	-0.08	0.3
Health education in research	-0.1	0.1
	0.6	0.000*
	0.6	0.000*

* Statistical significant difference.

Table 7 Barriers and challenges of information and communication technologies (ICT) utilization

Theme	<i>n</i> (35)	%
Poor commitment of policymaker towards ICT utilization in FP	20	57.1
Budget allocated for ICT utilization in workplace is not enough	34	97.1
No activities for preparation of FP human resources for ICT utilization	24	68.5
There is no incentives for ICT users than non-user at workplace	31	88.5
There is no connectivity to another network	26	74.2
Irregular or no ICT equipment maintenance at workplace	30	85.7
No presence of permanent stable electric supply for ICT unit in case of cut-off electric supply	31	88.5

FP = family physician.

with what was found in the current study where the above finding emphasizes the importance of providing training on ICTs usage, since all trained studied physicians agreed on the importance of using it in their workplaces. Also, among the 35 physicians

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who attended the focus group discussions, three-quarters of them (74.2%) stated the usefulness of having connectivity to other networks for sharing information.

However, when it comes to the potential barriers, lack of budget allocation for ICTs in primary care setting was the most reported obstacle mentioned by 97.1% of physicians, followed by incentives and maintenance. This is in accordance with Poland in 2008, where cost was a decisive factor concerning ICTs use and was seen as more important than the lack of ICTs maintenance support (EE, 2008).

The four most common hurdles to ICTs implementation in this study were the lack of fund, the absence of motivations to ICTs users and inadequate stable electric supply and maintenance of equipment. The lack of funds as a major barrier to adoption of ICTs has been shown in several other studies, particularly in the United States (Miller and Sim, 2004; Gans *et al.*, 2005; Jha *et al.*, 2009; Kreps and Neuhauser, 2010; Desroches *et al.*, 2013).

Conclusions

ICTs resources are underutilized by health information professionals. Lack of funds, risk of instability of the electric supply and lack of incentives for ICTs users were the most common barriers to ICTs implementation. These three challenges highlight the importance of designing systems from intergovernmental and non-governmental organizations perspective. Statistically significant differences between ICTs trained and non-trained groups concludes that ICTs training is recommended to optimize the use of digital resources. However, ICTs implementation depends not merely on the willingness of health administrators to adopt ICTs as a tool, but on the spread of, and access to, a network of ICTs among different segments of the health system.

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Authors' Contributions

Taghreed farahat, Nagwa Nashat and Maha Mowafy: conception and design, analysis of data, interpretation of data, revising the article critically for important intellectual content. N.N.H.: conception and design, contribution to writing and revising the article critically for important intellectual content. All the authors have read and approved the final version of the manuscript.

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Conflicts of Interest

None.

Ethical Standards

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional guidelines on human experimentation of the ethical committee of the Menoufia University and with the Helsinki Declaration of 1975, as revised in 2008.

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