Assessing The Impact Of Information And Communication Technology In Primary Health Care Delivery, A Case Of A Ghananian Municipal Hospital

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Abstract: Primary Health Care (PHC) has been singled out as the most suitable health care setting to meet the increasing needs for health promotion interventions and to curb the rising number of chronic diseases in Ghana. The health system in Ghana has a fundamental aim of maintaining or improving the health outcome of people living in the country. Therefore the study seeks to assess the impact of ICT in promoting Primary Health Care (PHC). This study was carried out in two Primary Health Care facilities at the Mampong Municipality of Ghana with a sample size of 55 nurses selected form the health centres within the Municipality. The most common forms of ICT tools available were radio (100%), mobile phone (96.4%), TV (89.1%), computer / laptop (74.5%), digital projector (58.2%), digital camera (54.6%), DVD (54.5%) and internet (52.7).

Keywords: Health, Health Education, Health promotion, Primary Health Care and Public Health

I. INTRODUCTION

A variety of programs fall under the ambit of primary health care requiring routine reporting of information. In addition to routine monthly information, the primary health care sector needs to also deal with large amounts of extraordinary data arising from epidemics and deaths that require immediate response and action (Bodavala, 2002). The PHC sector in developing countries like Ghana is often the key asset responsible for providing health care services to the population, especially within rural areas (Mosse, 2004).

The recent Human Development Report (HDR) 2004 describes that the majority of the population in developing countries are still living in hunger and poverty, and most are facing high disease burdens, and have limited access to sanitation and health care services. Therefore, the responsibility to provide health care to the broader community and to serve as the hub for the health information systems rests with the PHC structure (Mosse and Sahay, 2005). The culture of information and communication, whether supported by ICT or not, typically reflects the practice of collecting data and sending it upwards to satisfy the needs of the bureaucracy, rather than to support action at the local level of the sub-districts where information is needed most (Byrne and Sahay, 2012).

II. STATEMENT OF THE PROBLEM

The development of our health infrastructure has lagged behind as a result of continuing poor investments in the health sector. E-health holds a lot of promise for making the big strides urgently needed for improving the health of our communities, especially those living in rural areas. The inability to acquire and deploy the needed technology remains a formidable barrier in the health sector of the country and as such the primary health care sector (Ghana E-Health Strategy, 2009). The study seek to add to the body of knowledge in health studies, the impact of Information and Communication Technology in Primary Health Care delivery at the Mampong municipalty of Ghana. To achieve this broad objective, the following underlisted specific objectives will be considered:

- ✓ To identify the types of ICT tools available in the Public Health Care.
- ✓ To evaluate the usefulness of ICT in Public Health Care.
- ✓ To assess level of skills of health workers in use of ICT tools.
- ✓ To identify the challenges associated with the use ICT in PHC.

RESEARCH QUESTIONS

The study is guided by the following question:
- ✓ What are the types of ICT tools available in the Public Health Care?
- ✓ How usefulness is ICT in Public Health Care?
- ✓ Do the health workers have the skills and the known how to use some ICT applications?
- ✓ What are the challenges associated with the use ICT in Public Health Care?

SIGNIFICANCE OF THE STUDY

The study will provide current situation on the use of ICT in PHC in the Mampong Municipality and Ghana as a whole to help policy makers and health training institutions on the way forward to promote and improve the use of ICT in health care delivery in Ghana.

III. LITERATURE REVIEW

ICT IN HEALTH CARE

The applications of information and communications technologies in medicine are commonly referred to as telemedicine and medical informatics. Although these terms are often used together and confused with each other, they are separate and have their own definitions. The Institute of Medicine (1996) defines telemedicine as *the use of electronic information and communications technology to provide health care when distance separates the participants*. It includes all forms of electronic communication between patients and providers starting from telephone to interactive video and web-based communication. Medical informatics is defined by The National Library of Medicine (2001) as *the field of information science concerned with the analysis and dissemination of medical data through the application of computers to various aspects of health care and medicine.*

Medical informatics can also be referred to as the intersection of information science, computer science and health care. For example, medical informatics includes health care delivery processes that are supported by computers that help in analysing electronic data (Christensen and Remler, 2006).

SELF-CARE AND EDUCATION

Successful management of chronic disease care is facilitated considerably by active involvement of the patient in their own treatment procedure. There is also increasing willingness from the patient side to be integrated in their own health care process, and health consumers are actively searching for information independently (Detmer *et al*., 2003). The involvement is usually realized by patient though education and information about his or her disease (Asmar and Zanchetti, 2000) and information and communications technology can provide effective methods for patient participation.

ELECTRONIC DATA STORAGE AND SHARING

It has been stated that shifting from paper based storing to electronic health records (EHR, or electronic medical records, EMR) is associated with remarkable cost-savings (Hillestad *et al*., 2005) and faster access to information, which results in improved efficiency. Electronic process also enables storing bigger quantities of medical data (Haux 2006). This is essential as the amount and complexity of health-related information and knowledge constantly increases and has already made information processing a major component of any health organization. Health ICT facilitates moving from decentralized and institution-based towards more global data storing (Haux, 2006). Having national health records can improve health care processes as different providers can access the same information faster and duplication of tests could be prevented. In the European Union, the long term goal is to have a system where all the clinicians in Europe can access health records from all countries (Andersen, 2006). This would improve conditions for treatment as the patient as well as the health care professional mobility is expected to increase (European Commission 2004).

CONNECTIVITY

With connectivity there are issues such as the lack of an enabling telecom policy and regulatory environment; access to electricity, solar power options, UPS back-ups, insufficient infrastructure, connectivity access and high costs. Connectivity access – measured in terms of telephone access, personal computer ownership, and Internet connectivity varies widely around the world. Inequitable access also exists within societies. Within developing countries segments of the population have been by-passed by the products of the information revolution.

This is complicated by the fast-changing deployment of new technologies and accompanying standards that constantly raise the level of advancement that must be met by anyone who wants to remain current (Alcántara, 2001). This is part of much broader constraints that include insufficient telecommunications infrastructure, high telecommunications tariffs, inappropriate or weak policies, organisational inefficiency, lack of locally created content, and uneven ability to derive economic and social benefits from information-intensive activities (Chandrasekhar and Ghosh, 2001).

In the health sector, development and digital divides between industrialized and developing countries are wider than the gap observed in other productive and social sectors. In some cases, the changes brought about by the privatization of healthcare added to the already high degree of structural inequity that prevails in most low and middle-income

countries. Dependable connectivity is needed for reliable transactions. In developing countries fast connectivity is still limited and usually only dial-up access is available. Poor telecommunications infrastructure, limited number of Internet Service Providers (ISP), lack of access to international bandwidth, and affordable Internet access costs continue to be barriers to widespread use of ICTs.

National expenditures among countries, even for countries of comparable income level, vary considerably (Casas, 2001). Low per capita expenditure in health limits the market for new and expensive technologies. Per capita expenditure in ICT is a better indicator of the real level of ICT investment than expenditure as percentage of the Gross Domestic Product. Some developing countries have expenditures that are comparable to that of developed countries when expressed as percentage of the GDP, although the absolute value per capita is low -- for instance, relative to GNP Brazil has the same level of expenditures as Canada, although in absolute value Brazil invests 6.6 times less than Canada in ICT (World Bank, 2002).

The Internet can provide a wide range of users with timely, accurate, diverse and detailed health information. However, its decentralised structure, global reach, levelling of access to the tools of publication, immediacy of response, and ability to facilitate free-ranging interchange also make the Internet a channel for potential misinformation, concealed bias, covert self-dealing, and evasion of legitimate regulation. It is very difficult to ascertain and recommend on the credibility, motives, sponsorship, and eventual conflicts of interest in the more than 50,000 health websites in existence. Many health public-oriented websites are profit-driven, others promote unproven and even dangerous forms of treatment or products, while others may be good intentioned, but contain misleading or false information (Risk and Dzenowagis, 2001).

CAPACITY

While capacity to adapt information to ensure that it is culturally appropriate and relevant is a major challenge, so too is the capacity to use ICTs effectively. A skilled ICT work force is an essential ingredient for the effective use of ICTs in health care. Systems professionals, technology products, services providers and project team leaders with high skill levels and experience in working in the sector introducing the ICTs are important components of success. The number of technicians, scientists, and portion of the GNP devoted to research and development is a good indicator of those capabilities.

The most successful efforts to incorporate information and communication technologies have occurred in countries with strong and efficient government and academic institutions committed to invest in education, scientific and technological development, and public services, in tandem with business sectors (for instance, banking and retail commerce) ready and willing to automate their operations.

Capacity also refers to inequities in societies and the sharing of resources within the community. For example, due to lower rates of literacy, women (and marginalised groups in general) are not given equal access to the benefits of ICTs. Ensuring that women are part of the target group, that gender deliberations have been undertaken by choice of the ICT tool, and that language or cultural norms do not exclude women benefiting from the ICT intervention are important considerations (Danida, 2005).

COOPERATION

The use of ICTs for health and development involves local, regional and international participants as stakeholders. No one sector or one set of stakeholders can deal with the complexity involved in the effective use of ICTs in health. Technical knowledge, experience, and financial investments needed to establish large and complex ICT initiatives require tapping into resources and expertise that no single organisation retains. Several key groups should be considered when discussing efforts for ICTs and health. Dzenowagis (2005) identifies six major groups:
- ✓ Citizens (including patients)
- ✓ Professionals
- ✓ Hospitals and academia
- ✓ Health-related businesses
- ✓ Government
- ✓ International agencies.

CAPITAL

Generally, there is little investment in ICTs for health even in most developing countries. The picture is one of fragmentation, with many different varieties of ICTs being acquired from different donors. Very few government-run health services have properly functioning ICT tools and there is no reliable infrastructure to enable inter-organizational transfers of information. Invariably, there is no national health information and IT infrastructure to underpin the delivery of health care. WHO (2004) makes the point that technologies must be 'integrated into health services that meet basic needs' if they are to be considered to be essential investments.

CONSTRAINTS AND CHALLENGES IN THE USE OF ICT IN HEALTH CARE SECTOR

A number of factors can inhibit the introduction and successful application of ICT in the health sector in developing countries. Satellife (2005) identified three main categories as connectivity, content and capacity. Rao (2005) adds five more categories for analysis: community, commerce, culture, cooperation and capital.

IV. METHODOLOGY

Quantitative research design was used to assess the impact of Information and Communication Technology in Primary Health Care delivery in Mampong municipality. Cluster sampling technique was used in data collection due to a large and widely spread population. Fifty-five (55) public health nurses working within two health centers of the municipality were sampled as subjects for this study.

The sample size was obtained by using a formula chart proposed by Krejcie and Morgan (1970) which made it easier

to come out with a sample size of 55. Thus from two health centres: Mampong Municipal Hospital and Calvary Community hospital. 35 and 15 public health nurses were selected from the hospitals respectively. Open and closed ended questionnaire was designed and presented to the respondents to collect necessary data for the study. Data collected was coded for analysis using the statistical Package for Social Sciences (SPSS) Version 20. Pie charts and frequency distribution tables were used for data interpretation.

ANALYSIS

DEMOGRAPHIC CHARACTERISTICS

Majority of the nurses were within the age group of 25-29, this represents 50.9% of total number of 55 nurses, followed by 20 -24 age group with 21.8.7%, 30 – 34 years with 10.9%, 35 -39 years with 7.3%, 40 – 44 years with 5.0% and above 44 years with 3.6%.

The study revealed that, out of the 55 respondents, 20 (36.3%) had Diploma in community health whereas 19 (34.5%) had Certificate in community health. The remaining 16, representing 29.2%, had gone through varied level of education notable among them were Diploma in General Nursing, BSc in General Nursing whilst 3(5.5) were Post Diploma nurses.

Finding out the marital status of the respondents, 31 out of the 55 nurses representing 56.4% were not married, followed by 41.8% who were married and 1.8% were divorced.

With regards to number of years in service, collectively, 94.5% of the nurses have had at least one (1) year or more experience in the service whilst the remaining 5.5% have had less than one (1) year experience.

Items	Frequency	Percent (%)
Age		
20 -24	12	21.8
25 -29	28	50.9
30 – 34	6	10.9
35 – 39	4	7.3
40 – 44	3	5.5
Above 44	2	3.6
Total	55	100
Educational background		
Certificate in Community Health	19	34.5
Diploma in Community Health	20	36.3
Diploma in General Nursing	9	16.4
BSc in General Nursing	4	7.3
Others (Post Diploma)	3	5.5
Total	55	100
Marital status		
Married	23	41.8
Single	31	56.4
Divorced	1	1.8
Total	55	100
Number of years in service		
Less than 1 year	3	5.5
Between 1 to 2 years	12	21.8
2 to 3 years	19	34.4
3 to 4 years	14	25.5
4 to 5 years	3	5.5
5 or more years	4	7.3
Total	55	100

Source: Field Survey,2016
Table 1: Demographic characteristics of nurses

AVAILABILITY AND RATE OF EASE OF USING ICT TOOLS

ICT Tools	Level of availability	Rate of ease of usage					Total
		Very high	High	Medium	Low	Very low	
TV	Available	35 (63.6%)	5 (9.1%)	9 (16.4%)	-	-	55
	Non available	-	-	-	-	6 (10.9%)	
Mobile Phone	Available	34 (61.9%)	7 (12.7%)	6 (10.9%)	2 (3.6%)	4 (7.3%)	55
	Non available	-	-	2 (3.6%)	-	-	
Radio	Available	39 (70.9%)	6 (10.9%)	5 (9.1%)	2 (3.6%)	3 (5.5%)	55
	Non available	-	-	-	-	-	
Computer / laptop	Available	32 (58.2%)	2 (3.6%)	5 (9.1%)	2 (3.6%)	-	55
	Non available	-	-	1 (1.8%)	2 (3.6%)	11 (20%)	
Internet	Available	24 (43.6%)	3 (5.5%)	2 (3.6%)	-	-	55
	Non available	4 (7.3%)	2 (3.6%)	1 (1.8%)	4 (7.3%)	15 (27.3%)	
DVD	Available	22 (40%)	6 (10.9%)	2 (3.6%)	-	-	55
	Non available	-	1 (1.8%)	8 (14.5%)	2 (3.6%)	12 (21.8%)	
Digital Came	Available	20 (36.4%)	4 (7.3%)	-	6 (10.9%)	-	55

		Very high	High	Medium	Low	Very low	Total
ra	Non available	-	-	3 (5.5%)	10 (18.2%)	12 (21.8%)	
Digital Projector	Available	14 (25.5%)	2 (3.6%)	4 (7.3%)	2 (3.6%)	1 (1.8%)	55
	Non available	-	-	3 (5.5%)	6 (10.9%)	23 (41.8%)	
Printer	Available	23 (41.8%)	2 (3.6%)	6 (10.9%)	-	1 (1.8%)	55
	Non available	-	-	3 (5.5%)	-	20 (36.4%)	
Landline telephones	Available	25 (45.5%)	10 (18.2%)	3 (5.5%)	-	3 (5.5%)	55
	Non available	-	-	2 (3.6%)	5 (9.1%)	7 (12.7%)	

Source: Field Survey, 2016

Table 2: Availability and rate of ease of using ICT tools

With reference to the table 2, 49 (89.1%) of the nurses indicated that TV as ICT tool is available to them however, 63.6%, 9.1% and 16.4% of the nurse indicated their level of ease of using TV in PHC delivery as very high, high and medium respectively. In contrast, 6 (10.9%) of them reported not having TV available to them for PHC delivery with the 6 (10.9%) indicating their level of ease of using as very low.

In response to availability of mobile phone for PHC, 47 (96.4%) of the nurses indicated that mobile phone is available. With their levels of ease of using ICT tool – mobile phone, 34 (61.9%), 7 (12.7%), 6(10.9%), 2(3.6%) and 4 (7.3%) were very high, high, medium, low and very low respectively. In opposite, 2 (3.6%) said mobile phone is not available for PHC delivery but their level of ease of using such tool is medium.

All the respondents indicated that ICT tool such as radio is available for PHC delivery at their health centres. However, 39 (70.9%) mentioned that they have very high skills in using radio, 6 (10.9%) said they have high level, 5 (9.1%) indicated medium, 2 (3.6%) of them said they have low skills in using radio whereas 3 (5.5%) said they have very low skills in using radio for PHC.

In accordance with table 2, 41 (74.5%) of the nurses indicated that computer / laptop as ICT tool is available to them. However, 32 (58.2%), 2 (3.6%), 5 (9.1%) and 2 (3.6%) of the nurses indicated their level of ease of using computer / laptop in PHC delivery as very high, high, medium and low respectively. In contrast, 14 (25.5%) of them reported not having computer / laptop available to them for PHC delivery and this comprises medium, low and very low levels of ease of using computer / laptop respectively (Table 2).

With regards to internet availability for PHC delivery, 29(52.7%) of the nurses indicated that they have internet available. 24(43.6%), 3(5.5%) and 2(3.6%) of very high, high and medium level of ease of using respectively. 26(47.3%) of the nurses said that, they do not have internet available for PHC but they indicated varied level of ease of use ranging from very high to very low (Table 2).

In response to availability of digital camera for PHC, 30(54.6%) of the nurses indicated that digital camera is

available. With their levels of ease of using digital camera as an ICT tool; 20(36.4%), 4(7.3%) and 6(10.9%) were very high, high and low respectively. In opposite,25(45.4%) said digital camera is not available for PHC delivery but their level of ease of using such tool range from medium to very low (Table 2).

USEFULNESS OF ICT IN PHC

Usefulness	Very useful	Useful	Less useful	Not useful	No idea
For sending reports	47 (85.5%)	6 (10.9%)	-	-	2 (3.6%)
For receiving information	43 (78.2%)	11 (20%)	-	1 (1.8%)	-
For communication among staff	46 (83.6%)	8 (14.6%)	1 (1.8%)	-	-
For learning	29 (52.8%)	16 (29.1%)	4 (7.3%)	2 (3.6%)	4 (7.2%)
For report preparation	41 (74.6%)	7 (12.8%)	1 (1.8%)	2 (3.6%)	4 (7.2%)
For storage of data / information	31 (56.4%)	14 (25.5%)	6 (10.9%)	2 (3.6%)	2 (3.6%)
For education of clients / patients	25 (45.5%)	16 (29.1%)	2 (3.6%)	5 (9.1%)	7 (12.7%)
For leisure	27 (49.1%)	13 (23.6%)	2 (3.6%)	8 (14.5%)	5 (9.2%)
For entertainment	34 (61.8%)	9 (16.4%)	4 (7.2%)	4 (7.2%)	4 (7.2%)
For analysis of data	27 (49.1%)	18 (32.7%)	3 (5.5%)	2 (3.6%)	5 (9.1%)

Source: Field Survey, 2016

Table 3: Usefulness of ICT in PHC

LEVEL OF SKILLS IN THE USE OF ICT APPLICATIONS

The result in Table 4 points out that all of the nurses (100%) had fair to excellent knowledge on word processing application software. On Spreadsheet software, 50(90.9%) of the nurses had capabilities. On the use of ICT presentation tools, 53(96.4%) of the nurses had capabilities ranging from excellent to fair. On communication via the e-mail, 54(98.2%) of the nurses said they had fair to excellent skills in basic e-mailing. Also with regards to basic internet browsing, most of the nurses 51(92.7%) said they had fair to excellent knowledge in internet browsing. 39(70.8%) of the nurses had fair to excellent skills in using graphics. On both the issue of designing webpage and graphics, most (not more 72.7%) the nurses had some capabilities ranging from fair to excellent skills.

| ICT Application	Level of usage of ICT applications				
	Excellent	Very good	Good	Fair	No capability
Word processing – prepare report	26 (47.3%)	19 (34.5%)	5 (9.1%)	5 (9.1%)	-
Spreadsheets / MS excel	23 (41.8%)	18 (32.7%)	3 (5.5%)	6 (10.9%)	5 (9.1%)
Presentation tools (MS PowerPoint)	26 (47.3)	18 (32.7%)	7 (12.7%)	2 (3.6%)	2 (3.6%)
Basic E-mailing	23(41.8%)	20 (36.4%)	4 (7.3%)	7 (12.7%)	1 (1.8%)

Basic Internet browsing	24 (43.6%)	19 (34.5%)	5 (9.1%)	3 (5.5%)	4 (7.3%)
Graphics	18 (32.7%)	17 (30.9%)	2 (3.6%)	2 (3.6%)	16 (29.2%)
Web page designing	18 (32.7%)	14 (25.5%)	4 (7.3%)	4 (7.3%)	15 (27.3%)
Use of chatting platform	20 (36.4%)	14 (25.5%)	4 (7.3%)	2 (3.6%)	15 (27.3%)

Source: Field Survey, 2016
Table 4: Level of skills in the use of ICT applications

CHALLENGES ASSOCIATED WITH THE USE OF ICT IN PHC

Inadequate knowledge on ICT (12%) (17), high cost of purchase and installation (17%) (24), irregular power supply (26%) (35), lack of financial support on the use of ICT (12%) (16), lack of internet access (17%) (23), high cost of training 9(7%) and virus attack (9%) (13).
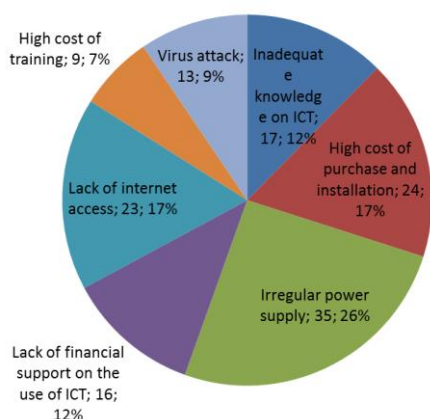
Source: Field Survey, 2016
Figure 1: Challenges associated with the use of ICT

V. DISCUSSION

The study showed that majority of the respondents were within the age group of 25-29, representing 50.9% of total number of 55, followed by 20 -24 years age group with 21.8.7% of the respondents also between the ages of 30 – 34 years representing 10.9%. 7.3% are between 35 -39 with 3.6% above 44 years.

Finding out the educational background of the respondents, it was revealed that 20 (36.3%) had Diploma in community health whereas 19 (34.5%) had Certificate in community health. The remaining 16, representing 29.2%, had gone through varied level of education notable among them was Diploma in General Nursing and BSc in General Nursing.

With reference to the use of the television as ICT tool, 49 (89.1%) of the nurses indicated that TV as ICT tool is available to them however, 63.6, 9.1 and 16.4% of the nurse indicated their level of ease of using TV in PHC delivery are very high, high and medium respectively. In contrast, 6 (10.9%) of them reported not having TV available to them for PHC delivery with 6 (10.9%) indicating that, their level of ease of using TV as ICT tool is very low.

In response to the availability of mobile phone and ease of use for PHC, 47 (96.4%) of the nurses indicated that mobile phone is available. With their levels of ease of using ICT tool – mobile phone, 34 (61.9%), 7 (12.7%), 6(10.9%), 2(3.6%) and 4 (7.3%) were very high, high, medium, low and very low respectively. In opposite, 2 (3.6%) said mobile phone is not available for PHC delivery but their level of ease of using such tool is medium.

On the availability of computer/laptop, (74.5%) of the nurses indicated that computer / laptop as ICT tool are available to them however, 32 (58.2%), 2 (3.6%), 5 (9.1%) and 2 (3.6%) of the nurses indicated their level of ease of using computer / laptop in PHC delivery are very high, high, medium and low respectively. In contrast, 14 (25.5%) of them reported not having computer / laptop available to them for PHC delivery.

The study also revealed that, there are challenges associated with the use of ICT tools for PHC. ICT with 17(12%) of the respondents indicating high cost of purchase and installation of computers, 24(17%) reported irregular power supply, 35(26%) also talked about the lack of financial support on the use of ICT, 16 (12%) complained of lack of internet access. 23 (17%) of the respondents said there is high cost of training of nurses on how to use various ICT too while 9 representing 7% were worried about virus attacks due to unavailability of active and updated antivirus.

VI. CONCLUSION AND RECOMMENDATION

ICT based solutions offer a modern measure to meet both current and future challenges of exploding health expenditures. However as concerns have been raised regarding data security and safety issues as well as acceptance by public health nurses, stakeholders have to appreciate their societal duty to minimize risks and optimize benefits of technical innovations. The presented data is evidence that public health nurses were highly aware of the on-going trends towards digitalization and surveillance society. The rapid progress in the future demands of health care requires for intensified co-operation and networking of stakeholders at a quite early stage of planning of public health strategies and implementation of health promotion related ICT tools.

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