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INFORMATION AND COMMUNICATION TECHNOLOGY USE BY REPRODUCTIVE HEALTH WORKERS IN NIGERIA: STATE OF THE ART, ISSUES, AND CHALLENGES

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Abstract: *This study investigated reproductive health workers' (RHWs) use of ICTs, the effects of ICTs on their job functions, and the challenges limiting full exploitation of ICTs. The study adopted a descriptive survey design. Stratified sampling technique was used to select a sample of 360 RHWs of the University College Hospital, Nigeria. A questionnaire obtained the data, and frequencies and percentage distributions were the analytical techniques adopted. Findings revealed that RHWs indicated extensive use of ICTs in their job functions. Faster access to relevant medical information, easy exchange of information with colleagues, and increased efficiency were the major impacts of ICT usage on their activities. The information accessed through ICTs was primarily educational, health, and research. Findings equally revealed that the major challenges in ICT use were erratic power supply and inadequate access to ICT facilities. Based on the findings, recommendations were made towards enhancing better utilization of ICTs by RHWs.*

Keywords: *reproductive health workers, University College Hospital, information and communication technology, Nigeria.*

INTRODUCTION

The emergence of information and communication technologies (ICTs) and their role in stimulating rapid development in all sectors of the economy, and in the inseparable sociocultural and political spheres of life, is widely acknowledged (Ajayi 2003; Akanbi 2005; Idowu, Ogunbodede, & Idowu, 2003). According to Ajayi (2003), ICTs are redefining the way almost everything is done and are a ready tool for all strata of society. Previous studies, like those of Idowu et al. (2003) and Akanbi (2005), have highlighted the strategic disadvantages that nations, institutions, and industrial sectors would face if they did not position themselves to harness and implement ICTs as tools for leveraging their activities in the emerging global economy. In the health sector, for instance, ICTs are being applied to facilitate the delivery of appropriate health services to the populace (Mechael, 2005). ICTs also

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contribute to health education, knowledge sharing, health monitoring, statistics gathering and analysis, the delivery of care, and in meeting internationally agreed upon health targets with respect to a number of diseases (United Nations Development Programme [UNDP], 2003). ICTs' impact on health care have been particularly significant in developing countries and in rural settings, where long distances and the quality of the infrastructure hinder the movement of physicians and patients (Geissuhler, Ly, Lovis, & L'Haire, 2003), reducing the quality of the health services delivered.

Health workers play important roles in a nation's socioeconomic and political growth. ICTs are vital tools that help them to access and use relevant information in their jobs. ICT usage can be highly effective if health workers harness the opportunities it offers to meet their needs. Ibegwam (2004) observed that the Internet has become an important component of the electronic services in academic institutions and has permeated all aspects of life, breaking down barriers to communication and information access worldwide. The Internet is a particularly valuable resource for information relating to health care. However, in spite of the potential contributions of ICTs to the activities of health workers, some constraints exist that prevent their widespread utilization. Some of the more obvious constraints common to developing countries include the limits of physical access to ICTs, the high cost of providing access for nations trying to balance multiple financial priorities, and the exclusion from access of large segments of the population due to inadequate infrastructure (Chandrasekhar & Ghosh, 2001).

One specific area of health is reproductive health, which represents a crucial part of general health and a central feature of human development. Globally, both epidemiological data and the expressed wishes of diverse constituencies indicate that reproductive health interventions are most likely to include attention to the issues of family planning, sexually transmitted disease (STD) prevention and management, and prevention of maternal and perinatal mortality and morbidity. Reproductive health should also address issues such as harmful practices, unwanted pregnancy, unsafe abortion, reproductive tract infections that include STDs and HIV/AIDS, gender-based violence, infertility, malnutrition and anemia, and reproductive tract cancers (United Nations Population Information Network, 1995). Reproductive health workers (RHWs) need timely information to discharge their duties effectively, to collaborate with colleagues and apply ICTs on their job. However, they are also constrained by the same factors that limit the general body of health workers from exploiting ICTs. Of major concern is the fact that many RHWs who live in rural areas, particularly in developing countries or emerging economies, do not have information on current developments in medicine because of their inadequate access to ICTs, nor are they able to collaborate with geographically distant colleagues, as their counterparts in other parts of the world can. For instance, in developed countries, health workers conduct on-line consultation with colleagues that is only possible through the use of ICTs. Thus, health workers with inadequate access to ICTs, such as those at the University College Hospital (UCH), Ibadan, Nigeria, are less likely to be able to collaborate with peers, to gather current or timely information, or to be skilled in the use of various ICTs.

This study seeks to investigate the extent to which RHWs at the UCH use ICTs in the discharge of their duties, and the types of activities for which they access and/or employ ICTs. We also sought to evaluate the effects of ICT usage on the RHWs' job functions and to identify the challenges hindering full exploitation of ICTs at the UCH. The study was guided by the following research questions that were formulated based on the objectives of the study.

1. What types of ICTs are used by the RHWs at the UCH, and what specific activities are they used for?
2. In what ways have the use of ICTs by the RHW impacted medical services delivery at the UCH?
3. What factors constrain the RHWs' from fully exploiting ICTs in the discharge of their duties?

Although previous studies in the Nigerian context (Idowu et al., 2003; Adeyemi & Ayegboyin, 2004) have considered ICT use in the hospital environment, neither of these studies specifically focused on ICT use by RHWs. Herein lies the basis for the formulation of the research questions.

The remainder of this paper is structured as follows: The next section is a brief review of previous studies, followed by the methodology employed in this research with the survey implementation scenarios. A presentation of the survey results and discussion of the findings are then presented, while the conclusions, recommendations and further research finalize the paper.

REVIEW OF LITERATURE

The production of quality health-care delivery in a country is guided by the level of the ICT infrastructure possessed and used by that country. A good ICT infrastructure, therefore, is a condition for enhancing the well-being of a country. Gates (1999) reported that intra- and inter-organizational networks in some advanced countries function like a digital neural system of the organization. Thus, he said, communication for health purposes has shifted from the largely manual or physical documentary method to digital communication. He further stated that such access to ICTs has helped disseminate information to the rest of the world. In the medical field, Gates reported, American doctors are able to collaborate as often and as quickly as they want with other medical doctors in other parts of the world through the use of ICTs. For example, while examining a patient, a medical doctor might be able to send an electronic x-ray of a patient to a leading expert in another country who could readily interpret and provide more details of the disease or condition, as well as send feedback to the medical doctor all within a few minutes. RHWs, in their research and application processes, can use the Internet to identify research issues, search literature databases, seek out information on surveys and clinical trials, and publish research results (Eysenbach & Wyatt, 2002).

Several studies have reported on ICT use among RHWs. Idowu et al. (2003) reported that while ICT capabilities (personal computers, mobile phones, Internet) were available in Nigerian teaching hospitals, mobile phones were spreading fastest. Their findings also revealed that computers and mobile phones were in use in all the teaching hospitals but not much Internet connectivity was available, meaning that most of the medical experts used external (nonhospital) Internet services, such as cybercafés, for even rudimentary Internet access, such as e-mail. They further explained that while just 1.4% of the medical staff did not use the Internet in any fashion, the vast majority (70.7%) of those using the Internet did so only for e-mail. In addition, Adeyemi and Ayegboyin (2004), in a survey involving four general hospitals, 10 primary health-care centers, and six private hospitals in Nigeria,

reported that none of the institutions had e-mail access or a Web site, only 5% of the workers possessed personal computers, only 7% of the health-care workers were computer literate, only 2% had any measurable computer skills, and just 65% had access to a mobile phone, but not necessarily their own. This was in spite of the fact that the state of Lagos has the largest concentration of Internet service providers, telecom operators, and cybercafés, intended to create a reasonable platform for ICT use.

The Tucker and Chetty (2004) case study series on ICT-enabled development initiatives illustrated the possible benefits when health workers use ICTs successfully to overcome development obstacles, and thus narrowing the digital divide gap. In their study, a wireless local area network (LAN) was set up in 1999 to connect the hospital in Sulenkama in Cape Town, with a clinic, local school, community center, and police station in Tsilitwa, South Africa. The LAN used wireless fidelity (WiFi) signals, with a booster between Tsilitwa and Sulenkama since Sulenkama lies in a slight valley. The clinic and hospital used the system in a telehealth project pioneered by researchers at the University of Cape Town. The system worked in such a way that a nurse at Tsilitwa focused a web camera on a patient and the picture was displayed on a computer in Sulenkama. In Sulenkama, the doctor opened up his computer that had been configured to load a Web page associated with the IP address of the Web camera that was focused on a patient in Tsilitwa and thus access the image. Simultaneously, the nurse, doctor, and patient could speak to one another using a Voice over Internet Protocol (VoIP) program on the LAN. The doctor was then able to advise the nurse regarding a course of treatment or could refer the patient to a specialist elsewhere, thus improving care while saving time and money.

In addition, Braa, Macome, Mavimbe, and Jose (2001) conducted a study of actual and potential usage of ICTs at the district and provincial levels in Mozambique, with a focus on the health sector. They demonstrated that computers and Internet access were rapidly becoming available in all provinces and major districts in Mozambique, although most of the health workers were using the computers only as advanced typewriters, that is, for word processing. The National Health Information System of Mozambique was said to be among the very first computer applications in the provinces. The study also revealed that while it was still rare to use application software developed in order to address particular needs, the health sector was a forerunner with such an innovation.

Meanwhile, an Academy for Educational Development-Sattellife (2009) study determined the extent of use of HealthNet by health workers. The study revealed that HealthNet was used by 1,950 health-care workers in more than 150 countries worldwide, and that the development impact of HealthNet had been most prevalent in Africa, where the model has contributed to increased rural and urban connectivity, capability building, increased demand for IT services, and, in some cases, commercially viable IT service enterprises. The study further explained that surgeons from Mozambique, Tanzania, and Uganda used HealthNet to consult regarding patient treatments and to learn new reconstructive surgery techniques. In Zambia, health-care workers who once traveled 700 kilometers each week to collect data for clinical trials now used HealthNet to send this information via e-mail. Physicians in Ethiopia used HealthNet to schedule consultations, making it unnecessary for ill patients to travel long distances with no guarantee of seeing a physician. Health workers in the Democratic Republic of Congo used HealthNet to report progress on treating trypanosomiasis to public health organizations in the north of the country

while, in Gambia, malaria researchers used HealthNet to submit data to European medical schools for clinical trials. The study concluded that many physicians in developing countries relied on HealthNet as their sole source of information on the treatment of AIDS and tropical diseases, essential drugs, pediatrics, and public health promotion (Academy for Educational Development-Sattellife, 2009).

Taylor and Lee's (2005) study on occupational therapists' use of ICTs in Western Australia revealed that e-mail and the personal computer were the most frequently used ICT-enabled services. Furthermore, regarding competency in the use of ICTs, 58% of therapists rated their competency level as good or better, although competence was rated lower for Web searching (48.5%) and searching for electronic articles (29.8%). Additionally, approximately one third of respondents were dissatisfied with the level of technical support available to them, and only 38.4% of the therapists had participated in basic computer training provided by their current employer. Rural therapists had less access to a computer in their work environments in comparison to their metropolitan peers but they proportionately used e-mail, teleconferencing, and videoconferencing more frequently than their metropolitan counterparts.

These studies provide a useful backdrop for the current study on ICT use by RHWs at the UHC in Nigeria. The following sections introduce the method adopted for the study including design, sampling, instrument administration and its results and outcomes.

METHOD

The quantitative survey research design was adopted and the target population comprised RHWs at the UCH, Ibadan, Nigeria. The 800-bed hospital is a tertiary care center established in 1957, and provides specialists as well as general medical services. In addition, it is a center for research and training of research and for training of health-care personnel in various medical disciplines at the undergraduate through postgraduate levels. Patients are referred to the UCH from several health-care facilities both within and beyond Nigeria. The hospital consists of clinical buildings, laboratories, administrative blocks, lecture rooms, students' residence halls, staff quarters, mini-markets, water and sewage treatment plants, commercial banks, and a filling station (Sangowawa et al., 2005). According to the UCH 2007 register, the total population of RHWs in UCH was 1,726 workers. Of this figure, 569 were pharmacists, 789 were medical doctors, and 207 and 161 were trained nurses and nurse/midwives, respectively. A sample of 360 was drawn across the RHWs as follows: 33% from pharmacists, 46% from medical doctors, and 21% from nurses and nurses/midwives, respectively, to ensure proportional representation. A questionnaire, containing structured questions, was the data collection instrument used. The instrument was divided into five sections, as indicated in Figure 1.

Prior to use, the questionnaire was examined by experts in ICT research and their comments were used to arrive at the final version. A Cronbach alpha reliability co-efficient of $\alpha = 0.70$ was achieved. Copies of the questionnaire were administered using the face-to-face approach in the respondents' offices in the months of June and July 2007. From a total number of 360 questionnaires administered, 342 (95%) were returned. The response rates differ among the categories of reproductive health workers, being highest among the medical doctors and pharmacists, each with 99.4%. The lowest response rate of 78% was recorded among nurses and

Section A elicited demographic data from the respondents.

Sections B and C collected data on the use of ICT facilities, the extent of use, and the nature and activities ICTs of ICT use. These sections were structured to gather data for Research Question 1.

Section D elicited data on the impact of ICTs on the respondents' job functions. This section was meant to collect data for Research Question 2.

Section E collected data on factors that constrain the RHW in their use of ICTs. Questions in this section were structured to gather data for Research Question 3.

Figure 1. The questionnaire structure used to gather information of ICT use by RHWs in rural Nigeria.

nurse/midwives collectively. Analyses were performed using the Statistical Package for Social Science (SPSS) software, and descriptive statistics, namely frequency and percentage distributions, were the techniques used to report the data analyzed.

The results presented in Table 1 show that the RHWs were concentrated in Obstetrics and Gynecology (O & G), with a frequency of 71 (20.7%), followed by the option "others" (which are relatively independent units that also provide reproductive health and related services, such as the Sexually Transmitted Infection Clinic), with a frequency of 22.8%, and nursing, with a frequency of 18.3%. Other areas/units where health workers were concentrated include the children's clinic (10.2%), pharmacy (8.2%), family planning (3.5%), and medical social work (2.9%). Results in Figure 2 show that the bulk of the respondents were females (60%). This could result from the fact that reproductive health issues were traditionally the major preoccupation of the female gender, except in more specialized cases, such as medicine and surgery.

Table 1. Frequency distribution of the RHWs Across Departments and Units.

	Frequency	Percent
Obstetrics and Gynecology	71	20.7
Pharmacy	28	8.2
Medical records	3	0.9
Radiology	3	0.9
Surgery	9	2.6
Delivery	1	0.3
Population and family health	5	1.5
Family planning	12	3.5
Chemical pathology	7	2.0
Microbiology	9	2.6
Hematology	2	0.6
Children clinic	35	10.2
Medical social work	10	2.9
Nursing department	60	17.5
School of midwifery	9	2.6
Others	78	22.8
Total	**342**	**100.0**

Figure 2. Gender distribution of respondents.

As presented in Table 2, all the respondents were well-educated and were specialists in their different areas of endeavor. This was expected, given the fact that all of them work in a teaching hospital with the entire nation and beyond as the scope/coverage of its operations. All the general medical practitioners had the basic qualification of bachelor of medicine and surgery (MBBS) degree, while the nurses and nurses/midwives were all registered with relevant professional bodies. The qualification with the least percentage was the doctor of philosophy (PhD) degree (6.1%). Those with a master of science (MSc) degree numbered 79 (23.1%). A quest for knowledge among the RHWs is evident since a considerable number of them had qualifications beyond the minimum required to practice.

Table 2. Frequency distribution of Respondents' Highest Educational Qualification.

Highest educational credentials	Frequency	Percent
MBBS	123	36
M.Sc.	79	23.1
Registered nurse/midwife	52	15.2
Registered nurse	46	13.5
Ph.D.	21	6.1
Others	15	4.4
No response	6	1.8
Total	**342**	**100**

Key: MBBS = Bachelor of Medicine and Bachelor of Surgery; MSc = Master of Science; PhD = Doctor of Philosophy.

MAJOR FINDINGS

Use of ICTs by RHWs

The response pattern to the question on the use of ICT facilities by the respondents is summarized below. ICT facilities, such as computers, scanners, fax machines, and so on, recorded a generally high level of usage across the RHW groups.

Multimedia projector

Results revealed that the usage level of this technology by the pharmacists was highest, with 100%, followed by the medical doctors, the nurses and nurse/midwives, with 95.4%, 71.7%, and 66.2% levels, respectively. This might be due to the fact that pharmacists and medical doctors were more likely to deliver public lectures and seminars using multimedia projectors than would the nurses and nurse/midwives.

Computers Linked with Internet Service Provider (ISP)

Nurses and pharmacists scored the highest percentage, with 100 percent usage level, followed by the medical doctors with 98.1% and the nurse/midwives with 96.2%. This showed a considerably high presence of Internet connectivity at the UCH showing some contrasts with previous studies (Idowu et al., 2003) and Adeyemi & Ayegboyin, 2004) that reported little connectivity and no connectivity in the surveyed hospitals respectively.

Electronic Mail Facilities/Services

The use of e-mail facilities/services was highest among the medical doctors (95.4%). This was not unexpected, given the fact that this facility affords them the opportunity to access, exchange, and receive large volume of information, as well as by the fact that the RHWs (medical doctors, in particular) need to upgrade their skills and obtain the result of new discoveries in their fields. The level of use was also high among the nurses (89.3%), nurse/midwives (86.5%), and pharmacists (75.0%).

World Wide Web (WWW) Access

Response to the question on the use of the WWW was lower, compared with the other questions, with just 260, or 76%, of the respondents answering the question. Of this number, medical doctors had the highest proportion (59.9%), followed by nurses/midwives (20.4%), nurses (14.2%), and pharmacists (5.5%). This was surprising considering the high percentage levels recorded for the use of computer linked with ISPs and electronic mail among the RHWs.

Video Conferencing

Results also revealed that 208 (63.4%) of the respondents indicated using videoconferencing. Medical doctors were in the majority at 49.7%, followed by nurses (27.3%), nurse/midwives (20.2%), and pharmacists (3.8%). Majority of those who did not respond to the question were females in the different categories of RHWs.

Sex Differentials in Usage Level of ICTs

Figure 3 presents the differentials in usage of ICTs between male and female RHWs at the UCH. The average usage level of all the facilities and services was higher among male respondents than their female counterparts, although the disparity varied among technologies. For example, more than 99% of the male respondents in the UCH indicated using the computer linked with ISP compared to their female counterpart at 97.4%. However, the usage level of multimedia projector among the male gender was 95.1%, compared with 77.2% among the female gender. The usage levels of the WWW, e-mail, and video conferencing technologies followed a similar trend, with e-mail showing the greatest disparity of all measured technologies.

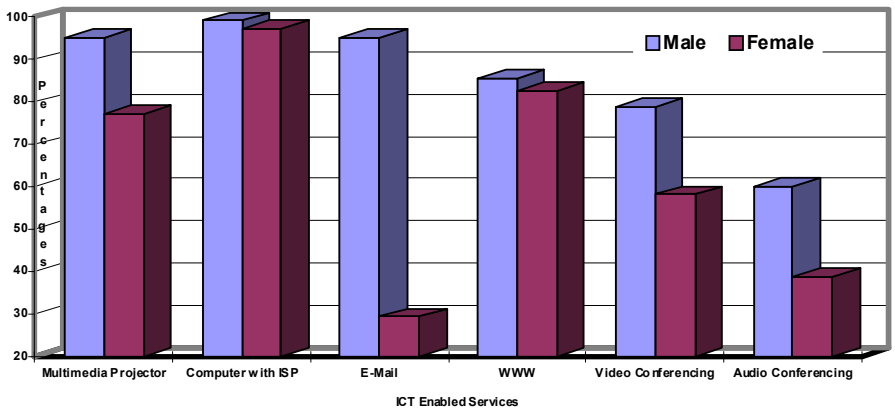

Figure 3. Gender and usage level of ICT services.

Common Places the RHWs Access ICTs

The results of the analysis of the common places of access to ICT by the RHWs are presented in Table 3. As shown, 74.6% of the RHWs claimed to use ICT in cybercafés. This high proportion of users in cybercafé confirm that RHWs who wish to access ICTs often have to be flexible in finding sources of access, and it could be attributable to the inadequate ICT facilities at their places of work or the persistently erratic power supply experienced generally in the country. The erratic power supply often cripples on-line activities in most public institutions in Nigeria, and a government teaching hospital, such as the UCH, is by no means an exception. Most of the cybercafés are commercial centers that have standby electric generators to supply electricity in cases of public power supply interruptions. Two-hundred and eleven (61.7%) respondents claimed that they use ICTs in their offices, while 52.6% used it in their homes, perhaps for comfort and privacy. One hundred and six (31%) used it in schools (both secondary and tertiary), while the remaining 9.1% chose the category "other," specifically churches, hotels and friends' homes.

Activities for Which RHWs Use ICTs

Table 4 presents the result of analysis of the form of activities in which RHWs used ICTs. The results presented in Table 4 revealed that a clear majority (90%) of the RHWs always use ICTs for communication. This cannot be disconnected from the nature of the medical profession, where

Table 3. Frequency Distribution of Places of Access to On-line Applications by the RHWs.

	Yes		No Response	
	Number	%	Number	%
Cybercafé	255	74.6	3	0.9
Office	211	61.7	-	-
Home	180	52.6	-	-
School	106	31	-	-
Other	31	9.1	-	-

Table 4. Frequency Distribution of RHWs' Activities in Which ICT Are Used.

	Never		Rarely		Always	
	Number	%	Number	%	Number	%
Communication	5	1.5	30	8.8	**308**	**90.0**
Research	13	3.8	38	11.1	**291**	**85.1**
Networking/linking with peers	23	6.7	40	11.7	**279**	**81.6**
Skills acquisition	12	3.5	51	14.9	**279**	**81.6**
Presentations	18	5.3	51	14.9	**273**	**79.8**
Collaboration with colleagues	25	7.3	45	13.2	**272**	**79.5**
Teaching/instruction	50	14.6	50	14.6	**242**	**70.8**
Data/records management	45	13.2	72	21.1	**225**	**65.8**
Medical diagnosis	45	13.2	88	25.7	**209**	**61.1**
Other					**7**	**2.0**

new discoveries are made everyday and, in order to remain current in their field, medical personnel must communicate with colleagues quite frequently. This was followed by 85.1% and 81.6% who use ICTs for research and presentations, respectively. Also, a significant proportion (81.6%) indicated ongoing use of ICTs for skills acquisition, showing that majority of RHWs desired to upgrade their knowledge by acquiring new and relevant skills. This was followed closely by 79.5% who used ICTs for collaboration with colleagues. Two hundred and forty-two (70.8%) used ICTs for teaching/instruction, while the lowest percentage 61.1% used ICTs for medical diagnoses, indicating that this is not yet a widespread practice, which may not be disconnected with the fact that they did not have adequate access to ICTs.

Nature of information RHWs access via ICTs

The result of the analysis of the types of information accessed by the RHWs with the use of ICTs is presented in Table 5. The results showed that educational information was the most sought knowledge by the RHWs, with 85.1% of the responses, followed by 84.5% who used

Table 5. Frequency Distribution of the Type of Information Accessed by the RHWs Via ICT Facilities.

Type of Information	Yes		No		No response	
	Freq	%	Freq	%	Freq	%
Educational information	291	85.1	51	14.9		
Health information	289	84.5	53	15.5		
Research information	289	84.5	52	15.2	1	0.3
Clinical information	284	83.0	58	16.9		
Career information	252	73.6	90	26.3		
Administrative information	182	53.2	160	46.8		
Other	22	6.4	320	93.6		

ICTs to seek health information and an equal proportion used it to access research information. Closely followed was the 83% who claimed to use ICTs to access clinical information. It could be inferred that the RHWs were very conscious of their academic/research activities, owing to the nature of their profession that requires them to continually update themselves. It could also be noted that the RHWs weigh their professional educational growth as equally important as seeking information most readily applied in their current work situations.

Impact of ICT Use on Job Functions

Presented in Table 6 is the result of analysis of the impact of ICT use on the job functions of the RHWs. The results showed that, in general, the RHWs' perceptions on the impact of ICT use on their job functions were very positive. Nearly 90% of them indicated that ICTs had increased their efficiency of their job; about 85.4% said that it had enabled increased faster access to relevant medical information, and 83.9% indicated that it had ensured easy exchange of information with colleagues. In addition about 80.7% submitted that it has made collaboration with colleagues easier, while 66.1% indicated that it had bettered the number of papers they submitted for publication.

Constraints on ICT Use and Measures for Enhancing ICT Use Among RHWs

Table 7 presents the data results of the challenges hindering effective use of ICTs by the RHWs. From the technical standpoint, the results in Table 7 reveal that about 84.5% of them indicated that there was some level of inadequate ICT facilities, while an erratic power supply (94.7%) and the continual breakdown of equipment (90.6%) constituted a somewhat or major challenge. On the usage issue, 87.1% of the respondents indicated that security and privacy issues, and their insufficient knowledge of ICT use (78.9%) created various levels of barriers to ICT implementation. Moreover, the costs for hardware, software, and access services serve as at least some type of barrier for over 30% of the RHWs, and as a serious barrier for 57.6%.

Table 6. Frequency Distribution of the Impact of ICTs on RHWs' Job Functions.

Impacts	No extent		Little extent		High extent	
	Freq	%	Freq	%	Freq	%
Increased efficiency	21	6.1	23	6.7	**298**	**87.1**
Enabled faster access to relevant medical information	21	6.1	29	8.5	**292**	**85.4**
Easy exchange of information with colleagues	26	7.6	29	8.5	**287**	**83.9**
Easy research collaboration among colleagues	24	7.0	42	12.3	**276**	**80.7**
More avenues for research grants	43	12.6	43	12.6	**256**	**74.9**
Has facilitated remote consultation, diagnoses, and treatment	45	13.2	47	13.7	**250**	**73.1**
Quicker medical diagnoses	41	12	61	17.8	**240**	**70.2**
Increased number of publications	58	17	58	17	**226**	**66.1**
Other	16	4.7	1	0.3	**17**	**5.0**

Table 7. Frequency Distribution of the Challenges of the Use of ICTs by RHWs.

Challenges	No response		Not at all		Low extent		High extent	
	Freq	%	Freq	%	Freq	%	Freq	%
Poor power supply	8	2.3	10	2.9	36	10.5	**288**	**84.2**
Inadequate access to ICT facilities	12	3.5	11	3.2	113	33.0	**206**	**60.2**
Cost of ICT facilities & services	16	4.7	15	4.4	108	31.6	**203**	**59.4**
Constant breakdown of equipments	9	2.6	23	6.7	114	33.3	**196**	**57.3**
Security/privacy issues	17	5.0	27	7.9	119	34.8	**179**	**52.3**
Lack of adequate ICT facilities	8	2.3	45	13.2	117	34.2	**172**	**50.3**
Insufficient knowledge on use of ICT	9	2.6	63	18.4	104	30.4	**166**	**48.5**
Other			1	0.3			**3**	**0.9**

Table 8 presents the results of the measures the RHWs identified for enhancing ICT use by themselves and their peers. The results reveal the varied measures identified by the respondents to enhance better use of ICTs. About 90% of them felt that the provision of adequate power supply and enough ICT equipment/services would enhance ICT use among RHWs at the UCH. Equally important, the respondents felt, are regular training for the staff (88%), the implementation of an effective system tailored toward health-care needs (87.4%), and easy access to the Internet (85.4%). These hardware, software, and access issues are the foundation for the ability to take advantage of other on-line resources, such as on-line distance education (82.2%) and ready access to on-line medical journals (73.7%).

Table 8. Frequency Distribution of the Measures for Enhancing ICT Use Among RHWs.

Measures for enhancing ICT use	Yes		No	
	Freq	%	Freq	%
Adequate power supply	308	90	34	10
Provision of enough ICT equipment/services	308	90	34	10
Organizing ICT training regularly for staff	301	88	41	12
Implementing an effective health information system of the UCH	299	87.4	43	12.6
Facilitating easy access to internet services	292	85.4	50	14.6
Proper maintenance of ICT equipments	281	82.2	61	17.8
Organizing on-line distance education	281	82.2	61	17.8
Free access to on-line medical journals	252	73.7	90	26.3
Other	17	5	325	95

DISCUSSION OF FINDINGS

In this section, the findings from the study are discussed in line with the research questions formulated for the study. Generally, the results showed variations in the degree of access among the RHWs, and the cybercafé was identified as a notable alternative source of access to ICTs. Also, ICT use provides a positive impact on health-care particularly improving

collaboration among the RHWs and access to research information. The results also showed erratic power supply as a major challenge hindering full exploitation of ICTs by the RHWs. Details of the findings are discussed in the succeeding sections.

The Types of ICTs and Their Purposes of Use

Research Question 1 sought to establish the current picture of ICT usage by RHWs at the UCH. Results showed that the RHWs make reasonable use of the various ICT facilities available, including e-mail, access to the World Wide Web, videoconferencing, and audio conferencing. However, the data also showed variation in the degree of access to the facilities by the RHWs. The availability of ICTs, to some extent, could be said to stem from the statements in 2006 by the then-president of Nigeria Olusegun Obasanjo that Nigerians have waited patiently long enough to enjoy qualitative health-care and that the UCH cannot afford to fail the nation because of lack of equipment and access.[1] Findings also revealed that male respondents used the ICT facilities more often than the females at varying degrees, particularly e-mail, videoconferencing and audioconferencing, which gives some credence to results of previous studies that technology is a male sphere, and research has also shown that boys have greater interest in technology than females (Enochsson, 2005). Also, according to the Women's Learning Partnership (2009), the typical Internet user worldwide is young, male, and wealthy—a member of an elite minority. However, while earlier research indicated males use the Internet more than the females (Noguchi, 2005), more recent findings show that girls and women are as frequent Internet users as men (Enochsson, 2005; Fallows, 2005). Women represent 42% of Internet users in the world although the gender divide gap is narrowing in certain countries: 47% of users in Brazil are women, 49% in Thailand, and 51% in the United States and Canada. However, the differential in usage of e-mail (95.1% for men, 29.4% for women) as a major finding from this study was particularly striking, and surprising, when one places the result side-by-side with this study's findings on Web usage (85% for men, 82% for women), and the previous studies that have shown the primary cybercafé (an alternative source of access for RHWs) usage in Nigeria is e-mail (Venkataramani, 2005). This huge disparity in males' versus females' use of email calls for more probing, particularly since most of the nurses indicated they had connectivity to the Internet. The data collected in this study cannot account for this wide disparity. Undoubtedly, this is one of the limitations of this study since there seems to be no plausible reason that could explain this paradox. Future studies should aim at unravelling what might account for this huge disparity.

Noteworthy also was the fact that the cybercafé was the major alternative place of access to on-line ICTs, which supports the notion that the majority of Internet users in developing countries use the cybercafé (Jagboro, 2003; Sairosse, 2003; Wahid, Furuholt, & Kristiansen, 2006), a finding in line with Venkataramani (2005), who established that, for most people in Nigeria, the cybercafé with its fixed times of operation and shared usage model, is a major means of Internet access. According to Venkataramani's (2005) study, the primary use for most cybercafé users is e-mail. However, some users rely on the operators to create, print, and manage documents—both when they are on site and when they are not. In some cases, trust between the operator and the users is strong enough that the operator takes on a quasi-secretarial role for the user, performing tasks such as checking and sending e-mail or getting documents printed and sent. Thus, there is a high tendency for a sizeable number of the RHWs to move some office jobs to the cybercafés, which could impact negatively the

confidentiality of some health data being exposed to the public in cybercafés. Moreover, given that cybercafés are the alternative site for official duties, the efficiency and effectiveness of such locations within health care delivery or critical care cannot be high because of the remote access. In the same vein, because inadequate access at the hospital forced the RHWs to find alternative means of access, there is no doubt that the digital divide is far from being bridged. This situation, in turn, will impact negatively any collaboration with colleagues around the country, in other parts of Africa, or on other continents.

It was discovered that the activities topping the list of what ICTs were used for were communication, skills acquisition, collaboration with colleagues, and research. These practices are in line with Eysenbach and Wyatt (2002), who reported that RHWs can use the Internet across the medical research process, such as identifying research issues, using databases for literature searches, using the Web for surveys and clinical trials, and publishing research results. The activities that ICT were seldom used for were teaching and instruction, medical diagnosis, or records management, implying that the use of Computer Aided Instruction (CAI) software and expert systems was very low among the RHWs at the UCH. Indeed, as the majority of respondents indicated, the infrastructure to make use of such systems possible was not available. This particular finding is significant when viewed against the backdrop of what Yamuah (2006) identified regarding the benefits of ICT among health-care professionals. Yamuah noted that (a) efficient and effective sharing of health information and skills among health professionals, (b) easy dissemination of research results and options for disease treatment and disease control, (c) reduced costs and inconvenience for patient transfers, (d) disease surveillance information and interventions accessible by all, and (e) databases of health management information system (HMIS) for efficient planning and policy formulation are all essential elements of a modern health-care system.

From these findings, it could be said that some progress has been made in the types of ICT tools and facilities that RHWs at the UCH currently use in their job functions and the level of access to health-care information, especially when compared to what had been found earlier this decade (see Adeyemi & Ayegboyin, 2004; Idowu et al., 2003). However, the capacity that will sustain and better the ICT infrastructure available at the UCH and other teaching hospitals in the country needs to be enhanced. Achieving this will require a better understanding of the local conditions peculiar to the UCH and other teaching hospitals, improved training of health workers, and the appropriate choice of ICT tools.

How ICT Use by RHWs Impacts Medical Services Delivery at the UCH

The second research question sought to understand how the use of ICTs impacts medical care for patients receiving service through the UCH. Findings revealed that the major effects of ICTs on the job functions of RHWs included faster access to relevant medical information, easier exchange of information with colleagues, and increased efficiency. Findings further showed that the RHWs understand and value how ICTs could facilitate access to all types of relevant information, as well as enhance health care by linking them to their peers and practices on important health issues. This corroborates Mansell and Wehn's (1998) view regarding how ICT applications support an efficient exchange of information between health professionals, enable the transfer of patient records between sites, and support improvement in clinical effectiveness, continuity, and quality of care by health professionals. Providing access to reliable health information for health-care

workers in developing countries is potentially the single most cost-effective and achievable strategy for sustainable improvement in health care (Pakenham-Walsh, Smith, & Priestley, 1997). Much of this could be achieved through use of the Internet. Espinoza (2005), in her evaluation of the impact and affordability of ICT in rural primary health-care centers of Peru, confirms the perceptions voiced by the RHWs in this study that ICTs provide a positive impact on health care. Findings from her study showed that participants' perceptions about the impact of ICTs on improving their work were very positive. Nearly all (93%) responded "Yes" when asked if they thought that using ICTs at work would help them make better medical decisions and improve the quality of health care (Espinoza, 2005). The same proportion responded positively when asked if they thought that having better access to medical information via ICTs would help reduce medical errors related to reproductive health. Eighty-six percent of them also thought that having real-time access to reproductive health information would make their jobs easier. Findings from Espinoza's study showed that, generally, there was a consensus regarding the usefulness of using the Internet or e-mail in improving the quality of the health-care services provided. Internet and e-mail use, in particular, as noted by this study's RHWs and supported by Espinoza (also, see Information for Development Program, 2003; Martinez, Villarroel, Seoane, & Pozo, 2005), can make long strides in improving the overall quality of the health-care services provided. Yet findings from Espinoza's study also revealed that while health workers saw specific benefits from ICTs, such as ease of coordinating meetings with the community, they failed to see how other, indirect benefits, such as increased patient retention from better quality health care, could make ICTs profitable or cost effective overall when compared to less expensive alternatives, such as pay phones or personal visits (Espinoza, 2005).

In addition, the impact/benefits of ICT use on reproductive health programs have been reported. Dentzer (2008, p. 1) noted that

> sophisticated information and communications technology in health care—sometimes dubbed "e-health"—is no longer a futuristic fantasy for the developing world. In low and middle-income countries, there's growing use of everything from electronic health records to mobile phone–based systems of ensuring drug adherence. The challenge is to optimize the use of these technologies in ways that translate into gains in fighting disease and improving population health.

In the area of research, RHWs use the Internet across the research process, including identifying research issues, using databases for literature searches, using the Web for surveys and clinical trials, and publishing research results (Eysenbach & Wyatt, 2002; Morris, 2006). They also use e-mail to share information and consult or collaborate with other professionals (Idowu et al., 2003). The increased availability of on-line publications and databases for literature searches improve research quality.

Regarding networking and advocacy, the expansion of communication networks and e-mail has markedly enhanced the development of professional networks and on-line communities of practice by making it possible to reach across geographical boundaries and communicate with someone or many people quickly and easily. This was the concept proposed by Castells (1996, 1997, 1998, 2000) through his network society theory. Castells proposed the idea of networking information and communication resources to better benefit from the opportunities offered by the Information Age. This idea of networking for better exploitation of the opportunities offered by ICTs is also widely reported in previous studies.

For instance, the Satellife discussion groups were reported to reach more than 10,000 health professionals in developing countries (Academy for Educational Development-Satellife, 2009). Membership in electronic discussion groups was meant to be self-selecting and might be active or passive, allowing anyone with a genuine interest to participate at the level of activity they chose (Kanyengo, 2003; Vyas, 2002). Moreover, on-line discussion groups, in conjunction with face-to-face interaction at conferences or trainings, enrich professional relationships and reinforce new learning. Perhaps the most tangible benefit of connectivity had been in enhancing regional and international links, thereby increasing knowledge-sharing and reducing isolation (Pacific Institute for Women's Health, 2002). All of these examples are tied to the idea of networking. In addition, advocacy groups use e-mail networks to build alliances, discuss strategies, and share experiences in efforts to build support for their issues (World Bank, 2003). These benefits/opportunities of networking could be explored by the management of the UCH in a bid to make ICTs serve the RHWs better.

In addition, Lucas (2006) noted that there is growing consensus that the impact of ICTs on health systems could be substantial, or even revolutionary. Although the precise nature of the impact is much more difficult to predict, it seems that the health sector will benefit from advances in mobile telephony and Internet services. He cited a few instances of such outcomes:

- Patients and informal providers in Bangladesh routinely seek advice from doctors supporting HealthLine, a subscriber service implemented by the Grameen mobile telephone company.
- Health information systems for HIV/AIDS services in Rwanda—including TRACNet, a mobile phone-based system that allows tracking the use of anti-AIDS drugs through text messaging—are widely regarded as having been improved by the introduction of data transfer via mobile phones and personal data assistants.
- Medical staff worldwide have many opportunities to update their skills through Internet-based advice and training initiatives. For example, Moorfields Eye Hospital in London provides an Internet-based consultancy service for ophthalmology patients in a number of African countries (Lucas, 2006, p. 1).

Lucas (2006) noted further that a shift in the power balance in the provider-patient paradigm can be offered by "expert-systems" software, which offer "best practice" clinical protocol information to the public to guide health diagnosis, recommend treatment, and monitor implementation. "It could transform existing power relations within the health sector by circumscribing the behaviour of professional staff," writes Lucas (2006, p. 1). The services of connecting patients and families and informing the public are already ICT functions.

> ICTs could also transform informal regulation by providing people with the knowledge they require to challenge existing practices and make more rational health care choices. Communications networks that allow those facing health problems to share information, identify trustworthy providers, seek advice or campaign for improved treatment are central to such forms of empowerment. (Lucas, 2006. p. 1)

However, Lucas (2006) cautioned that there may be an attraction to the potential power stemming from being a "trusted intermediary" in an unregulated health advisory network that could attract those looking for financial advantage, prestige, or support for religious or other convictions. Also, there is a risk that the most high profile health conditions and advocates may receive the most resource allocations. He concluded with the warning that,

> Those working on health systems have traditionally encouraged "evidence-based planning and priority setting" in order to address both equity and efficiency concerns. A world in which multiple disease-specific networks, possibly funded by international drug companies, use ICTs to compete for the attention of governments, donor agencies and private enterprises, may undermine the approach. (Lucas, 2006, p. 1)

In the area of training, ICTs present important new opportunities to enhance training for health workers both far and wide. Curricula on CD-ROMs, tapes, and Web sites reduce barriers associated with distance, allowing health workers to learn in their own workplace and within their own time constraints. E-mail provides learners with opportunities for interactive communication with trainers and other learners. ICTs also offer opportunities to generate and disseminate health information at the periphery and to inform practice and policy at the center (Ntiro & Mrema, 2003). ICTs assure quality learning, empower learners, and offer potential cost-effectiveness (Long & Kiplinger, 1999). When electronic tools are carefully integrated with face-to-face learning, they can enhance development opportunities for health-care professionals (Management Sciences for Health, 2003). In the area of improving health systems, providing connectivity among decentralized health systems is cost-effective and may significantly improve health outcomes (WideRay Corporation and Satellife, Inc., 2003). The ability to communicate quickly and directly by cell phone, e-mail, or walkie-talkie has improved supply and referral systems, improved epidemiological monitoring systems, and reduced isolation. Automating systems may provide additional efficiencies, with the reduction of duplicate paperwork, thereby saving time for both staff and patients (Pan American Health Organization, 2001; Rotich et al., 2003).

In the context of Nigeria, and the UCH in particular, current resource allocation does not seem to give adequate funds to the collection and documentation of health information, the invisible resource in the complex health systems. Yet, paradoxically, the health sector has long been recognized as the most information-intense sector (Economic Commission for Africa, 1999). In order for the acknowledged impacts of ICTs on reproductive health identified above to make continued impacts on RHWs at the UCH, there is a need for future action to enable the uptake of ICTs as a means to improve health and the health-related millennium development goals in Nigeria. This would require policymakers and other decision makers in the Nigerian health sector to set priorities appropriately and to ensure that ICT issues are prioritized with a view toward improving care and advancing equitable access to health care by all patients.

Factors that Constrain RHWs' Full Exploitation of ICTs

The final research question sought to surface areas where progress could be made in improved use of ICTs in the RHWs' many duties. On the challenges hindering full exploitation of ICTs by the RHWs, the study showed that erratic power supply was a major challenge. Other challenges identified include lack of ICT facilities, insufficient knowledge on use of ICTs, inadequate access to ICT facilities, high cost of ICT facilities & services, constant breakdown of equipments and security/privacy issues.

In Africa, on-line connectivity is still very poor and unreliable. It can typically take several minutes to download a single article on a 56K dial-up connection; connectivity is often unstable, so that an attempt to download may be frustrated by a loss of connection during the download process (Bukachi & Pakenham-Walsh, 2007). The Access to Research

Initiative (HINARI; World Health Organization, 2009) data confirm that Internet usage levels seem to depend more on good connectivity than, for example, on the relative economic strength of the country. Some of the biggest ICT users are in Ethiopia, Nepal, Sudan, and Vietnam, all of which are among the poorest countries in the world (Aronson, 2004). Also, the cost of telephony, Internet services, and computer hardware and maintenance remain relatively high in Africa compared to other parts of the world (Jensen, 2001). Furthermore, local expertise and human resource capacity, as well as the organizational structures to support these ICTs, remain major challenges in Africa.

Specifically, Smith et al. (2007) noted that the capacity to use electronic devices, including computers, is low among health professionals, especially those working at primary and district levels, generally because of lack of exposure. Even among higher level professionals, a recent survey (Smith et al., 2007) showed that some researchers in Africa still prefer books to information accessed on the Web. Finally, Africa is traditionally an oral culture, and the reading culture is still growing. The central message learned in the last decade about communications and access and the use of health information in Africa is that cultural contexts vary and require different models and approaches. Thus, to harness the full potential of ICTs in the health field will require an intricate mix of old and new technologies.

According to Bukachi and Pakenham-Walsh (2007), the following technologies have been identified as being potentially useful in alleviating barriers to rural access: satellite technology, wireless Internet connectivity, and cellular networks (see also Iluyemi, 2007). These technologies are suggested as superior alternatives for bypassing inefficient landlines. As a low-cost alternative to landlines for Internet access, mobile phones have not yet lived up to this expectation because they are driven by voice communication, with data transmission limited only to short text messaging. Nevertheless, mobile phones have become ubiquitous and are already used as widely by health workers as by the rest of the population, despite the fact that they are more expensive than fixed lines (Gray, 2005). High-frequency radio links also have been used in some parts of Africa (Musoke, 2002) as a means of voice communication, but seem likely to be superseded by mobile telephony and other wireless technologies. In most rural areas in Africa, the issue of electricity supply is often not given priority attention due to the limited penetration of the electricity grid in most countries, but also because of its unreliability, even when present (Jensen, 2001). Solar power is one solution, but the scaling up of this technology has been limited by cost (Bukachi & Pakenham-Walsh, 2007).

Moreover, some of the challenges identified in this study clearly showed that the digital divide is still very much present in Nigeria, and at the UCH in particular. Statistics on the digital divide in Africa, a continent where nearly 15% of the world's population (more than 1 billion people; BBC News, 2009) lives, indicate that ICT products and services are scarce and expensive, and where the services do exist, they are often erratic and unreliable, just as the findings from this study underscored. Africa, therefore, is hampered in its ability to contribute its research knowledge and perspectives, as well as the wisdom of its indigenous knowledge and societies, with the rest of the world.

Even within Africa, the disparity is dramatic (see Figure 4). For example, Egypt, Nigeria and Morocco account for over a third of all Internet users on the African continent (Internet World Stats, 2009). While being the world's most rapidly growing market for mobile telephony and also home to the fastest growing fixed telephony markets in the world, Africa still has the world's lowest penetration rates (Lange, 2009a). Explosive growth in the mobile sector has meant that, by

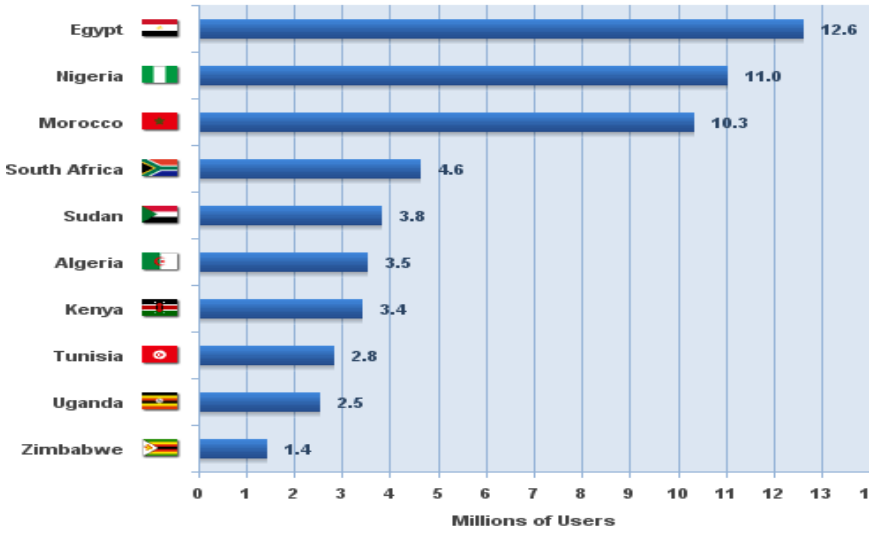

Figure 4. Africa's top ten Internet countries (June 2009).
Reprinted from the Internet World Statistics site for June 2009; Used with permission.

early-2005, mobile users constituted around 80% of all African telephone subscribers. Overall Internet and broadband penetration is very low due to limited fixed-line infrastructures, but growth in Africa's Internet and Broadband sector has accelerated in recent years due to improvements in infrastructure, the arrival of wireless access technologies, and lower tariffs. Broadband is rapidly replacing dial-up as the preferred access method, and this process is already virtually completed in the continent's more developed markets (Lange, 2009b).

In addition, most African countries now have commercial Digital Subscriber Line (DSL) services, but their growth is limited by the poor geographical reach of the fixed-line networks. The rapid growth of Internet access has therefore been mostly confined to the capital cities so far. The introduction of mobile data and 3G broadband services is changing this, with the mobile networks bringing Internet access to many areas outside of the main cities for the first time (Lange 2009b). International bandwidth is extremely expensive in Africa because access to international submarine fiber optic cables has been monopolized by national telecoms in most countries, while others depend entirely on satellite bandwidth. This is expected to change dramatically with the arrival of several new international cables to the continent's shores beginning in 2009. To accommodate the growing data traffic, national fiber backbone networks are being rolled out at an increasing pace. Many African countries are undergoing sectoral reform and foreign investment is flowing in as privatization and deregulation are progressively being introduced. Overall, the future technologies of Africa's telecoms offers great opportunities to service providers, equipment vendors, and investors (Lange, 2009a).

Africa holds only 3% of the world's mobile subscribers, yet Africa is the first place where mobile subscribers outnumbered fixed-line subscribers. The total African mobile subscriber base is roughly 280.7 million people (30% of total) and is expected to reach 561 million (53.5%) by 2012. South Africa, Nigeria, Morocco Egypt, Algeria and Kenya constitute the key mobile markets in Africa in terms of potential growth (Kujawski, 2009).

Specifically in the case of Nigeria, there is no doubt that government is making policies geared at bridging the digital divide. Notably are the Nigerian National Policy for

Information Technology (2003), the Nigerian Communications Act (2003), and the recent passage into law of the National Information Technology Development Agency Act. All these efforts are with a view to bridging the digital divide and, no doubt, they will bring about opportunities for enhancing the quality of life by increasing access by RHWs to medical knowledge and state of the art medical interventions. Sharing and comparing health information, increasing communication through the Internet, and the use of telemedicine are also some of the far-reaching benefits that developments in the Nigerian ICT sector could bring into the health sector. Telemedicine in particular has increased the potential for improving access to care by underserved populations and point the way to a future when distance will no longer impede care. In addition, it could enable the RHWs have access to ICT facilities that they need to do their job better, such as Personal Digital Assistants (PDAs) that could be used by the RHWs to reduce paperwork, increase data accuracy and ensure availability of data in electronic form. Also PDAs could be used to transmit data through wireless communication and enter it into database using the Internet. This will also increase access to e-mail leading to increased communication with professional colleagues in far and wide, hence improvement in collaboration among the RHWs.

According to Espinoza (2005), although ICTs cannot directly address urgent needs such as lack of qualified personnel or equipment, they can help to increase the active time that health workers spend in their health posts, while also improving the qualifications of the current workers. Currently, attending training courses or searching for health information outside the workplace facility requires a health professional to leave the health center. With ICTs, on-site and on-line distance education could help satisfy the need for staff training yet keep needed staff at the facility. Regarding the financial feasibility of ICTs, although investment in ICT acquisition and staff development could be high, the potential increase in the productivity in actual health-care activities could help to cover the expenses of acquiring such ICT services.

In sum, it is hoped that in view of the increased global attention on the need to strengthen health systems in general, and human resources in particular, the Nigerian government will rise to the occasion and roll out health policy reforms that will make the challenges of ICT exploitation by the RHWs highlighted above a thing of the past. There is, thus, the need for a "seismic" paradigm shift on the part of the Nigerian government, and indeed the management of the UCH, to address the diverse needs of RHWs in skills, equipment, information, structural support, medicines, incentives, and communication facilities (Pakenham-Walsh, Bukachi, & Stancliffe, 2006). This paradigm shift will make applications of ICTs more meaningful to the activities of RHWs at the UCH and Nigerian health workers in general.

CONCLUSIONS, RECOMMENDATIONS, AND FUTURE RESEARCH

This study was undertaken to investigate the use of ICTs by RHWs in a teaching hospital (UCH) in Nigeria. It also aimed to identify the impact of ICT use on the job functions of the RHWs and the challenges they face in using ICTs. Findings showed that the RHWs use various ICT facilities to varying degrees in their work, and that erratic power supply, inadequate access to ICT facilities, insufficient knowledge on use of ICTs, as well as constant breakdown of equipment constitute major challenges. The study also revealed that the measures that topped the list of what could be done to enhance ICT use among RHWs in

UCH were provision of enough ICT equipment/services, implementing an effective technology-based health information system at the UCH, and facilitating easy access to the Internet. Additional requirements were found to be an adequate power supply, proper maintenance of ICT equipment, organizing on-line distance education, and free access to on-line medical journals. These findings rebut those of Idowu et al. (2003) and Adeyemi and Ayegboyin (2004), who generally reported, just a half a decade ago, low ICT facilities and usage in the hospitals and health workers surveyed having few measurable ICT skills. Findings showed that the health workers now have access to Internet facilities, although the access is erratic because of the poor power supply and maintenance issues.

Our findings however confirm those of Braa et al. (2001) and Academy for Educational Development-Sattellife (2009), who reported a high uptake of ICT usage among health workers in their studies. It also confirms those of Taylor and Lee's (2005), who found that rural therapists had less access to a computer in their work environments but contradicts their finding that rural health workers used e-mail, teleconferencing, and videoconferencing frequently. Thus, resulting from the findings of this study and building on those of earlier research, the following recommendations are made:

- The problem of low generation of electricity needs to be addressed for RHWs to better benefit from ICTs. The poor state of the energy infrastructure in Nigeria has been endemic for a long time. Correcting this problem requires a holistic approach on the part of the Nigerian government. Currently, about 3,000 megawatts are being generated nationwide (Alexander's Gas & Oil Connections, 2009; James, 2009; Oxford Analytica, 2009), which leads to load shedding across the country, and therefore cannot in any way lead to full exploitation of ICTs by any segment of the Nigerian society. Thus, RHWs can never avail themselves fully of the opportunities offered by ICTs if the energy situation in the country remains erratic. In addition, as an interim solution to a national problem, the management of the UCH must invest in alternative sources(s) of power generation for the health-care delivery system. When this is achieved, the RHWs would undoubtedly reap the benefits offered by ICTs: maximum use of the knowledge, improved application of ICTs in the discharge of their job functions, and overall increased health benefits for the citizens of Nigeria.
- In order to ensure better exploitation of ICTs, the management of the UCH must invest in acquisition of ICTs, both hardware and software, in sufficient numbers. Investment in maintenance also is required, as is the expectation of updating the hardware and software from time to time. Systematically harnessed ICTs have been shown to improve the health of populations in many developed countries through empowering those who access and use information—from the individual homemaker and working mother to the highest-ranking policymaker (Ajuwon & Rhine, 2008). These technologies also have been shown to democratize the public space by fostering freedom of choice and expression, as well as rapid access to and sharing of information. These highly-cherished values of participatory democracy have in turn clearly helped to engender better health in individuals and communities (Odutola, 2003). Yet, as fascinating and beneficial as these technologies may sound, the deep-rooted factors militating against access to information and the daunting challenges thereto within developing countries are well known (Edejer, 2000; Ogunyade &

Oyibo, 2003). Developing countries generally have not invested in access to information as much as they should, even within their available means. Indeed, many developing countries are being left behind (resulting in the so-called digital gap or digital divide). Very little benefit from the incredible and bountiful digital world is accruing within developing nations. And these countries need to benefit (see, e.g., Bongo, 2005; Dentzer, 2008; Jensen, 2007; Lucas, 2006; Mercer, 2001; Oberski, 2004; Opit, 1987; Reisman, Roger, & Edge, 2001; Simba & Mwangu, 2004; UNDP, 2001; World Bank, 2001; World Health Organisation, 1997) for many good reasons.

- RHWs need ongoing ICT-related training, which will assist in significantly developing their ICT skills, improve access to needed information, and enhance efficiency in their job function. The introduction of continuous medical education (CME) programs for all practicing physicians and health-care workers would certainly assist in ensuring maximal utilization of the innumerable advantages offered by ICTs. Health is an information-based, ever-evolving discipline and, as such, the provision of structured ICT training for all members of the health-care team would equip them with the skills and knowledge they need to practice up-to-date and evidence-based medicine. This is essential for improving the quality of medical care.
- Finally, provision of adequate and state-of-the-art ICT equipment and services relevant in the health industry should be ensured by the Nigerian government in conjunction with leading medical hospitals, with a view toward increasing availability and access to ICTs in particular, and to improving the health-care delivery in the UCH in general. Such access to health-specific software is expected to enhance production, gathering, storage, and dissemination of and wider access to health information among the RHWs. It will also be a long-term strategy that could assist the institution in bridging the digital divide among the practicing RHWs around the world, and for health-care workers in general.

This study investigated only RHWs at the UCH – a teaching hospital in Ibadan, Nigeria. Due to the small sample size, one cannot assume that the results of this study could be generalized to RHWs across the country, or to any other country. Thus, future studies should investigate other populations of health workers around Nigeria and confirm, rebut, or disprove the findings from this study, or relate these findings to RHWs in other developing nations or emerging economies in Africa or around the world. Future studies could also be conducted to examine ICT use along gender dimensions among the RHWs, particularly the use of e-mail where the findings from this study reports wide disparity along gender lines. Deeper analyses would be needed to unearth the reasons that account for this wide disparity. All these will contribute to the efforts towards bridging gender digital divide among the RHWs in particular and in Nigeria health-care professionals in general.

ENDNOTE

1. The comments were made by Nigeria's then-President Olusegun Obasanjo as part of a speech during the commissioning of hospital equipments at the University College Hospital, Ibadan, on January 2, 2006.

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