

The Strategy to Implement of PACS in Sudan Radiology

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Abstract: Rapid changes in the medical industry have brought developments in the medical image technology, promoting most hospitals to introduce PACS (Picture and Archiving and Communication System). The concept of PACS was initiated in 1982 during the first international conference and workshop on picture archiving and communication system, held in Newport Beach, California. During the past seventeen years, many large and small PAC systems have been installed and are running smoothly. Around the world, many more systems will be planned and installed for coming years before 2016. This research paper describes the strategy of PACS which will be implemented in Sudan radiology. The purpose of the strategy is to produce adequate health services to improve Sudan radiology and to help in the management of the health Services in all areas. The strategy will change the residency programs in Sudan radiology. PACS change the nature of the work for the technologist. Implementation will be through steps. The introduction of this new technology will mandate a new method for radiologist to interface with clinicians and vice versa.

Keywords: Radiology, PAC, implement, radiography, system, health, service, residency

1. Introduction

Sudan is the largest country in Africa. It has an area of 2.5 million km². It is characterized by its strategic geographical location that links the Arab world to Sub-Saharan Africa and it shares its borders with 9 countries (Table.1).

Table 1: Country Data Sudan

World view	2005	2006	2007
Population ,total (million)	36.9	37.71	38.56
Population growth (annual%)	2.1	2.2	2.2
Surface area(sq.km)thousands.	2.505.8	2.505.8	2.505.8
Poverty head count ratio at national poverty	„	„	„
Line (%of population)GNI,atlas method (current us\$(billions)	22.94	29.25	36.7
GNI per capita, atlas method (current us\$)	620	780	950
GNI ,PPP (current international \$)(billions)	57.46	65.46	72.52
GNI Per capita, PPP (current international \$)	1.56	1.74	1.88

Its climate ranges from damp and rainy in the south to desert in the northern areas. Climatic factors can contribute to humanitarian emergencies related to drought and flooding and ecological factors expose much of the population to major infectious diseases.

The agriculture contribution to GDP (growth domestic product) has declined during the last five years while the contribution of the oil sector has increased to more than 11% of GDP during the same period. Oil and petroleum products now account for over 80% of exports and 40% of public revenue [1]. Economic reform packages have been implemented since 1992. However, widespread poverty, highly skewed income distribution and inadequate delivery of social services remain serious problems [2]. The federal level is concerned with policy making, planning, supervision and co-ordination. The state governments are empowered for planning, policy making and implementation at the state level [3]. Health system suffer from many things that affect it directly and the current system is based in health units

with minimal use of information system at community level (Table (2))

Table 2: Health units in Sudan 2007

State	Hosp-Itals	Beds	Health Centers		Basic Units						
					Basic Units		Dressing Stations		PHCU		
					Work	Closed	Work	Closed	Work	Closed	
F.Ministry of health	18	3877	0	0	0	0	0	0	0	0	0
Khartoum state	25	2230	121	35	161	17	0	0	25	0	0
Gezira	55	3343	265	0	0	0	0	0	634	0	0
Sinnar	23	1291	16	12	101	27	57	75	0	0	0
Bule Nile	16	620	13	18	29	0	71	0	40	4	0
White Nile	23	1201	31	58	125	20	29	7	67	31	0
Red Sea	13	947	19	18	36	2	23	2	126	32	0
Gadarief	22	1272	21	18	94	1	89	5	56	6	0
Kassala	11	1044	46	50	0	0	0	0	195	46	0
Northern	26	1545	7	75	138	35	36	9	5	3	0
R.Nile	30	1744	229	0	57	0	62	0	33	0	0
N.Kordofan	27	1722	52	2	105	4	103	3	448	2	0
S.Kordofan	16	995	36	109	0	0	0	0	151	94	0
N.Darfour	13	874	26	12	44	23	0	0	63	153	0
S.Darfour	14	1040	19	0	58	16	57	5	140	18	0
W.Darfour	6	593	7	6	23	15	4	8	45	147	0
Upper Nile	9	625	10	0	16	0	0	0	43	0	0
Bhr algalab	4	648	19	0	14	0	3	0	55	0	0
Unity	4	131	13	0	9	0	17	0	0	0	0
Buhyrat	3	250	0	0	0	0	0	0	0	0	0
Gongly	4	200	10	0	0	0	0	0	0	0	0
E.Equatoria	5	188	13	0	14	0	34	0	47	0	0
W. Equatoria	7	354	5	0	4	0	0	0	8	0	0
N.Bahr algalab	1	150	4	0	2	0	0	0	4	0	0
W.Bhr algalab	2	461	2	0	34	0	2	0	23	0	0
Warab	3	93	0	0	0	0	0	0	0	0	0
Total	378	27467	978	419	1064	160	587	114	2208	536	0

A rapid change in the medical industry leads to development in medical imaging technology and prompts most hospitals to introduce PACS (Figure .1).

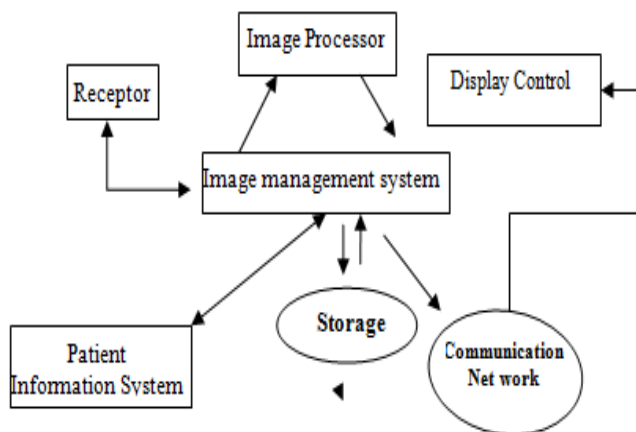


Figure 1: Digital Radiography System

The purpose of the strategy is to produce adequate health services to improve Sudan radiology and help in the management of the health Services in all areas, especially Darfour and to take the useful advantage and benefit of PACS to the community. Researcher advice to propose future plans for radiological services in Sudan by building computer based patient records and other electronic information systems that provide easy and fast access to the large database.

Concerning the importance of this strategy, the introduction of PACS in the radiological services is among the most important motivators in sharing in the digital revolution in medical imaging .This revolution has changed not only the manner in which images are acquired, transmitted, stored and interpreted, but also profoundly altered the tasks associated with professional roles.

2. Materials and Methods

This study includes three hospitals, first, prepare hospital staff with an explanation of all capabilities of (PACS). Second, explain to the manufacturer the goals of hospital pre and post PACS installation so that the manufacturer will prepare accordingly. Third, the importance of training to both the manufacturer and the hospital before, during, and after implementation, without proper training in every user level, the PACS will not run properly. Hospitals and manufacturers facilitate contract, system implementation, clinical release and training. Technologists acquire new skills; radiologists learn novel ways of interacting with images, reporting findings and radiology administrators face unfamiliar challenges in integrating information radiology.

3. Implementation Plan

The progress of PACS as a development technology can be observed according to it is importance as a clinical tool. So implement of PACS in Sudan radiology through 3 years strategy .The PACS project of Sudan hospital will start as a part of development project of introduce a new hospital information system will start by testing operations in radiology department by installing core systems such as servers and storage(Table.2) .

Table 2: Implementation Plan

Costs	Initial cost	1st year	2 nd year	3rd year	Total
Infinite PACS software one set	\$531.900	\$531.900	\$531.900	\$531.900	\$531.900
PACS server and storage one set	\$257.800	\$257.800	\$257.800	\$257.800	\$257.800
Medical hardware one set	\$478.500	\$478.500	\$478.500	\$478.500	\$478.500
Implementation for one hospital					\$1.268.200
Implementation costs	\$1.268.200	\$1.268.200	\$2.536.400		\$3.804.600
Support and maintenance cost	0	0	0		0
Education and training	\$10.000	\$20.000	\$30.000		\$60.000
Total					\$5.132.000

PACS assist to promote healthy lifestyle also the digital departments will take place one year after The PACS implementation, indicating that there had been sufficient time to adapt to the use of the PACS .Several different techniques, video studies, observations and integration of discussions. Health information system will rapidly grow and that will affect directly the system in all area of Sudan, at that time government will support a small company to start PACS business. In the beginning PACS societies will focus in developing peripheral solutions such as DICOM gateway (Digital Imaging and Communications in Medicine) for image acquisition, x-ray film digitizer and viewing software for research or management of personal image data .In similar time frame, few hospitals will start developing and installing domestic large scale full PACS system .Several years later, many Sudan hospitals will have to install PACS System with national policy of reimbursement for PACS exams. It is believed that Korea is one of the first countries that adopted PACS. Reimbursement for full PACS installation, national policy generated tremendous intellectual, technological expertise about PACS at all levels, clinical, hospital management, education and industrial sectors. Sudan hospital after implementation of PACS will have strength for the highest integration technology of the hospital information; however, further understanding and timely implementation, continuously evolving international standard and integrated health care enterprise concepts may be necessary for international leading of PACS technologies for the future.

4. Result

Development of PACS in Korea was geared by Samsung Medical Center (SMC) PACS project (4) as early in 1994.SMC had started a first phased full PACS installation which was a fully imported system, where Asian Medical Center (AMC) [5] had started developing domestics PACS solution as a long term project started in 1994 and completed full PACS system in early 2000.Korea PACS society was formed around this time and played very important role in PACS promotion. Collaborative PACS project with government support was started providing mini PACS solutions and a few mini PACS systems were installed [6].

4.1 Hard Copy Replace

PACS replaces hard copy based means of managing medical images, such as film archives .With the decreasing price of

digital storage, PACS provide a growing cost and space advantage over the film archives in addition to the instant access to prior images at the same institution digital copies are referred to as softcopy.

4.2 Remote Access

It expands on the possibilities of conventional systems by providing capabilities of offsite viewing and reporting (distance education and teleradiology). It enables practitioners in different physical locations to access the same information simultaneously for teleradiology [7].

Enough experiences of full PACS installation in Korea lead PACS industry to start exporting their full PACS solutions [8]. Few companies had started providing mini PACS solutions and few mini PACS systems were installed around this time [9]. This geared up a various size of PACS installation and small PACS companies had experiences of large scale full PACS installation within a short period of time [10].

The fourth category is the partnership between a hospital and manufacturer, which is the most recent trend in the large scale PACS implementation [11]. Implementing PACS in Sudan radiology maybe take place within 4 years in the near future.

5. Discussion

Building a nation of healthy individuals, families and communities, served by a health system [12], Sudan Government will support collaborative PACS project between industry and university Hospitals so PACS industry of the private sector in Sudan will be rapidly growing. In the beginning PACS industry will focus on developing the peripheral PACS solution, while the Sudan PACS society will be formed. A few companies will start developing and installing domestic large scale full PACS system for teaching hospitals and the private sector. Several years later Sudan will have more than 5 domestic PACS companies shared with Korea. They will have enough experiences of full PACS installation in Sudan and also into all Arabian countries. That will lead PACS industry to start exporting their full PACS solutions to other counties in Africa.

There are currently three types of PACS system which includes Domestic, imported and hybrid PACS system with imported solution for core system and domestic solution for peripheral system. In Korea there are more than 20 domestic PACS companies and they have now enough experiences so that they are capable of installing a truly full PACS system for large scale teaching hospitals, PACS societies in Korea understand how to design, implement, install, manage, sustain and provide good services for large scale full PACS.

The fifth generation of PACS will be distinguished by server side rendering. There are two factors that will drive the industry towards server side computing. One is the growth in volumetric data generated in a single study the larger the study the longer the time required to deliver those image to the client. The second is the limitations in growth of net work speeds [13]. However, further understanding and timely implementation of continuously evolving standard

and integrated health care enterprise will be necessary for international leading of Sudan PACS technologies for the future.

PACS will change the culture of our practice of medicine. It also will change the flavor of the residency programs. The introduction of this new technology will mandate a new method for radiologist to interface with clinicians and vice versa. The ready availability of images at clinical workstations carried the potential of reducing the interaction of radiologists with clinicians. Recognizing this danger of loss avenues of input into the management patients, so radiologists will become a part of clinical team. This have a salutary effect of exposing radiologists to far more clinical situations than they had in the past. The reliability and easy access to the historical records provided both the radiologists and the referring clinicians to a previously unavailable luxury.

The availability of the entire data set on every image and the capability of changing contrast etc. will add another dimension of responsibility to the radiologist. PACS will change the nature of the work for the technologist requiring change to their approach to the exposure parameters, quality control, work load accounting and data entry etc. Quality control took on an entirely new meaning since it encompassed the reliability of monitors, workstations and demographics etc. While the file room personnel will become unnecessary, the radiology departments will have to address the issues of retraining long term employees in other areas. It will quickly become apparent that different type of worker will become crucial to the operation of the digital department the system engineers and support personnel. Since the operation of hospitals will be dependent on health and operability of PACS system, capable and responsive systems support personnel will become an integral part of the department. The automation staff will be new standard of support requiring that they will be available on an call basis.

6. Conclusion

PACS is a dynamic system integration of evolving medical imaging, computer, networking, data base and soft ware technologies over the world. The implementation of PACS in Sudan radiology will be more advantageous to the patients, the referring clinician and the administrative staff of the hospital than it was to the radiologist. The radiologist and the technologist had to learn an entirely new modality while the rest of the hospital garnered the benefits. PACS will change the culture of the practice of medicine. It also will change the flavor of the residency programs in Sudan radiology. PACS change the nature of the work for the technologist.

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