

The systemic linkage for using telemedicine of medical equipments-In the case of Hao Binh situation in Vietnam-

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ABSTRACT

The writer has been implementing the research work in order to achieve the rural clinics that can provide the similar quality of clinic performance as that of urban general hospitals, and to improve medical indicators as beneficial effects for local people. The research work involves the introduction of telemedicine system from the viewpoint of medical quality improvement. Our research fields have been rural villages near Hanoi, Hoa Binh Province, Vietnam, an advanced developing country in Asia. This report discusses the establishment of system of supplying medical equipments in a stable manner, and as maintenance methods, the establishment of safety and maintenance system of medical equipments that use IT in developing countries, classifying them according to international standards, based on my experience and methods of internal audits.

KEYWORDS: Social Security Classification, E-Medicine, International Standards of Medical Equipments, Centralization Method of Medical Equipments

1. INTRODUCTION

When you look at the healthcare and medical sector of developing countries, the level of urban

general hospitals is similar to that of developed countries but rural clinics face shortage of medical equipments, doctors and nurses.

In case of Vietnam, impoverished rural clinics which are brought by economic poverty, particularly in mountain region, are causing wider gap between the urban areas and rural areas. Therefore, the writer proposes a scheme that establishes common fund by village people, and financing using the common fund. Through this financing, the number of medical consultations received by local people at rural clinics will be increased, old medical practice of herbal therapy will be changed to modern medical treatment, telemedicine system will be introduced linking rural villages and urban general hospitals, and quality of healthcare and medical service will be improved.

This report discusses the necessity of internal audit using risk approach to maintain effective internal controls, by designing medical equipment maintenance system for the purpose of supplying medical equipments, based on the result of data analysis, by classifying medical data in accordance with type of disease, and using telemedicine system.

2. SOCIAL SECURITY AND CLASSIFICATION OF DISEASE IN ASIA

Social security in Asia, if analyzed, can be classified into 4 phases depending on social security situation. Phase 1 includes the countries with national social security system, but due to industrialization and aging society, sustainability will be the issue (Japan, Korea, Taiwan, Singapore), Phase 2 includes the countries under industrialization, with social security system for the employees, but national medical insurance system that covers farmers and self-employed is not established (Malaysia, Thailand, the Philippines, Indonesia), Phase 3 includes the countries under initial stage of industrialization, with limited social security system for the public employees and the military personnel only, and social security for the private employees is in the developing stage (Vietnam, Laos, Cambodia), and Phase 4 includes the countries with the great number of population, which do not fall under Phase 3 (China, India).

Also, type of disease can be classified into 3 phases. Phase 1 is the elderly care problem in the stage from chronic disease to elder degenerative disease, Phase 2 is the stage from infectious disease to chronic disease such as cancer, heart disease, stroke, and Phase 3 is the stage from famine, plague to infectious disease (see Table1). In Vietnam, one of the emerging economies after BRICs, industrialization is rapidly going on, and traffic accidents and diseases are increasing across urban areas to rural areas. Therefore, Vietnam is very much closer to Phase 2 under disease classification.

Under the circumstances, centralized medical equipment management is more efficient method rather than individual management by each regional medical organization, under the leadership of administrative organization depending on geographical distribution.

Table 1. Social security and classification of disease in Asia

	Disease; Medical Structure	Medical Equipment	Legislative Improvement	Medical Information System	Country
Phase 1	Elder degenerative disease; Welfare, home care Mainly personal care	High, Legal requirements	High	Being developed	Japan, Korea, Taiwan Singapore
Phase 2	Chronic disease; Medical facility Mainly hospital	High, Legal requirements Effectiveness is in question	High, Legislation is made but effectiveness is the issue Cause is poverty	Under development	Malaysia, Thailand the Philippines Indonesia
Phase 3	Infectious disease; Hospital, clinic Need urgent development	Under development	Under development Legislation is made but effectiveness is the issue	Under development	Vietnam, Laos Cambodia Myanmar
Phase 4	Infectious disease; Hospital, clinic Need urgent development	Under development	Legislation is made but effectiveness is the issue	Under development	China India

3. HEALTHCARE IN VIETNAM

Vietnam is located in the eastern edge of Indochina, which is divided into subtropical climate around Red River Delta in northern region and tropical climate around Mekong Delta in southern region. The boarder area with China and Laos is mountain region, and land area is about 330,000m², which is slightly smaller than Japan. Vietnam is multi-racial comprised of about 50 ethnic minorities living in the northern mountain region, with the main ethnic group of the Kinh.

Healthcare indicators show significant improvements with infant mortality rate down to 30 per 1,000 births in 2001 from 72 in 1985, and maternal mortality rate down to 95 per 100,000 births in 1999 from more than 400 in the 1950s. However, there are many children aged fewer than 5 with chronic malnutrition, and such infectious diseases as pneumonia and tuberculosis are the most common diseases. But along with eco

nomie development after the Doi Moi in urban areas, there are increasing number of deaths caused by traffic accident and drug addiction which are not seen in other developing countries.

According to World Bank, about 90 percent of poor families are living in rural areas. Poverty ratio is particularly high in the areas where minority people are living and it is high in northern and central highland areas. Particularly, regional gap is widening in healthcare indicators.

Under the circumstances, popular diseases in the North West region and the Red River Delta region, Hoa Binh province are classified as follows, where the rural villages are concentrated and the research was conducted. That is to say, acute pharyngitis, tonsillitis, influenza, and pneumonia are popular in the North West region, and pneumonia, acute bronchial pneumonia, infectious disease diarrhea, and gastroenteritis are popular in the Red River Delta region. (See Table 2)

Table 2. Major Disease in Patients by Region (per 100 thousands people)

	Top 10 diseases	North West	Red River Delta
1	Acute pharyngitis • Tonsillitis	1,125.62	146.19
2	Influenza	727.10	81.03
3	Pneumonia	694.76	368.73
4	Acute bronchial pneumonia	420.83	251.41
5	endometitis	358.25	
6	Infectious disease diarrhea • Gastroenteritis	316.18	153.04
7	Traffic accident	206.13	116.02
8	stomach • duodenal ulcer	115.67	
9	Chronic pharyngitis • Tonsillitis	115.32	109.93
10	Decayed tooth	101.66	122.27

Source: Health Statistics Year 2002, MOH

4. COMMUNICATION SITUATION IN VIETNAM

4.1 Spread of the Internet and Mobile Phone

According to the Computer Association of Vietnam, 450,000 units of computers were sold in

2004, up 25%. According to a survey conducted by a market reasearch company GfK in 2004, the Internet is expanding rapidly in recent years in Vietnam. During that year, the number of the Internet users tripled, and the Internet bandwidth

quintuplicated In order to control the Internet services and websites, Ministry of Information and Communications promulgated a regulation that requires to obtain permission when individual or organization establish website in 2005. This legislation hindered the development of the Internet services and websites. Also, there is a regulation promulgated which requires to keep record of the name, age, address, and national ID number of the user of the Internet café which is increasing in number in recent years. This gives negative effects on the users.

Low-cost verbal communication (VoIP) service provided on the IP network expanded rapidly because three VoIP service companies were established in 2004. The Vietnam Post and Telecommunication Corporation(VNPT) says that its market share in the VoIP market is 36.72%, followed by Saigon Postel, Viettel, VP Telecoms, Vishipel, Hanoi Telecoms, and their market shares are 22.31 %, 20.11 %, 12.9 %, 12.93 %, and 4.53% respectively.

As for mobile phone, the market is significantly expanding with 3.2 million users in 2003, and 4.5 million users in 2005. There are 6 mobile phone companies of Vinaphone, Mobifone, Saigon Postel, Viettel, Hanoi Telecom, and VP Telecom, for competing each other. Vinaphone and Mobifone are the subsidiaries of VNPT. In terms of costs, the minimum communication is possible if video conference system or TV monitor is available (Yen1,330,000 in Japan). PC-based video phone software is sufficient for telemedicine diagnosis. In terms of administration, operation will be smoothly conducted if a telemedicine support hospital such as Bach Mai Hospital is established under financial support from the national or provincial government.

4.2 Expansion of E-medicine Room for Video Conference to Medical Equipment Management Room

An E-medicine room that uses the Internet is established in Bach Mai Hospital(BMH) in Hanoi under assistance from the National International Medical Center. Currently E-medicine room is used for video conference using the Internet. Medical equipment management room can be expanded by installing software for lending/returning, and placement history of medical equipments real-time to dedicated video terminal in the future. For instance, management of medical equipments by the BMH management center will be possible if the usage history of x-ray equipment of the Hoa Binh Hospital, a regional center hospital, used by rural clinics is entered, and a system is established, where data is fed back to medical equipment management center. Under the circumstances, maintenance of the medical equipments using IT will be the issue.

5. PROPOSAL TO ESTABLISH MEDICAL EQUIPMENT MAINTENANCE MANAGEMENT CENTER

5.1 Outline of Proposal

According to World Health Organization, expected roles of the improved healthcare system are improvement in health, provision of healthcare services in accordance with expectation, and protection from funding risk.

Real healthcare situation in Vietnam is not satisfactory as mentioned in healthcare indicators. Particularly in rural farming village, expected medical service is not provided due to low quality of public medical sector and difficulty in access.

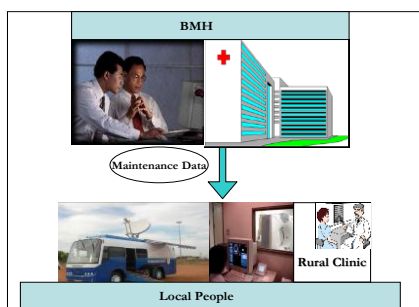


Fig. 1. Medical Equipment management center

In order to solve this problem, we examined the method of linking rural village and urban general hospital through telemedicine. Specifically, linkage using the Internet between BMH in Hanoi, and Hoa Binh General Hospital in Hoa Binh Province, and rural village clinic. Also, in terms of cost of linking rural village and general hospital through telemedicine, it is more economical to visit patients using mobile van clinic at the clinics located in the province and to manage data at the central management center, transmitting data to urban general hospital from regional hospital than using fixed medical equipments.

Regarding medical equipment management, we wish to suggest to be used a medical equipment management method where rural villages and urban general hospitals are linked through telemedicine system; mobile van clinic is used, based on the classified patient data which is obtained from telemedicine diagnosis data. That is to say, the establishment of the system of visiting clinics scattered around rural areas, transporting medical equipments on mobile van, based on the data accumulated by the management data center.

Definition/Maintenance of Safety of Medical Equipment

● International Classification (Pharmaceutical Affairs Act)

Class I (General Medical Equipment) X-ray film

Class II (Management Medical Equipment)
Ultrasonograph, CT, MRI

Class III (Advanced Management Medical Equipment) Artificial respirator, cardiac valve, catheter

Class IV (same as above) Pacemaker, sent

● Maintenance of Safety (Pharmaceutical Affairs Act)

Class I (General Medical Equipment) Regulation on sales/primary distributor

Class II (Management Medical Equipment)
Approval for sales/primary distribution not required

Class III & IV (Advanced Management Medical Equipment) Sales licence system, minister approval for primary distribution

5.2 International Standards Classification and Medical Equipment Maintenance Management Policy

When you look at medical equipment maintenance management methods in the U.S., a leading country, equipment management is centralized to a special division in hospital. Such division comprehensively manages radiological equipments, testing equipments, and hospital facility, in addition to general medical equipments. This division is independent as a management division. Medical equipment classification and maintenance management methods are the same in developing countries.

5.3 International Standards Classification of Medical Equipment

Medical equipments are classified into class I to class IV in accordance with the level of risks. Class I refers to extremely low risk to the human

body in case of malfunction of equipment, class II refers to relatively low risk to the human body, class III refers to relatively high risk to the human body, and class IV refers to direct risk of danger to life in case of malfunction of equipment.

The following shows the classification of mobile equipments and equipments installed in general hospital in accordance with international standards classification.

(1) Mobile equipments: Ultrasonograph, artificial respirator, catheter, pacemaker, medical imager, data-save stethoscope

(2) Equipments installed in hospital: CT, MRT

At this point, we wish to suggest the following methods as medical equipment maintenance management.

6. MAINTENANCE MANAGEMENT POLICY

6.1 Product Planning Type Quality Function Deployment (QFD)/Task Analysis

High performance medical equipments do not necessarily guarantee satisfaction of healthcare suitable to the patients, and whether healthcare

workers. It is important to know what the diseases of the patients are in order to install proper medical equipment, what medical equipment is workers maintain medical equipments understanding them correctly. Following is the management methods which combine the QFD, one of the methods to link patients' needs and specification of healthcare workers, which is used in product planning process, and task analysis based on internal audit methods. Task analysis is the methods to verify control process design whether business operations satisfy the objectives of the laws, regulations and superior regulations surrounding business organization in accordance with the flow of operations, in internal controls.

Analyzing medical equipment maintenance management and efficient medical equipment placement using the above methods based on the opinions of healthcare workers is necessary for medical equipment maintenance management based on medical equipment classification.

The following shows the order of quality analysis of electrocardiogram monitor.

Table 3. Task Analysis (Electrocardiogram Monitor)

Task	Input of Information	Judgment of Understanding	Operation
Selection	Difficult to understand switch display	Fail to find difference in switch	
Power-on	Difficult to understand switch position		Difficult to put power on
Switch-on	Easy to understand switch position		Is switch at proper position?
Monitor Paper	Is it easy to understand exit of printed paper?	Is it possible to know before printing paper run out?	Is printing paper easily printed out and picked out in one hand?
Monitor Sharpness		Is monitor sharp?	

Table 4. Selection of Required Quality and Quality Factors Based on Task Analysis

Task	Problem	Required Quality	Quality Factors
Selection	Difficult to understand switch display	Make switch display easier to see	Display methods, display brightness, display color, display size

	Fail to find difference in switch	Make switch difference easier to see	Display methods, display size, display color, check function, display brightness
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Table 5. Preparation of Quality Sheet

Required Quality	Customer Importance	Quality Factor				
		Display	Structure	Check Function	Management Function	Maintenance Frequency
Avoid run out of monitor paper	9				9	9
Distinguish switches	9	9				
Avoid pressing wrong switch	3	1		9		
Avoid switch bad connection	3		3		9	9
Make power on/power off easier to see	3	3	9			
Maintain monitor paper sharpness	3					9
Total		93	36	27	108	162
Relative Importance (%)		21	8	6	25	38

Monitor paper is under Management Function

As a result of the electrocardiogram monitor quality analysis above, it was found that the importance of management function and maintenance frequency is high.

Next, as the maintenance management methods, bar code method and IC tag method are explained.

6.2 Bar Code Method

Bar code function is standard equipped, and flow from lending to return of equipment is simplified, (2) by registering inspection items, inspection results are entered, uninspected equipments and equipments with close inspection deadline are displayed on screen as caution items, and inspection past due equipments are not allowed to lend, therefore uninspected equipments and lending these items can be avoided, (3) expense control of individual equipment can be traced anytime, thus expense control from purchase to abolishment, and renewal can be made.

6.3 IC Tag Method

Medical equipments lent by medical equipment management room to each department are to be

returned to management room after finish in principle. In order to monitor location of medical equipments, tag reader is installed at the entrance of elevator and nurse station. It is possible to locate medical equipment by obtaining user ID of a tag when medical equipment equipped with a tag pass it, and by registering the user ID, machine number of the reader, and time and date in database.

For any of these methods, bar code and tag reader will be necessary to establish the system. Primary specifications are frequency, transmission power, and corresponding tag. Understanding of medical equipment details, repair/inspection data, lending/returning information, and tag information will be necessary.

6.4 Medical Equipment Centralization Method

In order to solve the problems, we wish to suggest to use medical equipment management sheet using Excel to keep history data of medical equipment details, repair/inspection data, and

lending/returning information (Table6).

This method solves the following problems of the bar code method and IC tag method, (1) inspection results can not be managed in chronological order, (2) projection of medical equipment

Table 6. Medical Equipment Management Sheet (Example)

Name of Equipment	Model	Serial No.	Type	Delivery	State	Remarks
Electrocardiogram Monitor	Hitachi	8030		May 3	1W	May 3 repaired
Nurse Call	Aiphone	8031	UAX	May 4	2W	May 4 maintenance
CT	GE	8032		May 5	X-ray room	May 5 maintenance
Air Purifier	Sanyo	8033		May 6	3W	May 6repaired

7. CONCLUSIONS

Vietnam which is classified as Phase 3 in social security among Asian countries, shows high economic growth rate, and associated with it, prices are rising and income is growing in urban areas. However, there is funding problem for rural villages to take action voluntarily and independently; therefore assistance from third party is necessary. We made a suggestion regarding promotion of medical cooperation with urban general hospitals using telemedicine system, and establishment of system to improve medical quality. In this report, the reason why we made the proposal is that it is necessary to link Bach Mai Hospital in Hanoi and Hoa Binh General Hospital via the Internet, and to transmit the medical data of the rural village people created by mobile van clinic to an urban general hospital, which is managed by an adjacent central management center. The solution is to establish a system where medical equipments are installed in mobile van clinic which will visit clinics dotted around the rural area, based on the data accumulated in a management data center. (For example, the areas where there are many patients with heart disease, brain disease, and many traffic accidents.)

life cycle over a period of time is not possible, (3) analysis of causes of equipment breakdown is not possible, (4) in case of outsourcing repair service, service request can not be printed out, etc.

Also, monitoring through internal audits is to be implemented through QFD and internal management in order to maintain the system.

Because, for example, popular diseases in the North West region and the Red River Delta region, Hoa Binh province are classified as table 2.

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