A Study on Trouble Management and Necessity for Preventive Check in PACS

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Abstract

PACS has been run at the Kyung Hee University Medical Center since 2001, and the installation and operation of PACS have contributed to automation and quantification of center's medical environment. In order to classify the annual number of trouble cases processed by PACS, the authorshave made a classification code system which enabled detailed statistical processes for each section. Such process method has not only shown the management efficiency to trouble management of PACS, but also raised the interests in frequently occurring troubles, and enabled the prediction of troubles that may occur hereafter. Predictable troubles lead to preventive check, and this has direct effects on medical treatment and the hospital administration.

The authors intend to arouse the necessity of preventive check of PACS by analyzing trouble management processes for the last 1 year.

Keywords : Troubleshooting, Classification Code, Preventive check

I. Introduction

Management processes should be systemized through result statistics and preventive check regarding trouble management, in order to improve the performance of PACS component. An efficient management for equipments to be used for the period of life span advised by each manufacturer can be achieved through preventive check. This enables more devoted support for medical treatment, and has an advantage of economic operation of PACS before troubles occur.

II. Purpose

It has been intended to analyze variety of troubles occurring under PACS operation for the last 1 year, and to understand the present status of the management. It has also been intended to understand the necessity and economic effects of preventive check regarding the troubles that can occur.

III. Methods

1. Classified in two groups ; Troubleshooting and Preventive Check

"Troubleshooting'is defined as PACS related specific malfunctioning of inconvenience for users that are processed at PACS team, and "Preventive check" is defined as preventive quality control management, or upgrade and performance enhancement, and etc. for an efficient operation of the system regardless of troubles.

The cases of 676 troubleshooting and 486 preventive

check gathered from Kyung Hee Medical Center during the one-year period from March 2004 to February 2005 were investigated. The data were classified by required time for troubleshooting, preventive check, occurrence time, and the grade and the operating code. Trouble management processes have been classified as trouble grade 1, 2, 3 and general grade depending on the importance of the processes for troubles occurred. The classification criteria are first, the degree of effects it puts on medical treatment, and second, the extent of troubles. In addition, item by item replacement cases were

analyzed and the economical effect due to the preventive check was predicted.

2. The Classification Code

Before gathering the cases of troubleshooting and preventive check, made our own PACS check code.PACS check code has been divided into 10 major classification codes, which then have been divided into 51 sub codes to be managed at PACS team depending on the characteristics of the processes(Table 1). Process codes for each main element of PACS management have been made in order toinvestigate the work load frequency for each corresponding code and cycle.

Table 1. PACS Check Code. The major classification codes are on the left, and the details of each sub classification item are on the right.

PACS Check Code(Kyung Hee Medical Center)		
0 (Storage)	1	NAS & RAID System Check, Repair & Replacement
	2	Storage Environment
	3	etc.
1 (Network)	1	Slow Network Speed and Test
	2	Image Send Error
	3	Networking(Error in Initial working and Communication)
	4	Error in Worklist and Inquiry of Image
	5	HUB Malfunction and Examination
	6	Network Gateway Malfunction and Examination
	7	Image Loss
	8	PACS, OCS Operation Down and Error
2 (Virus)	1	Virus Infection Examination / Treatment and Repair
	2	Virus Preventive Vaccine Installation
	3	etc.
3 (Hardware)	1	Hard Disk Drive Check, Replacement & Setting
	2	Mouse
	3	CD-Rom
	4	Key Board
	5	Printer(Film & Paper)
	6	Floppy Disk Drive
	7	Graphic Card & Graphic Board

	8	LAN Card (10/100 & Giga LAN Card)
3 (Hardware)	9	Scanner (Film & Paper)
	10	etc.
4 (PiView)	1	Install
	2	Dictation
	3	Connection
	4	Oracle
	5	Reinstall
	6	Piview Configuration
	7	Update & Upgrade
	8	etc.
5 (Monitor)	1	Monitor Check, Replacement & Setting
	2	Driver Update & Upgrade
	3	etc.
6 (Booting)	1	Blue Screen
	2	Booting Check, Repair & Rebooting
7 (PC)	1	Setting, Install & Check
	2	Reinstall, Format & Data Back-up
	3	Replacement
	4	etc.
8 (Gateway PC)	1	Worklist
	2	Foot Switch
	3	Non-DICOM Gateway PC Check & Configuration
	4	Visual Gateway License Configuration & Change
	5	etc.
9 (etc.)	1	PACS Support
	2	Setting Exchange
	3	PACS Education
	4	License & Log-in Authorization
	5	etc.

IV. Results

The average required times for troubleshooting and preventive check were 40 minutes and 18 seconds per trouble and 34 minutes and 22 seconds per preventive check. The occurrence frequency of trouble and preventive check was highest from 10 a.m. to 12 a.m. Among 32 upper grade cases(24 troubleshooting/8 preventive check), 6(4/2) cases were the first grade, 17(17/0) cases were the second grade, and 9(3/6) cases were the third grade.

The classification of all 676 troubleshooting cases by the trouble management operating code was as follows: 21 cases by STORAGE(3%), 89 cases by NETWORK(13%), 12 cases by VIRUS(2%), 156 cases by HARDWARE(23%), 176 cases by PIVIEW(26%), 74 cases by MONITOR(11%), 4 cases by BOOTING(1%), 87 cases by PC(13%), 7 cases by GATEWAY PC(1%), and 50 cases by the others(7%). Moreover, the classification of all 486 preventive check cases by the preventive check operating code was as follows: 11 cases(2%), 10 cases(2%), 119 cases(24%), 100 cases

(21%), 15 cases(3%), 107 cases(22%), 0 cases(0%), 52 cases(11%), 1 cases(0.2%), and 71 cases(15%) by STORAGE, NETWORK, VIRUS, HARDWARE, PIVIEW, MONITOR, BOOTING, PC, GATEWAY PC, and the others, respectively. Troubles in PACS operating system were mainly caused by failure of monitor and hard disk drive, virus, piview install, and reinstall of pc(Table 2). There have been annually 487 cases (221/266) occurred from these four process codes reaching up to 42%(33%/55%) of the total 1,162 cases (676/486).

The replacement items by trouble were 25 LTO TAPES, 14 POWER SUPPLIES, 14 CD-ROMS, and 11 SCSI HDDS, and those by preventive check were 20 LTO TAPES, 10 LAN CARDS, 8 POWER SUPPLIES, and 4 MAIN BOARDS. There have been economic effects of over 0.1 billion won(US$ 100,000)as a result of placing 423 products of 18 items at no cost through such trouble management and preventive check, and expenses of 20 million won(US$ 20,000) have been saved through self QA and calibration of 18 monitors of BARCO CRT MGD521 that are used exclusively for interpretation(Table 3). Especially, there have been economic effects of 20 million won(US$ 20,000) from self interlocking of Gateway equipment. The econo-

Table 2. The Total Cases of Troubleshooting (Tr) and Preventive Check (Pr).

	PACS Check Code			Cases(Tr/Pr)
5	MONITOR	1	Monitor Check, Replacement & Setting	66/79
2	VIRUS	2	Installation of Virus Preventive Vaccine	9/114
3	HARDWARE	1	Hard Disk Drive Check, Replacement & Setting	46/69
4	PIVIEW	1	Install	100/4

Table 3. Replacement of Items and Their Cost During 1 Year.

Name of Item	Replacement Quantity (Trouble/Preventive)	Amount(Won) (US$)
HDD	136(46/90)	20,400,000 (20,400)
MONITOR	89(10/79)	42,600.000 (42,600)
LTO TAPE	45(25/20)	9,000,000 (9,000)
LAN CARD	24(4/20)	480,000 (480)
POWER SUPPLY	22(14/8)	440,000 (440)
FOOT SWITCH	19(5/14)	4,750,000 (4,750)
MOUSE	18(5/13)	360,000 (360)
CD-ROM	17(14/3)	510,000 (510)
GRAPHIC CARD	16(6/10)	480,000 (480)
Board	12(8/4)	2,400,000 (2,400)
SCSI HDD	11(11/0)	16,500,000 (16,500)
MEMORY 512	3(1/2)	840,000 (840)
KEY BOARD	3(3/0)	60,000 (60)
MEMORY 128	2(2/0)	200,000 (200)
FDD	2(2/0)	40,000 (40)
STOR. CACHE BA.	2(2/0)	300,000 (300)
DVD-ROM	1(1/0)	50,000 (50)
SPEECH MIKE	1(1/0)	300,000 (300)

mical effect due to the preventive check wasestimated up to 100,000,000 won(US$ 100,000).

V. Conclusion

The economical PACS management as well as the systemization of PACS flow chart and the maintenance of appropriate PACS operating environment could be established maximally by the preventive check.

The followings can be secured from these annual statistics, analysis, and preventive check of PACS management processes. First, it can contribute to systemization of the process flow, and second, it not only enables focused management of frequently occurring troubles, but also, third, by maintaining the optimal efficiency of PACS environment, and fourth, it can maximize the economic efficiency.

The key point to successful operation of PACS, which a lot of medical institutions have introduced around the world, may be an effective and systematic management effort of the manager that is well matched with the invested amount. Data centered management using PACS Check Code presented earlier, is required for systematic management.

The authors also intend to improve and present the Check Code, which enables better systematic management of PACS being operated in each country as soon as possible, based on years of operational results.

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