

CHAPTER 4

RESULTS AND DISCUSSIONS



This chapter provides the results as well as the discussions. The results follow the objectives, and conceptual framework of the study. Discussions include in each part to answer the objectives and compare with other studies that have been done before. These are divided into two parts: the first part deals with factors that influence the utilization pattern of mammography screening, and the second with cost, revenue and cost recovery of mammography screening.

4.1 Utilization Pattern of Mammography Screening

This part presents the factors influencing the utilization of mammography screening that include of patient characteristics, provider features, and other factors i.e. national policy and diffusion of mammography.

4.1.1 Patient Characteristics

In this study, 464 women of user groups and 432 women of non-user groups were interview by designed questionnaires (Appendix B). The results are following:

Sociodemographic characteristics: i.e. age, marital status, education, occupation, household monthly income, and domicile. Sociodemographic characteristics of both user and non-user groups are shown in Table 4.1-4.6.

Age characteristic: The highest proportions of user and non-user groups are women aged 40-49 at 46 %, and 37%, respectively. Less than 5% are women aged under 30. About 80% of users are aged over 40, which is an appropriate age of female to obtain a mammogram. Many studies have revealed that the women older than 40 years are strongly recommended to have routine mammography screening which can reduce mortality by about 25% in breast cancer. This is consistent with the result of a study by Miller et al. (1994), which found that the incidence and mortality from breast cancer increase rapidly after 40 years of age and, thus, they should increase the frequency of mammography screening. The age characteristic of users and non-users is shown in Table 4.1.

Table 4.1 Age Characteristic of Users and Non-users of Mammography Screening at NCI.

Age (years)	Users		Nonusers	
	Frequency	Percent	Frequency	Percent
< 29	14	3.03	23	5.36
30-39	83	17.97	112	26.11
40-49	210	45.45	158	36.83
50-59	110	23.81	91	21.21
60-69	38	8.23	37	8.62
70-79	6	1.30	8	1.86
>80	1	0.22	0	0
Total	462	100.00	429	100.00

Note: 1) N of users is 464, missing data is 2
2) N of non-users is 432, missing data is 3

Marital status: Among the women who visited this hospital, 71% are married in user group and 73% in non-user group; approximately 20% for both of groups are single, and less than 10 % are separated and widows. This follows age characteristic, i.e. most women aged over 30 are married. The marital status of users and non-users groups is shown in Table 4.2.

Table 4.2 Marital Status of Users and Non-users of Mammography Screening at NCI.

Marital status	Users		Nonusers	
	Frequency	Percent	Frequency	Percent
Single	55	19.37	76	19.54
Married	202	71.13	286	73.52
Widow	21	7.39	17	4.37
Separated	6	2.11	10	2.57
Total	284	100.00	389	100.00

Note: 1) N of users is 464, missing data is 180 because this question was added after the first few questionnaires collected.

2) N of non-users is 432, missing data is 43

Educational level: Regarding educational level, in both of user and non-user groups are peak in 2 groups, elementary and bachelor's degree. The proportions of those with elementary are nearly the same, 34.7% and 36% of user and non-user group, respectively. In the high education level, bachelor's and higher than bachelor's, 40.3% in user group could access mammography screening, and only 30% for non user group. In a survey of Thai population migration, 1998, the National Statistical Office found that the proportions of people with elementary, vocational and higher education were 71.2%, 5.4%, and 7.4%, respectively. It is clearly shown that only 50% of the user and non-user groups completing the elementary level can access the cancer screening and treatment services from this hospital. For those with high education, user group can access mammography screening more than the general people nearly 6-fold, and non-user group can access only 4-fold more. The educational level of users and non-users is shown in Table 4.3.

Table 4.3 Educational Level of Users and Non-users of Mammography Screening at NCI.

Educational level	Users		Nonusers	
	Frequency	Percent	Frequency	Percent
Illiterate	4	0.89	3	0.71
Elementary	155	34.68	153	36.00
Lower-secondary	26	5.82	39	9.18
Upper-secondary	39	8.72	42	9.88
Certificate	43	9.62	62	14.59
Bachelor's	152	34.00	110	25.88
> Bachelor's	28	6.26	16	3.76
Total	447	100.00	425	100.00

Note: 1) N of users is 464, missing data is 17
2) N of non-users is 432, missing data is 7

Occupation: With regard to occupation pattern, 38% and 31% of user and non-user groups are civil servants and state enterprise employees, respectively; followed by traders 14% and 17%, respectively. Civil servants and state enterprise employees can access mammography screening more than the other occupations. This reflects unequal treatment for equal needs. The occupation of users and non-users is shown in Table 4.4.

Table 4.4 Occupation of Users and Non-users of Mammography Screening at NCI.

Occupation	Users		Nonusers	
	Frequency	Percent	Frequency	Percent
Civil servants and state enterprise employees	171	37.83	130	30.66
General labor	57	12.61	48	11.32
Traders	61	13.50	70	16.51
Workmen	34	7.52	45	10.61
Agriculture	30	6.64	35	8.25
No occupation	60	13.27	55	12.97
Others	39	8.63	41	9.67
Total	452	100.00	424	100.00

Note: 1) N of users is 464, missing data is 12

2) N of non-users is 432, missing data is 8

Monthly household income: Regarding the monthly household income, the highest proportions in user and non-user groups, are in the middle-income group (10,000-25,000 Baht/month) at 38.92% and 41.73% respectively, followed by the low-income group (less than 10,000 Baht/month) at 37.26% and 41.48% respectively. In the high income group (more than 25,000 Baht/month), 23.83% are user group and 16.80% are non-user group. It is noted that high-income group of user is higher than non-user, so they can access mammography screening more than non-user group. Thailand in figures (1999) presents that average monthly household income (1996) for Bangkok is 21,550 Baht, and for whole kingdom 10,779 Baht. It is noteworthy that about 80% low and middle-income groups of utilized and unutilized of mammogram. This group's income is nearly the same as the average monthly household income for Thailand. The monthly household income of users and non-users is shown in Table 4.5.

Table 4.5 Monthly Household Income of Users and Non-users of Mammography Screening at NCI.

Household monthly income (Baht/month)	Users		Nonusers	
	Frequency	Percent	Frequency	Percent
<10,000	158	37.26	163	41.48
10,000-25,000	165	38.92	164	41.73
25,001-50,000	71	16.75	44	11.20
50,001-75,000	17	4.01	13	3.31
75,001-100,000	7	1.65	8	2.04
>10,000	6	1.42	1	0.25
Total	424	100.00	393	100.00

Note: 1) N of users is 464, missing data is 40
2) N of non-users is 432, missing data is 39

Domicile: For domicile of patients, 58% and 59% for user and non-user groups live in Bangkok and vicinity; followed 13% of users and 11 % of non-users living the central region. And less than 10%, come from the other regions of the country. This still cannot be concluded that the patients who live in the urban area (Bangkok and vicinity) can utilize mammography more than those in the rural area (other regions) because this hospital is located in Bangkok and most of its patients should live places not far away from the hospital. The domicile of users and non-users are shown in Table 4.6.

Table 4.6 Domicile of Users and Non-users of Mammography Screening at NCI.

Domicile (region)	Users		Nonusers	
	Frequency	Percent	Frequency	Percent
Bangkok	188	41.41	182	42.52
Vicinity of Bangkok	75	16.52	70	16.36
Central	58	12.78	48	11.21
Eastern	25	5.51	37	8.64
Northeastern	34	7.49	52	12.15
Northern	42	9.25	18	4.21
Southern	32	7.05	21	4.91
Total	454	100.00	428	100.00

Note: 1) N of users is 464, missing data is 10
2) N of non-users is 432, missing data is 4

Payment mechanism: An analysis of payment mechanism and insurance coverage of users found that the highest proportion at 47%, is under civil service medical benefit schemes (CSMBS) and state enterprises, followed 43% out-of-pocket, and the rest, about 10%, covered by other insurance schemes or pay for themselves. But for non-users of mammography screening, the highest group is out-of-pocket, 44%; followed by CSMBS and state enterprise 36%, and the rest, 16%, under other schemes. This reveals that the patients who are poor, having low income cards or health cards, relatively less access this screening, compared with those who can pay out-of-pocket or civil servants and state enterprise group. This means that occupation has some effects on the payment mechanism, which continues to utilize mammography screening in hospital and lead to equity problem among these groups. The payment mechanism of user and non-user are shown in Table 4.7.

Table 4.7 Patient Payment Mechanism and Insurance Coverage of Users and Non-users of Mammography Screening at NCI

Source of payment mechanism	Users		Non-users*	
	Frequency	Percent	Frequency	Percent
Out-of-pocket	189	43.05	188	43.93
CSMBS and state enterprises	206	46.92	154	35.98
Health insurance and Out-of-pocket	13	2.96	5	1.17
Private health insurance	1	0.23	3	0.70
Social Security Scheme	6	1.37	35	8.18
Welfare from employer	2	0.46	8	1.87
Low income card	3	0.68	10	2.34
Health card	9	2.05	25	5.84
Others	10	2.28	0	0
Total	439	100.00	428	100.00

Note: 1) N of users is 464, missing 10.

2) N of non-users is 432, missing 4.

3) * Refer to payment mechanism for non-users; if the patients have mammogram in the future, which payment mechanism they would like to use.

The result of payment mechanism of mammography screening at NCI is consistent with the study on the use of Extra-corporeal Shock Wave Lithotripters (ESWL) in Thailand (Tangcharoensathien et al.,1994) and a study on diffusion and utilization of Magnetic Resonance Imaging (MRI) in Thailand (Harnvoravongchai et al.,1999). They found 2 major patient payment mechanisms: out-of-pocket and CSMBS. Of all ESWL users, 38 % paid out-of-pocket and 35% were covered by CSMBS. Of the MRI users, 30% the patients paid out-of-pocket and 41% were covered by CSMBS. Among holders of low income cards and health cards, only 5% used ESWL and about 12% used MRI.

In conclusion, occupation of patient has some effects on payment mechanism, and on the utilization level of high technology equipment i.e. ESWL, MRI and mammography machine. The poor group with the same need has less opportunity to access these services, compared with those who can pay by themselves (high-income group) and civil servants group, who can fully reimbursed for these services. This leads to the equity problem among these groups in society.

Transportation cost and Average distance: The average transportation cost for user and non-user groups are 554 and 435 Baht/person, respectively. The average distance for user and non-user groups are 197 and 264 kilometers, respectively. The result shows that the user group live near the hospital more than the non-user group. On the contrary, the average transportation cost of non-user group is higher than the user. The raw data revealed that some users from the southern provinces came to this hospital by airplane, which has an effect on the transportation cost as a whole. The transportation cost and average distance of user and non-user are shown in Table 4.8.

Table 4.8 Transportation Cost and Average Distance of Users and Non-users of Mammography Screening at NCI, by Domicile

Domicile (region)	Transportation Cost (Baht)		Average distance (Km.)	
	User	Non-user	User	Non-user
Bangkok	101	104	22	22
Vicinity of Bangkok	174	143	33	42
Central	256	271	114	129
Eastern	535	274	145	181
Northeastern	921	717	430	380
Northern	690	673	303	460
Southern	1,261	865	493	638
Average	554	435	197	264

Note : 1) Transportation cost refers to the average cost of patient that was paid to go to hospital.

2) Average distance refers to the average distance of province which far away from Bangkok.

This clearly shows an indirect indicator of the average distance and transportation cost that the patients have to pay for themselves. So, at this hospital, the patient cost in accessing this service is not too high because they come from the areas around Bangkok who have 50% higher income than patients from other provinces. Therefore, the utilization pattern of mammography screening at this hospital confirms that the shorter distance, lower transportation cost and higher income can utilize more than the long distance, high transportation and low income group. This is consistent with study of Carr et al (1996) showing that in rural population was lower utilization than in urban population.

Ever had mammogram: For all of the patients who utilize mammogram, when asked within they had ever got mammogram or not, about 57% revealed that they had ever got it (Table 4.9) and 66% had done it last year (Table 4.10).

Table 4.9 Number and Percent of Users who Ever Had Mammogram

Ever had mammogram	Frequency	Percent
Never	125	42.52
Ever	169	57.48
Total	294	100.00

Note: 1) N of users who ever had mammogram is 164, missing data is 170.

2) The missing data for patients who ever had mammogram look rather high because there were some new additional questions after a first-few questionnaire collected.

Table 4.10 Last Mammogram that the Users who Utilized this Screening at NCI

The last time to get mammogram	Frequency	Percent
Last year	102	65.81
Last 2 years	20	12.90
5 years	11	7.10
> 5 years	13	8.39
Cannot remember	9	5.81
Total	155	100.00

Note: N of users who ever had mammogram is 169, missing data is 14

Ever had mammogram and sociodemographic characteristics: The relationships of the mammography utilization and user'age, education, and monthly household income are shown in Table 4.11.

24.7% of women aged 40-49 is the highest percentage of having mammogram before. Women aged more than 40 have chanced to access mammogram more than the women aged less than 39.

Among married women, 49.4% ever had mammogram which is higher than never got mammogram (31.7%) and higher than the single women (7.9%).

Among people with low and middle educational level, the proportions of women who have ever and never got mammogram are nearly the same, i.e. 20.4% and 20.8%, and 8.6% and 8.2%, respectively. In the high educational level, 27.2% of users have ever got mammogram, nearly 2-fold higher than the users who had never got mammogram (14.7%).

In the low-monthly household income group, 16.6% ever got mammogram, which is less than 18.9% for those who never got it. In the middle and high monthly household income group, the proportion of users who ever got mammogram are higher than those who never got mammogram, i.e. 21.9% and 15.5%, and 18.5% and 8.7%, respectively.

In conclusion, the women aged over 40, the married women, the high educational level, and the middle and high monthly household income have a higher rate of mammogram in the past, compared with the other groups. These reveal that age, marital status, educational level, and income level affect not only access mammography at present but also in the past as well.

Table 4.11 Relationship of the Users between Ever Had Mammogram and Sociodemographic Characteristics

Sociodemographic characteristics	Mammogram		Total	
	Never	Ever	% of Total	No.
1. Age (year)				
<29	2.4	0.3	2.8	8
30-39	8.7	8.4	17.1	49
40-49	20.9	24.7	45.6	131
50-59	8.0	16.0	24.0	69
>60	3.1	7.3	10.5	30
Total	43.2	56.8	100.0	287
2. Marrital status				
Single	10.9	7.9	18.9	50
Married/widow/separated	31.7	49.4	81.1	215
Total	42.6	57.4	100.0	265
3. Educational level				
Low	20.8	20.4	41.2	115
Middle	8.2	8.6	16.8	47
High	14.7	27.2	41.9	117
Total	43.7	56.3	100.0	279
4. Monthly household income level				
Low	18.9	16.6	35.5	94
Middle	15.5	21.9	37.4	99
High	8.7	18.5	27.2	72
Total	43.0	57.0	100.0	265

Note: N of users is 464; over 100 were missing in each group because of the addition of a question about mammogram experience after some dato have been collected.

The last mammogram and sociodemographic characteristics: The relationships of the users among the last time to get mammogram and their ages, educational levels, and monthly household income levels are shown in Table 4.12.

The women in all age group, 65.8% utilized mammogram in last year. For married women, in all levels of education, and income, utilized mammogram last year at a highest proportion as well (about 66%). The results of utilization of their last mammogram are very interesting - all the women aged 40-49 can remember their last

mammogram. On the contrary, for the low education level and household income group, 3.3% and 3.5% cannot remember when they utilized the last mammogram in the highest proportion, respectively. These reveal that women aged 40-49, in the middle and high educational level and household income groups are more concerned about their health than those in other groups.

Table 4.12 Relationship of the Users between Last Time to Get Mammogram and Sociodemographic Characteristics.

Sociodemographic Characteristics	Last Mammogram					Total	
	Last year	Last 2 years	5 years	> 5 years	Cannot remember	% of Total	No.
1. Age							
<29	0.6	0	0	0	0	0.6	1
30-39	7.1	1.3	3.9	0.6	1.3	14.2	22
40-49	28.4	8.4	1.9	4.5	0	43.2	67
50-59	21.9	2.6	0.6	0.6	3.2	29.0	45
>60	7.8	0.6	0.6	2.6	1.3	12.9	20
Total	65.8	12.9	7.1	8.4	5.8	100.0	155
2. Marrital status							
Single	8.3	2.1	0.7	2.8	1.4	15.2	22
Married/Widow/ Separated	57.2	10.3	6.9	6.2	4.1	84.8	123
Total	65.5	12.4	7.6	9.0	5.5	100.0	145
3. Education level							
Low	28.0	3.3	0	2.0	3.3	36.7	55
Middle	9.3	1.3	2.0	1.3	0.7	14.7	22
High	28.7	7.3	5.3	5.3	2.0	48.7	73
Total	66.0	12.0	7.3	8.7	6.0	100.0	150

Table 4.12 (Continue)

Sociodemographic Characteristics	Last Mammogram					Total	
	Last year	Last 2 years	5 years	> 5 years	Cannot remember	% of Total	No.
4. Household monthly income level							
Low	20.8	2.1	0.7	2.1	3.5	29.2	42
Middle	25.0	2.8	4.9	6.3	0	38.9	56
High	20.1	6.9	2.1	0.7	2.1	31.9	46
Total	66.0	11.8	7.6	9.0	5.6	100.0	144

Results of mammogram: The results of mammogram test has shown that the rate of positive cases or breast cancer is 15.4% or 15,400 per 100,000 women. This proportion looks very high because the result is obtained from the hospital or it is hospital-based information. The estimated incidence rate in Bangkok (1993) was 20.6 per 100,000 women, which is less than this study's result by nearly 750-fold. The results of mammogram showed the rate of normal cases are 37%; some cases needed investigation from physician by other techniques are 20%; and some got benign tumor, cyst or fibro-adenoma, are 28% (Table 4.13).

Table 4.13 Results of Mammogram Test of the Users at NCI

Results of Mammogram Test	Frequency	Percent
Normal	150	36.59
Borderline/ Need investigate more	83	20.24
Breast cancer	64	15.61
Benign tumor	113	27.56
Total	410	100.00

Note: N of users is 464, missing data is 54

Results of mammogram and sociodemographic characteristics: The relationships of the users among the results of mammogram and their age, marital status, education, and monthly household income level are shown in Table 4.14, Table 4.15 and Table 4.16.

In comparing the percentage of total number of patients between women aged, it was found that nearly 86% of women aged over 40 had breast cancer. The women aged 40-49 had a highest proportion of breast cancer, this might be caused by the fact that these women utilized mammogram more than other age groups; then breast cancer rate gradually decline in older age (Table 4.14). This result is consistent with estimate incidence in Thailand (1993) – the rate increases gradually for women aged 40 (39.7-ASR) to maximum at around age 65 (53-ASR), and declines in older age (Deerasamee et al., 1999).

In comparing women's age groups and breast cancer, found that the highest proportion of breast cancer was found in women aged over 60 (36.6%) (Table 4.15). The rate is gradually increases for women aged 30-39 to over 60, except for women aged under 29. The percentage of women in young aged group (less than 29) is 15.4%, that is higher than women aged 30-49. There is a very interesting point for young Thai women who have a chance to get breast cancer more than in the past or women in Western countries. This result is consistent with the result of a review of expert opinions from Chulalongkorn Memorial Hospital, Siriraj Hospital and the National Cancer Institute. This problem should be investigated further with an increased sample size and a study from population-based data because of the sample size in this study, only 13 women aged under 29 were included, and the result is from one hospital that has expertise in cancer treatment.

In analyzing marital status and breast cancer rates, the highest proportion of breast cancer was found in married women, 78.8% of all users, which may be an effect of higher utilization, compared with single women (Table 4.14). However, within their own group (Table 4.15), the proportions of single and married women who had breast cancer were nearly the same, i.e. 15 and 16%. Thus, married or single women have about the same chance of developing breast cancer.

In analyzing educational level and breast cancer rates, the highest proportion of breast cancer is those who have low educational level (58.3%) which is 2.5-fold higher than the high educational level group (Table 4.14). This result came from nearly the same number of patients, this means that the low education group has a higher chance to get breast cancer than the high education. Then, in comparing the percentage of breast cancer cases within each educational level, it is confirmed that the groups with low and middle educational level have a greater chance to have breast cancer than the high educational level group. Low education group, 22% have breast cancer, compared with 8.8% in the high education group (Table 4.15). Thus, this point have to analyze more and the result from Table 4.16 shows that women aged over 60 is the highest proportion in low educational level (15.2%), and the less proportion in high educational level(6.7%). In the young aged women (less than 39) with high educational level can utilize mammogram more than low education level in the same group.

In conclusion, the low educational level can access mammogram in older aged more than the high educational level. This reveal that the low educational level can access the mammography screening in the late stage of breast cancer and they have chance to get breast cancer more than the high educational level.

By analyzing the monthly household income and breast cancer rates, the highest proportion of breast cancer 50% is the low household monthly income group, which is 2.5-fold higher than the high income group (Table 4.14). This result is consistent with educational level. When comparing the percentage of breast cancer cases within their income level, the low-income group has the highest proportion of 19.7% (Table 4.15). Thus, this confirms that the low income group can utilize mammogram less than the high income group. However, Table 4.16 clearly shows that the high income group women aged over 40 (80.4%) utilize mammogram more than the low income group women (77.8%) of the same age. In conclusion, the low income group has a low utilization of mammography screening, compared with the high income group, and has a higher chance to get breast cancer as well.

Table 4.14 Relationship of Users between the Results of Mammogram and Sociodemographic Characteristics, by Percent of Total

Sociodemographic Characteristic	Results of Mammogram				Total	
	Normal	Borderline	Breast cancer	Tumor	% of Total	No.
1. Age						
<29	4.0	2.4	3.2	2.7	3.2	13
30-39	20.7	18.1	11.1	22.3	19.1	78
40-49	40.7	50.6	33.3	52.7	44.9	183
50-59	24.0	25.3	28.6	16.1	22.8	93
>60	10.7	3.6	23.9	56.3	10.0	41
% with in result	100.0	100.0	100.0	100.0	100.0	408
No. of patients	150	83	63	112	408	
2. Marrital status						
Single	15.6	21.2	17.5	20.9	18.4	47
Married/widow/ separated	84.4	78.8	82.5	79.1	81.6	208
% with in result	100.0	100.0	100.0	100.0	100.0	255
No. of patients	96	33	40	86	255	
3. Education level						
Low	40.0	37.8	58.3	33.0	40.5	159
Middle	14.5	15.9	18.3	27.4	18.8	74
High	45.5	46.3	23.3	39.6	40.7	160
% with in result	100.0	100.0	100.0	100.0	100.0	393
No. of patients	145	82	60	106	393	
4. Monthly household income level						
Low	31.4	38.3	50.0	38.2	37.5	142
Middle	43.6	35.8	30.4	42.2	39.6	150
High	25.0	25.9	19.6	19.6	23.0	87
% with in result	100.0	100.0	100.0	100.0	100.0	379
No. of patients	140.0	81.0	56.0	102.0	379.0	

Table 4.15 Relationship of User between Result of Mammogram and Sociodemographic Characteristics, by Percent within Each Group

Sociodemographic Characteristic	Results of Mammogram				Total	
	Normal	Borderline	Breast cancer	Tumor	% within each group	No.
1. Age						
<29	46.2	15.4	15.4	23.1	100	13
30-39	39.7	19.2	9.0	32.1	100	78
40-49	33.3	23.0	11.5	32.2	100	183
50-59	38.7	22.6	19.4	19.4	100	93
>60	39.0	7.3	36.6	17.1	100	41
Total	36.8	20.3	15.4	27.5	100	408
2. Marrital status						
Single	31.9	14.9	14.9	38.3	100	47
Married/widow/ separated	38.9	12.5	15.9	32.7	100	208
Total	37.6	12.9	15.7	33.7	100	255
3. Education level						
Low	36.5	19.5	22.0	22.0	100	159
Middle	28.4	17.6	14.9	39.2	100	74
High	41.3	23.8	8.8	26.3	100	160
Total	36.9	20.9	15.3	27.0	100	393
4. Monthly household income level						
Low	31.0	21.8	19.7	27.5	100	142
Middle	40.7	19.3	11.3	28.7	100	150
High	40.2	24.1	12.6	23.0	100	87
Total	36.9	21.4	14.8	26.9	100	379

Table 4.16 Relationship of Users among Age and their Education, and Income

Sociodemographic characteristic	Age					Total	
	<29	30-39	40-49	50-59	>60	% within each group	No.
1. Education level							
Low	2.2	10.3	44.0	28.3	15.2	100.0	184
Middle	2.4	34.1	41.5	18.3	3.7	100.0	82
High	4.4	19.4	48.9	20.6	6.7	100.0	180
Total	3.1	18.4	45.5	23.3	9.7	100.0	446
2. Household monthly income level							
Low	3.2	19.1	46.5	21.7	9.6	100.0	157
Middle	2.4	21.2	47.9	21.8	6.7	100.0	165
High	4.0	15.8	41.6	30.7	7.9	100.0	101
Total	3.1	19.1	45.9	23.9	8.0	100.0	423

Reason to use mammogram: When asked the users why they utilize mammography screening. About 28%, they did breast self-examinations (BSE) and found abnormality in their breast; followed by 17% found something abnormal from clinical breast examination (CBE) and were referred, the same percentage with routine checkup; about 13%, they got some recommendations from the physician; about 9%, they have a history of breast cancer in their relative; the same percentage with their relative or friend's recommendation; about 5%, they are referred from other hospitals. All of reasons to utilize mammogram are shown in Table 4.17

Seow et al. (1996) found that in Singapore the strongest factor that determine acceptability of mammography was the encouragement by her spouse or family member. The results of this study show that that relatives or friends or others recommended using this service in only 9% when compare with other reasons. So, it cannot be clearly stated in the same way as in the former study that users come for mammography screening with spouse's recommendation.

Table 4.17 Reasons for Users Utilizing Mammography Screening

Reason	Frequency(%)
• BSE and found abnormality	168(27.68)
• Abnormal from CBE and referred	103(16.97)
• Routine checkup	102(16.80)
• Physician recommendation	78 (12.85)
• History of BC in a relative	57(9.39)
• Relative or friend or others recommendation	56(9.23)
• Referred from other hospitals	31(5.11)
• Others	12(1.98)
Total*	607(100.00)

Note: Frequency of reasons is greater than N of users because one patient can specify more than one reason.

Reasons for selecting this hospital: The factors that influence the utilization pattern, which are obtained by asking the question why they would like to utilize mammogram at the National Cancer Institute and do not choose another hospital, are shown in Table 4.18. The reasons are as follows; Firstly, 48% trust this hospital in term of quality and price (not expensive). Secondly, 24% have relatives and someone available to help them here. Thirdly, 12% don't have the hospital nearby their house. Fourthly, 9% don't trust the nearest hospital. Lastly, 8% specify other reasons; e.g. "they used to be a patient here before", and "this hospital has experts in treatment of cancer".

Therefore, the main factors influencing utilization of mammography screening are the awareness of people to take care of themselves, e.g. BSE, routine checkup, and the factors related to physician (CBE, physician recommendation, and being referred). Moreover, they trust in the National Cancer Institute in terms of quality and price (the best for cancer treatment and not expensive charge for mammogram). These results have shown very clearly consistent with many studies (Chapter 2).

Table 4.18 Reasons for Utilizing Mammography Screening at NCI

Reason	Frequency(%)
Trust in this hospital in terms of quality and price	262 (47.99)
• Have a relative and someone available to help here	129(23.63)
• No hospital nearby their house	63(11.54)
• No trust in the nearest hospital	49(8.97)
• Others	43(7.88)
Total	546(100.00)

Note: Frequency of reasons are greater than N of users because one patient can specify more than one reason.

Reasons for not using mammogram: The reasons for not using mammogram of non-user group are shown in Table 4.19. About 15% they don't know mammography screening, and about the same percentage used to have an examination by physician and have no problem with their breasts. About 12% they don't have family history, about 10% they don't not know where to do. Other interesting reasons include; 9.5% no recommendation from physician, family and friend; 7% no time; 5.5% cannot reimburse; 4.65% don't want to do now; 4.5 have no probability to get breast cancer; and less than 4.5%, the reasons include they do BSE, it's too difficult to go to hospital, mammography screening is expensive, and they shy and afraid to do this screening. The interesting reasons e.g. expensive, and shy and afraid of mammography screening are very low percentage, only 4%. Thus, the price of mammogram in this hospital and cultural barrier do not affect the utilization of mammography screening. This is confirmed by the high percentage of users who choose to utilize mammography screening at this hospital because of their trust in quality and price. However, the awareness of breast cancer should be of concern in the non-user group, as it can prevent them from having a screening before it is too late to know.

Table 4.19 Reasons for Non-use Mammography Screening at NCI

Reason	No.	Percent
• Don't know of mammogram before	134	14.82
• Used to examine by physician and no problem	134	14.82
• No family history	107	11.84
• Don't know where to do	91	10.07
• No recommend from physician, family or friend	86	9.51
• No time	64	7.08
• Having to pay out of pocket; cannot get reimbursed	50	5.53
• Know well about mammogram but need to do now	42	4.65
• No probability of getting breast cancer	41	4.54
• Do it by themselves	40	4.42
• Not being convenient to go to hospital	40	4.42
• Being expensive	34	3.76
• Being shy and afraid	36	3.98
• Others	5	0.55
Total	904	100.00

Note: Frequency of reasons are greater than N of non-users because one patient can specify more than one reason.

Gender of physician: Among non-users, when asked about their preference for gender of physician with whom they would like to get mammogram in the future, 63% would like to choose a female physician, followed by either male or female 35%, and only male 2%, as shown in Table 4.20. This result is consistent with that of Lurie et al.(1993), which found that the patients preferred a female physician to a male.

Table 4.20 Physician Gender Preferred by Non-users If They have to Get Mammography Screening in the Future

Physician Gender	Frequency	Percent
Male	7	1.89
Female	232	62.70
Male or Female	131	35.41
<i>Total</i>	<i>370</i>	<i>100.00</i>

Note: N of non-users is 374, missing data is 4

4.1.2 Provider features

In this part, data was derived from interviewing the radiologist (Head of the Diagnostic Radiology Section) and the nurse (Head of the Mammographic Unit), of the National Cancer Institute. The results are shown in Table 4.21 below.

Table 4.21 Provider Features that Influence the Utilization of Mammography Screening at NCI

Items	Results
Institutional policy	In the past, this hospital planned to cover all women aged over 40 who came to hospital (about 100 patients/day). Because of a limited of radiologists, (only 3), and there are only 2 mammography machines. This hospital has set the institution policy to provide mammography screening for not more than 20 persons/day.

Table 4.21 (Continue)

Items	Results
Screening protocol	<p>For women who can access mammography screening in this hospital, every case has to do ultrasound of the breasts in order to confirm the result of mammogram test. This hospital has some criteria as follows:</p> <ul style="list-style-type: none"> - Doctor's judgment after clinical breast examination - History of breast cancer in a relative. - Breast self-examination and found abnormal by themselves. <p>The women aged over 40 and may keep mammographic films as their history.</p>
Manpower arrangement	<p>Because of the limitation of human resources, (radiologists and technicians), and budget, this hospital cannot increase the number of staff which has been stable since 1998. An the hospital cannot prepare or have more manpower for itself.</p>
Unit charge for mammogram test	<p>The charge for mammogram test has been stable since 1997, at 1,000 Baht per mammogram test plus ultrasound for every patient. Although a patients has to take many mammogram tests (1 visit) in order for the radiologist to diagnose more clearly and justifiably, the hospital doesn't charge more than the rate of 1,000 Baht/visit.</p>

Based on the interview with the hospital staff concerned, to provide mammography screening, several constraints have been found, i.e. limitation of radiologists, capacity of machines, number of patients per day, service hours, and the fixed unit charge for mammography screening. There are very strong factors influencing the utilization pattern of mammography screening. These seem like the hospital cannot serve more than 20 patients per day though many more women in this aged group need to receive mammography screening. So, it is a very crucial problem to reformulate the national

policy on mammography screening in the near future, if the hospital does not try to provide the other methods for the benefits both hospital and patients.

4.1.3 Other Factors

In this part, other factors comprise the national policies on mammography screening in Thailand and other countries, and the diffusion of mammography machines in Thailand.

1) National Policy on Mammography Screening

National policies of mammography screening in Thailand and other countries and the year that the policies were introduced in those countries are shown in Table 4.22.

Table 4.22 National Policies on Mammography Screening in Other Countries and the Year that Policies were Introduced

Country	National Policy/Women Aged/Frequency	Year	Source
Thailand	- The national policy on mammography screening has not clearly been introduced. Since 1995, the National Cancer Control Program, which includes screening and early detection of cervical cancer, breast cancer and oral cancer, has been implemented.	-	Deerasamee et al. (1999)
USA	The American Cancer Society recommendation: <ul style="list-style-type: none"> - monthly breast self-examination; - women aged 20-40 should be examined by the physician; - women aged 40-49 are invited to mammography screening at 1 or 2 yearly intervals; - women aged 50 and older should receive mammogram annually. 	1994	American Cancer Society (1977)
Sweden	- The mammography screening program covers women aged 40-74 years	1986	Tabar and Dean (1987)

Table 4.22 (Continue)

Country	National Policy/Women Aged/Frequency	Year	Source
Finland	- The mammography screening program covers women aged 50-59 years and can continue up to age 64. They are screened at 2 year intervals.	1987	Hakama et al. (1997)
Japan	- na	1987	Oshima (1994) quoted in Bennette (1998)
Spain, Netherlands	- The mammography screening program covers women aged 50-70 and they are screened at 2 year intervals.	na	Ineveld et al. (1993)
Norway	- The mammography screening program covers women aged 50-69 and they are screened at 2 year intervals.	na	Norum (1999)
Denmark	- The mammography screening program covers women aged 50-69 and they are screened at 2 year intervals.	na	Lynge (1998)
France	- The mammography screening program covers women aged 50-69 and they are screened at 3 year intervals.	1989	Bader (1994)
New Zealand	- The mammography screening program covers women aged over 50; and if they are under 50, and have the high risk, they can be reimbursed from the government.	1994	Coney (1994)

Note: na means that data is not available.

Although many countries in the world have set up national policies on mammography screening, they try to prevent the breast cancer which is the second most frequent cancer of women. In Thailand, the problem of this cancer is similar to that in other countries. Normally, Thai hospitals act like a place for treatment, not for prevention, and are not concerned about how to provide preventive care. Screening is an important tool to greatly reduce cost for treatment on both provider and patient sides. Thus, mammography screening policy should be of concern in the National Health Policy Program with the others that should be provided to all special or high-risk groups.

2) Diffusion of Mammography in Thailand.

As of October 1999 there were a total of 113 mammography machines in Thailand, 73 of them were in private hospitals and 40 in public hospitals. Of which, 61 machines (54%) were in Bangkok and vicinity as shown in Figure 4.1, 15 machines (13.3%) in Northeast, 12 machines (10.6%) in the Central region, at 9 machines (8%) in the South and the East, and 7 machines (6.2%) in the North (Table 4.23).

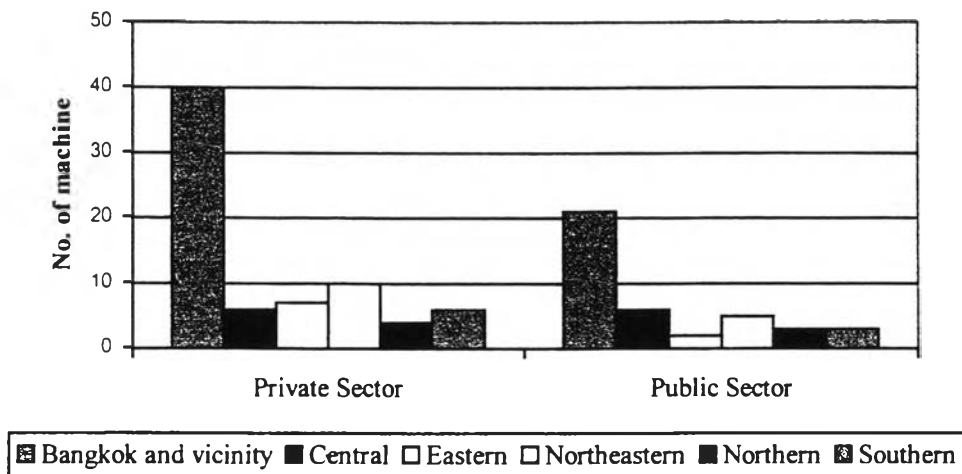
The population in the whole country (1998) includes 30,874,576 women. Therefore, in Thailand there are 3.66 mammography machines for a million women population.

Table 4.23 Diffusion of Mammography in Thailand by Ownership and Region

Region	Private Sector	Public Sector	Total	
			No.	%
Bangkok and vicinity	40	21	61	54.0
Central	6	6	12	10.6
Eastern	7	2	9	8.0
Northeastern	10	5	15	13.3
Northern	4	3	7	6.2
Southern	6	3	9	8.0
<i>Total</i>	73	40	113	100.0

Source: Tangcharoensathien et al. (1999), Update figures on expensive medical devices in Thailand, 1999.

Figure 4.1 Diffusion of Mammography in Thailand Divided by Ownership and Region.



Source: Tangcharoensathien et al. (1999), Update figures on expensive medical devices in Thailand, 1999.

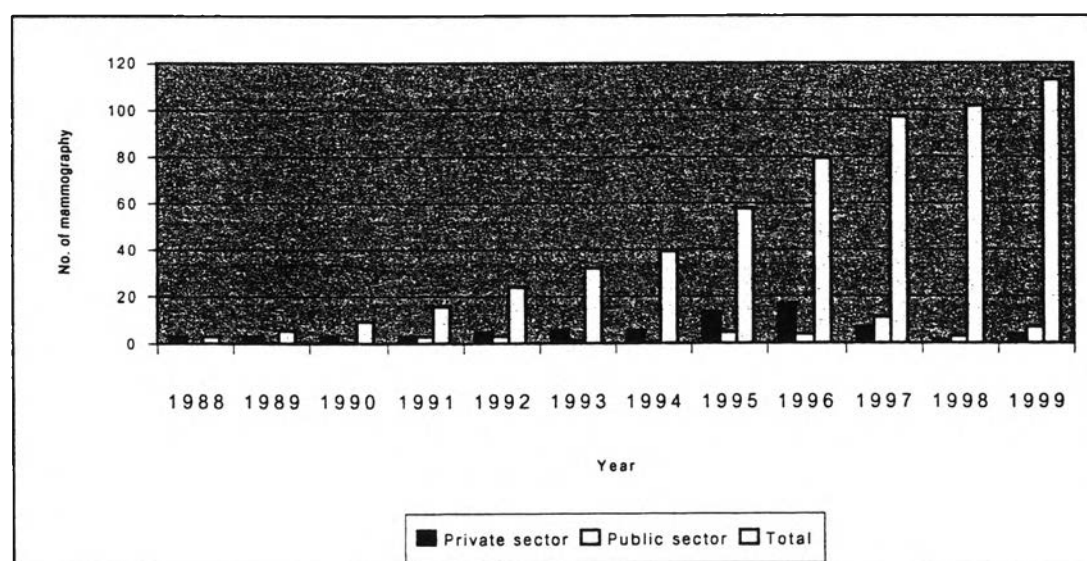
In reviewing the distribution of all mammography by ownership in Thailand, it is found that since 1988 the proportion of such machines in private hospital has increased especially during the bubble economy period (1995-1996). After the economic crisis in 1997, the increase rate of mammography machines in private hospitals, dropped from 15% to 6% and in the public sector the increase at the greater rate increased from 3.5% to 9.7% as shown in Table 4.24 and Figure 4.2.

Moreover, the diffusion of mammography machines in Thailand is one of the other factors influencing the utilization; and the machines should be distributed in the area where the incidence rate of breast cancer is high. The incidence in Bangkok is 20.6 per 100,000 population and it has the highest number of mammography machines (54%). Therefore, the people in Bangkok have a better opportunity to select from both of public and private hospitals to utilize mammogram. The National Cancer Institute has been providing mammography screening for a long time. However, it cannot support all target women who come to hospital each day because there are some other factors from the provider side.

Table 4.24 Diffusion of Mammography in the Private and Public Sectors, 1988-1999

Year	Private Sector		Public Sector		Total	
	No.	Percent	No.	Percent	No.	Percent
1988	3	2.7	0	-	3	2.7
1989	3	2.7	0	-	3	2.7
1990	3	2.7	1	0.9	4	3.5
1991	3	2.7	3	2.7	6	5.3
1992	5	4.4	3	2.7	8	7.1
1993	6	5.3	2	1.8	8	7.1
1994	6	5.3	1	0.9	7	6.2
1995	14	12.4	5	4.4	19	16.8
1996	17	15.0	4	3.5	21	18.6
1997	7	6.2	11	9.7	18	15.9
1998	2	1.8	3	2.7	5	4.4
1999	4	3.5	7	6.2	11	9.7
Total	73	64.6	40	35.4	113	100.0

Source: Tangcharoensathien et al. (1999), Update figures on expensive medical devices in Thailand, 1999.

Figure 4.2 Cumulative Number of Mammography in Thailand, 1988-1999 by Ownership

Source: Tangcharoensathien et al. (1999), Update figures on expensive medical devices in Thailand, 1999.

4.2 Cost, Revenue, and Cost recovery of mammography screening

This part consists of total cost, operating cost, average cost, marginal cost, cost recovery, break even analysis, and sensitivity analysis.

4.2.1 Total Cost

Total cost for each fiscal year (1997-1999) from the provider point of view is calculated by the equation explained in Chapter 3; and how to analyse labour cost, material cost, capital cost, and total cost are shown in Appendices C, D, E and F. Table 4.25 found that the total cost for fiscal years 1997-1999 are 3,224,661, 3,565,187 and 4,119,365 Baht, respectively.

Table 4.25 Total Cost of the Mammographic Unit at NCI, FY 1997-1999

Unit: Baht

Year	Labour Cost (%)	Material Cost (%)	Capital Cost (%)	Total Cost (%)
1997	721,910 (22.4)	629,868 (19.5)	1,872,883 (58.1)	3,224,661 <i>(100)</i>
1998	706,298 (19.8)	807,509 (22.6)	2,051,379 (57.5)	3,565,187 <i>(100)</i>
1999	750,408 (18.2)	853,536 (20.7)	2,515,420 (61.1)	4,119,365 <i>(100)</i>
Total Cost Ratio	1	1	3	5

Note: All costs in every year are the real cost at 1999 constant price.

The change in the real labour cost from fiscal year 1997 to 1998 (Appendix C: Table C.4) is -15,611 Baht because due to an adjustment of total cost with inflation rate; and thus there is a change from nominal total cost to real total cost at 1999 price. Between 1997-1998, the number of patients increased, some staff used more allocated time based on the quantity of a workload, but staff number is the same. Normal, the total cost increases every year. From the fiscal years 1998 to 1999, the change in the amount of labour cost is 44,110 Baht, which has sharply increased.

This is caused by an increase number of personnel, from 15 to 18 persons, which is 2 times higher than the number of radiologists; and the number of patients increases too. Thus, the allocated time of some staff increases, but the proportion time of radiologist for this service decreases.

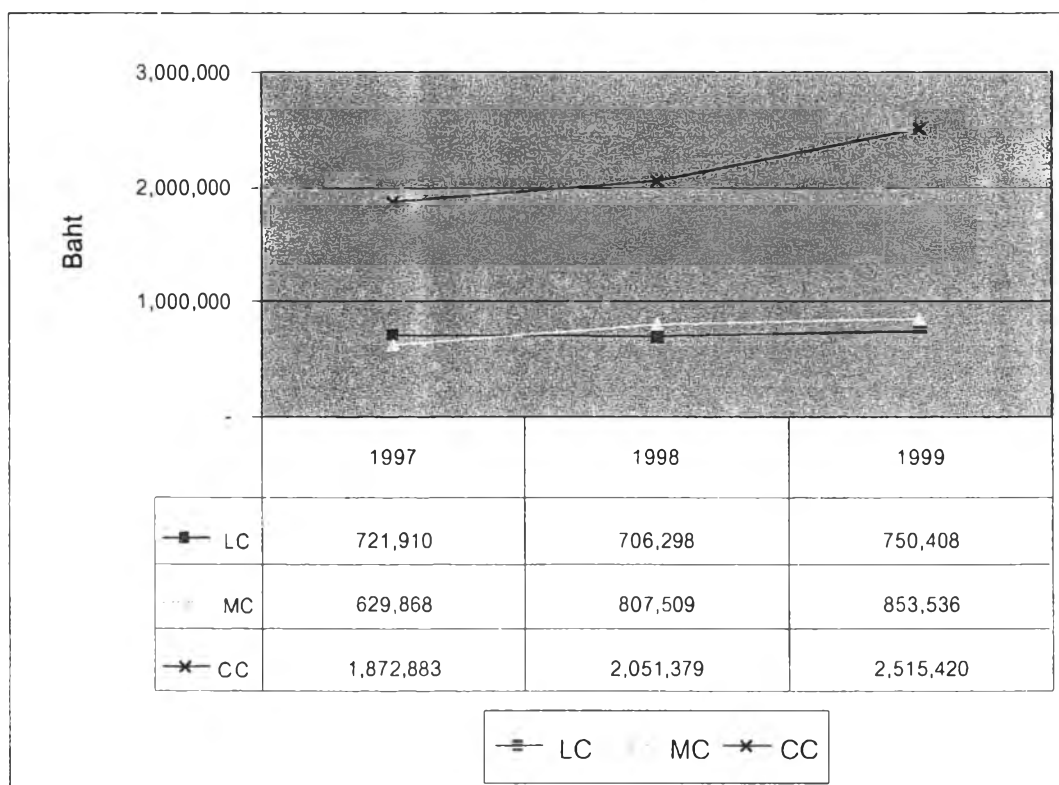
The material cost increased sharply from fiscal years 1997 to 1998, as a result of an increase in the number of patients and and this causes a greater amount of material cost for this service. In fiscal years 1998 to 1999, the material cost gradually increased as well.

The capital cost is a major part of the total cost; and the ratio of this cost is greater than labour cost and material cost by 3-fold as shown in Appendix E: Table E1-3 and in Appendix F: Table F7. Capital cost in fiscal years 1998 to 1999 is sharply high from 2,051,379 to 2,515,420 Baht because the hospital bought a new mammography machine in fiscal year 1999 (Table 4.25).

The ratio of labour cost, material cost, and capital cost in the 3 fiscal years is 1:1:3. Therefore, the capital cost is the highest part of total cost in every fiscal year, which is nearly 60%.

In conclusion, the trend of total cost from fiscal years 1997 to 1999 is gradually increasing and the number of patients who receive mammography screening is increasing as well. Largely, the increase in total cost results from the higher capital cost, particularly in fiscal years 1998 to 1999. During the same period, the labour and the material cost increase slightly and steadily (Figure 4.3).

Figure 4.3 Labour, Material and Capital Cost of the Mammographic Unit at NCI, FY 1997-1999



Source: From Appendix F :Table F.1.

4.2.2 Operating cost

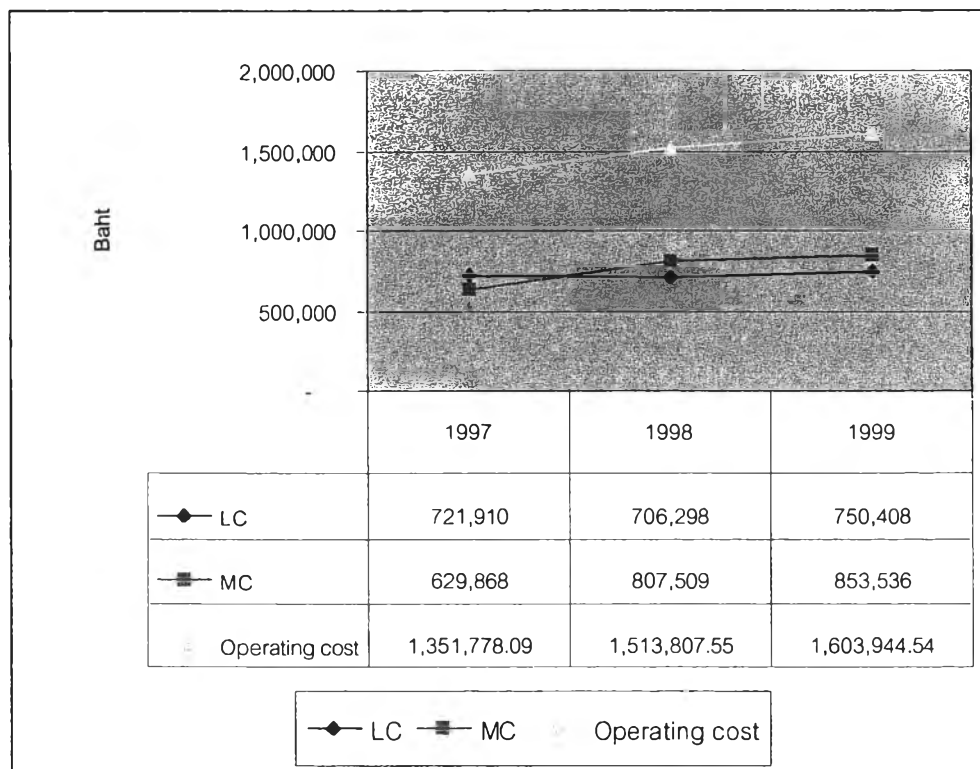
Operating cost for each fiscal year (1997-1999) is calculated by the summation of labour cost and material cost (LC + MC). The operating cost by month and year are shown in Appendix G: Table G.1-G.3. The operating cost for the 3 years gradually increased each year, which is consistent with the number of mammogram test in this hospital as shown in Table 4.26.

Table 4.26 Operating Cost of the Mammographic Unit at NCI, FY 1997-1999

Unit: Baht

Year	No. of patient	Labour Cost	Material Cost	Operating Cost
1997	1,617	721,910	629,868	1,351,778
1998	2,414	706,298	807,509	1,513,808
1999	3,088	750,408	853,536	1,603,945
<i>Average</i>	2,373	726,205	763,638	1,489,843

Figure 4.4 Labour, Material and Operating Cost of the Mammographic Unit at NCI, FY 1997-1999



Source: From Appendix G :Table G.4.

4.2.3 Total Revenue

Total revenue is the revenue that the hospital collects from the patients. The unit charge of mammography screening including a mammogram and breast ultrasound, is 1,000 Baht/visit. This rate has been used since 1995. In some cases, more than one mammogram has to be performed if there is an area suspicious for cancer, in order to diagnose accurately; and, the hospital does not charge for extra costs. At the beginning in 1968, the rate was only 200 Baht/visit. Since then the unit charge has been changed twice to 300 Baht in 1988 to 500 Baht in 1994. In this study, the total revenue is adjusted by inflation rate, and then calculated the real total revenue at the 1999 constant price as shown in Table 4.27.

The loss of revenue that the hospital has to subsidize for some patients who cannot pay for mammography screening is a very small amount. Raw data of 464 women

who utilize this service, only 5 patients actually paid a reduced breast cancer treatment cost but they could pay some money that covered the charge of mammography screening.

Therefore, the total revenue is mainly calculated by multiplying the number of patients in that year by the unit charge (1000 Baht/test), and the inflation rate in order to adjusted to the price at 1999. Thus, the highest total revenue is collected in fiscal year 1999 for 3,088,000 Baht, and the least in fiscal year 1997 for 1,811,040 Baht (as shown in Table 4.27).

Table 4.27 Total Revenue of the Mammographic Unit of NCI, FY 1997-1999

Year	No. of Patient	Total Revenue	Inflation Rate	Total Revenue at 1999 Price (Baht)
1997	1,617	1,617,000	1.12	1,811,040
1998	2,414	2,414,000	1.03	2,486,420
1999	3,088	3,088,000	1	3,088,000
Average	2,373	2,373,000		2,461,820

Note: The unit charge for each year equals 1,000 Baht/mammography screening.

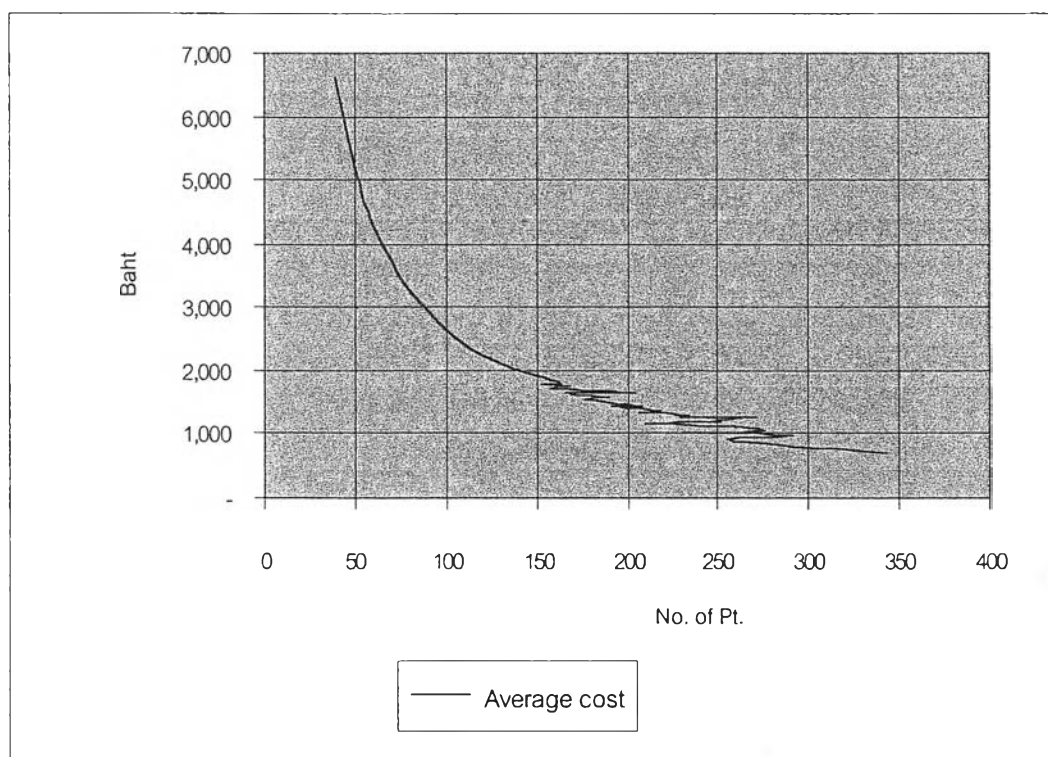
4.2.4 Average Cost

Average cost of mammography screening is about 1,710 Baht/test.(Table 4.28). The trend of average cost has sharply dropped from 6,620 Baht to 695 Baht as the number of patients from 39 to 343 per month.(Appendix F: Table F.6). Figure 4.5 shows that if the number of patients is less than 150, the average cost is greater than 2,000 Bath; and if the number of patients are between 150-250, the average cost is rather fluctuation but steadily decline. When the hospital can provide the service more and more patients, the average cost has decreased continuously. This indicated the decreasing average cost of service.

Table 4.28 Average Cost of Mammography Screening at NCI, FY 1997-1999

Unit: Baht

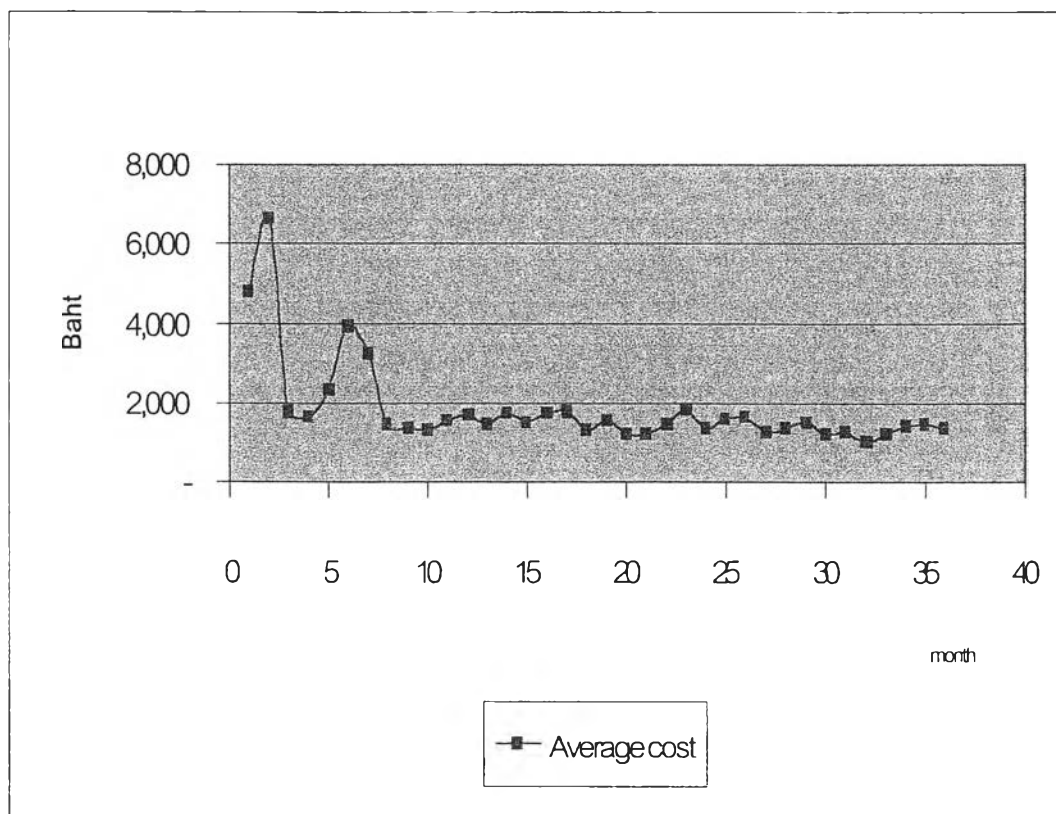
Fiscal Year/Period	Average Cost at that Fiscal Year	Average Cost of that Period
FY 1997/12 months	1,994	2,640
FY 1998/12 months	1,477	1,512
FY 1999/12 months	1,334	1,360
FY 1997-1999/36 months	1,532	1,837
Average Cost of all	1,710	

Figure 4.5 Average Cost of Mammography Screening, by Number of Patients

Source : From Appendix F, Table F.8

When comparing the monthly average cost in fiscal years 1997-1999, the average cost was very high in 7 months of the first year (1997), then it was sharply decline from July at 3,237 Baht/test to August at 1,438 Baht/test (Appendix F: Table F.6). From that point the average cost is not fluctuate too much around 1,100-1800 Baht. (Figure 4.6)

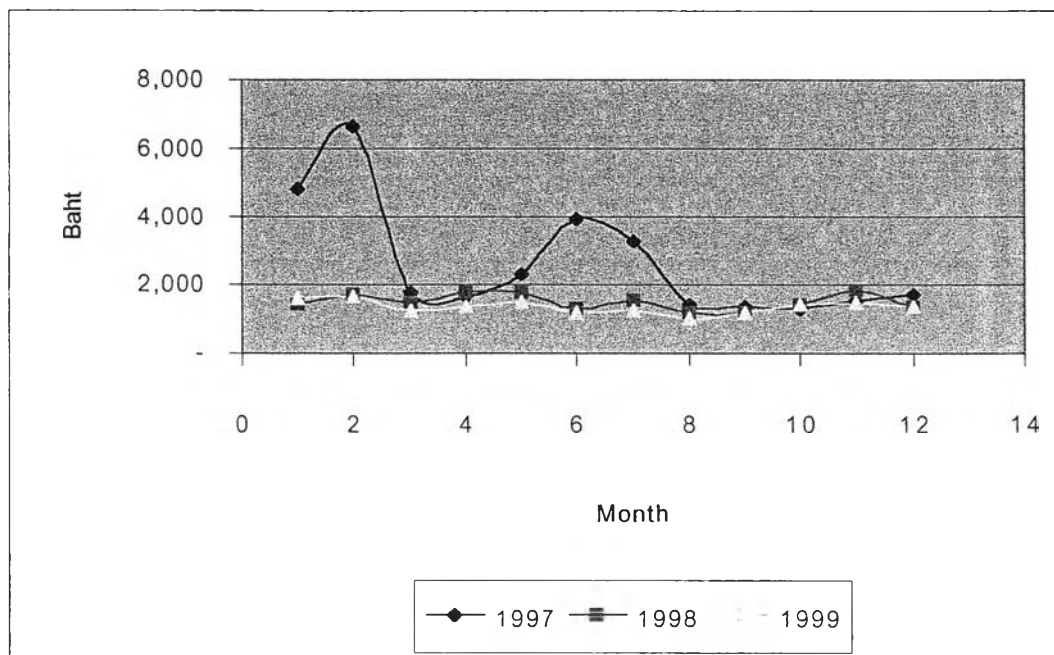
Figure 4.6 Monthly Average Cost of Mammography Screening (36 months), during FY 1997-1999



Source : From Appendix F, Table F.6

When comparing average cost by month in 3 fiscal years, 1997-1999, refer from Table 4.28 and Figure 4.7, the highest of average cost is found in fiscal year 1997, followed by the fiscal year 1998 and 1999, respectively.

Figure 4.7 Monthly Average Cost Comparison for 3 Fiscal Years (1997-1999)



Source : From Appendix F, Table F.7

4.2.4 Marginal Cost

Marginal cost is calculated and divided into 2 items: yearly and monthly marginal costs (detail in Chapter 3). The results are shown in Appendix H: Table H.1-H.2. Marginal cost, which is the extra cost to produce one of mammography screening in this hospital during fiscal year 1997 to 1998 is 427 Baht, and 822 Baht during the fiscal years 1998 to 1999. Therefore, the average marginal cost is 625 Baht during fiscal years 1997 to 1999 at the average 2,373 patients/year. (Table 4.29)

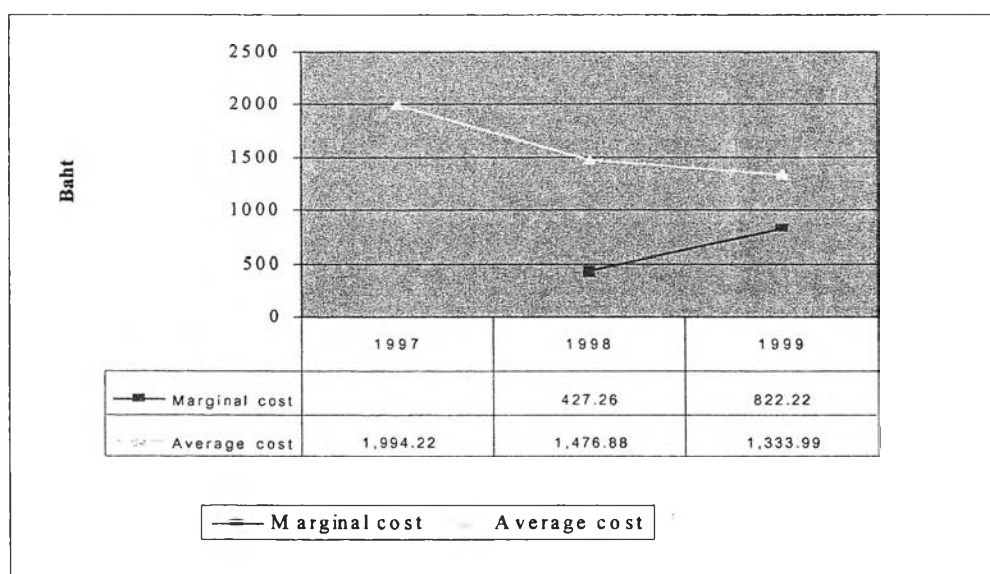
The average marginal cost that is average extra cost to produce one mammography screening which was calculated by monthly basis cost during 3 fiscal years 1997-1999, it is found to be 310 Baht. (Refer Appendix H: Table H.2) This means that when this hospital would like to produce one more test of mammography, the hospital should pay money 310 Baht at the point of average number of patient about 198 per month. (Table 4.29)

Table 4.29 Marginal Cost of Mammography Screening at NCI, FY 1997-1999

By Yearly	No. of patient	Total cost (Baht)	Delta Pt.	Delta TC (Baht)	Marginal cost (Baht)
1997	1617	3,224,661			
1998	2414	3,565,187	797	340,525.11	427.26
1999	3088	4,119,365	674	554,178.33	822.22
			Average marginal cost		624.74
By monthly (36 months)	7,119	10,459,873.09	304	94,227.00	309.96
			Average Marginal cost of all		467.35

Source : From Appendix H, Table H.1 and H.2

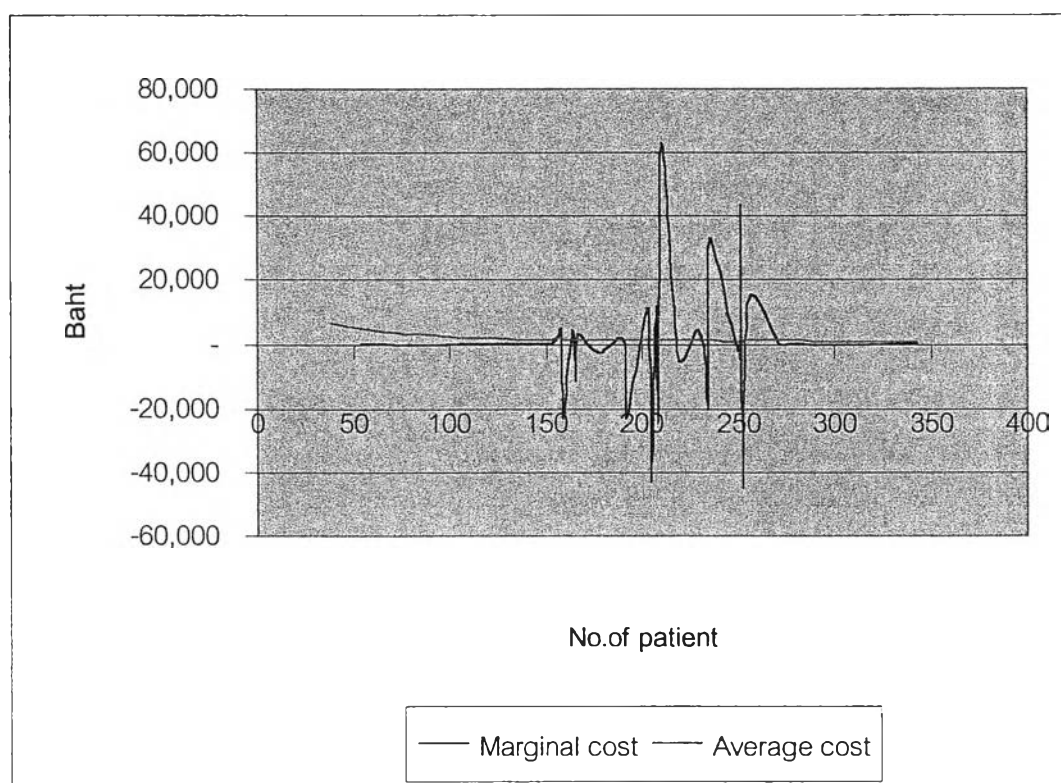
The trend of marginal cost is increasing when produce more test of mammogram, however it is still lower than average cost. By comparing marginal cost and average cost during the 3 fiscal years, it was found that marginal cost is still less than average cost (Figure 4.8). The trend of marginal cost curve is gradually increased but the trend of average cost is gradually decrease. This suggested that hospital should try to increase the quantity of mammogram test at least until a marginal cost equals an average cost or even higher. That will be the optimum solution for this service provision in the long run in term of efficiency ground.

Figure 4.8 Yearly Marginal Cost and Average Cost of Mammography Screening at NCI, FY 1997-1999.

Source : From Appendix H, Table H.1

The average marginal cost of yearly and monthly basis is 467 Baht, which is less than an average cost of mammogram test (1,710 Baht, see Table 4.28). So, in comparing the marginal cost to average cost of mammography screening during 3 fiscal years, this still confirms that the marginal cost is less than average cost in the same period of time as shown in Figure 4.9.

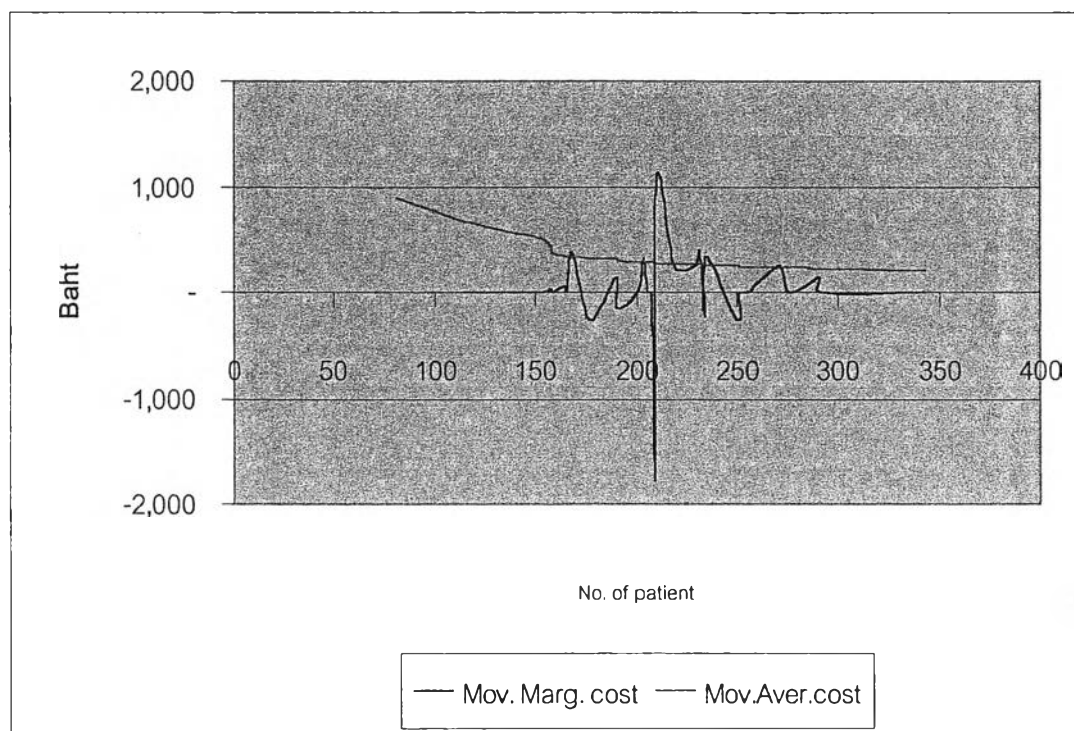
Figure 4.9 Monthly Marginal Cost and Average Cost of Mammography Screening by Ascending the Number of Patients (36 Months) in FY 1997-1999



Source : From Appendix H, Table H.2

The use of the simple 4-month marginal cost moving average arises in order to solve the problem of seasonal and irregular fluctuations in 36-month series data. Data is made to smoother both the trend and the cyclical variation of marginal cost (Figure 4.10). The trend of marginal cost is found still less than average cost, the decreasing rate of average cost slows down, the trend of marginal cost when produce more and more is rising. Thus, if the productivity of hospital is still in the situation that the marginal cost is less than average cost, it suggests the National Cancer Institute to expand more and provide more patients of mammography screening until at the efficient scale or at the point that the marginal cost curve equals the price.

Figure 4.10 A Simple Four-month Marginal Cost Moving Averages and Average Cost by Ascending the Number of Patients in FY 1997-1999



Source: From Appendix H, Table H.3

4.2.5 Cost Recovery

Cost recovery ratio of mammography screening, when comparing the total revenue to total cost from 1997 to 1999, has increased gradually from 0.56 to 0.75. The average cost recovery ratio for the 3 fiscal years is 0.68 (Table 4.30).

Table 4.30 Cost Recovery of the Mammographic Unit at NCI, when Compare with the Total Cost, FY 1997-1999.

Year	No. of Patient	Total Cost (Baht)	Total Revenue (Baht)	Cost Recovery Ratio
1997	1,617	3,224,661	1,811,040	0.56
1998	2,414	3,565,187	2,486,420	0.70
1999	3,088	4,119,365	3,088,000	0.75
Average	2,373	3,636,404	2,461,820	0.68

Source: From Appendix I, Table I.1

When cost recovery when compare between total revenue and operating cost, this found that the revenue of hospital can recover the operating cost every year at 1.34, 1.64, and 1.93 in fiscal year 1997, 1998 and 1999, respectively. The average cost recovery of 3 fiscal years is about 1.65 (Table 4.31). Therefore, when the cost (operating cost) recovery equals 1, the number of patient should be 1,436 cases/year.

Table 4.31 Cost Recovery of Mammography Screening at NCI when Compare with Operating Cost, FY 1997-1999.

Year	No. of Patient	Operating Cost (Baht)	Total Revenue (Baht)	Cost Recovery Ratio
1997	1,617	1,351,778.09	1,811,040	1.34
1998	2,414	1,513,807.55	2,486,420	1.64
1999	3,088	1,603,944.54	3,088,000	1.93
Average	2,373	1,489,843.39	2,461,820	1.65

Source: From Appendix I, Table I.2

In term of cost recovery, the hospital cannot recover all the costs of investment on this screening. It can recover only 0.68 of the total cost on average in 3 fiscal years. But normally, in the public sector, the capital cost should be invested by the government for welfare people and do not conclude this capital cost with the other costs (labour cost and material cost) or operating cost. So, in this study also calculated the cost recovery comparing the total revenue and the operating cost, there found that this hospital can recover the cost at a ratio of 1.65-fold of the investment.

4.2.6 Break Even Analysis

Break even analysis is calculated on an annual basis from 1997-1999 and the average number of patients in the 3 fiscal years. The break even point was obtained based on the total cost equal the total revenue. Table 4.32 shows that the number of patients at break even point in this hospital is higher than the number of patients that the hospital services each year. Thus, hospital should provide mammography screening about 23 cases/day (Analyze on assumption 220 days/year). It cloud serve only

serve only 32%, 50%, and 59% of the number of patients at break even point in fiscal year 1997, 1998, and 1999, respectively. The average number of patients during 1997-1999 is 5,039 while the actual average number of patient is only 2,373 (47% of the number of patients at break even point). The trend of actual number of patient is rising every year, if the hospital tries to expand its capacity, it will be beneficial to both the hospital and the patients.

However, as this hospital is a public sector, it has been subsidized by the government and the services must be provided to society even though is profit or losing. However, for the long-run sustainability of mammography screening, the hospital should be concerned about reaching the target of people at break even point and increasing efficiency by reduce cost or increasing revenue by raise the number of patients.

Table 4.32 Number of Patients at Break Even Point, FY 1997-1999

	1997	1998	1999	Average 1997-1999
<i>Number of patient at BEP.</i>	5,013	4,871	5,234	5,039
Actual number of patients	1,617	2,414	3,088	2,373
Actual test/ test at BEP (%)	0.32	0.50	0.59	0.47
Number of patients per day at BEP.	23	22	24	23

Source: From Appendix J, Table J.1.

4.2.7 Sensitivity analysis

Sensitivity was done based on unit charge and number of test in the year 1999. Then, sensitivity analysis is calculated as follow:

1) Given the price is equal the marginal cost, what should be the quantity change.

In term of marginal cost, it is assumed at 850 Baht which is closed by the marginal cost during 1998-1999. Thus,

$$\begin{aligned}
 \text{Number of tests} &= \text{Total cost} / \text{Unit charge} \\
 &= 4,119,365 / 850 = 4,846 \text{ tests}
 \end{aligned}$$

The result shows that number of tests is 57% higher than actual number of test (3088 tests). In long-run, the hospital should set the charge not more than marginal cost and try to increase the quantity of tests. The decision-makers should create more demand by provide health education and recommend from physician in the appropriate cases based on the high risk groups and the diagnosis.

2) Given the price is constant, what should be the number of test change.

In the current situation, the price is constant (1,000 Baht/test). Thus,

$$\begin{aligned} \text{Number of tests} &= \text{Total cost} / \text{Unit charge} \\ &= 4,119,365 / 1,000 = 4,120 \text{ tests} \end{aligned}$$

The result of the number of tests is still increased; it is 33.4% higher than the actual number of test. The hospital should increase the number of test in order to recover 100% of the total cost.

3) Given the number of test constant, what should be the unit charge change.

If the number of patient equal 3,088 patients, the charge should be change. Thus,

$$\begin{aligned} \text{Unit charge} &= \text{Total cost} / \text{Number of test} \\ &= 4,119,365 / 3,088 = 1,334 \text{ Baht} \end{aligned}$$

The result shows that the charge should be increase 33.4% from 1,000 to 1,334 Baht/test. If the hospital increase the charge, it should be effect to the utilization of mammography screening i.e. the reduction of number of patients.