Cost Analysis of Laboratory Tests: A Study of the Central Laboratory of King Chulalongkorn Memorial Hospital

Navapun Charuruks MD*,
Seangtipa Chamnanpai BSc**, Tada Seublinvog MD***

** Department of Laboratory Medicine, Faculty of Medicine, Chulalongkorn University*
*** Department of Laboratory Medicine, King Chulalongkorn Memorial Hospital,Thai Red Cross*
**** Department of Biochemistry, Faculty of Medicine, Chulalongkorn University*

Objectives : *To present cost analysis on laboratory management of laboratory tests provided by the Central Laboratory of King Chulalongkorn Memorial Hospital (KCMH).*
Material and Method : *The expenditure and income of thelaboratory were studied using a descriptive design.*
Results : *The Central Laboratory provided routine hematology, urinalysis, and chemistry tests, and performed 2,157,275 tests in year 2002. The expenditure of the Central Laboratory was 32,094,960.24 baht, while the income was 97,393,244.40 baht. The average calculated profitability ratio for all parameters was 3.03.*
Conclusion : *The authors concluded that the Central Laboratory is a good Revenue Producing Cost Center (RPCC) for the hospital. To improve the laboratory efficiency, the data needed for laboratory management should be easily available to the laboratory manager. In addition, the authors strongly suggest that the organization structure and the data management system of the hospital and the faculty should be simplified for future management. In addition, all laboratories should perform their own cost analysis.*

Keywords : *Cost analysis, Central laboratory, Laboratory efficiency*

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After the economic crisis of 1997, the revision of financial management was concerned and considered seriously by the government. Efficiency has been demanded in all governmental functions, including healthcare service. The changing of financial reimbursements from the government has threatened the management of many government-run hospitals. Nevertheless, hospitals are generally neither run like other businesses that aim for profit, nor is it really possible for them to function in the same manner. Besides providing the non-stop service 24 hours a day, seven days a week, hospitals need to work under codes of ethics. It is perhaps better for hospital administrative teams to change to a more efficient management system. Clinical laboratory service is one of the potential revenue-producing cost centers (RPCC) (e.g. laboratory, X-ray, and pharmacy) that can be used as a tool to increase the productivity for the hospitals[1]. In order to achieve the highest profit and benefit, clinical laboratories everywhere are being challenged to do more tests at less cost under the best quality control[2]. Although information on cost analysis for clinical laboratories has been made available for some time, there is a lack of precision and details for individual laboratories. The estimation of laboratory cost will be useful not only for laboratory management, but also for clinicians and patients. The dissemination of cost information to clinicians and patients has been studied and found that it can influence the habits of requesting diagnostic tests. Clinicians and patients would rather order a test only when needed. Therefore, it probably leads to lowering the cost of treatment while increasing its efficiency[3-5].

King Chulalongkorn Memorial Hospital (KCMH) was established and opened in 1914 as a memorial for King Chulalongkorn (Rama V) by King

Correspondence to : Charuruks N, Department of Laboratory Medicine, Faculty of Medicine, Chulalongkorn University, King Chulalongkorn Memorial Hospital, Patumwan, Bangkok 10330, Thailand. Phone: 0-2252-7788, Fax: 0-2256-4626, E-mail: ncharuruks@yahoo.com

Vajiravudh (Rama VI) and his cousins. Since 1947, it has been an affiliated hospital of the Faculty of Medicine, Chulalongkorn University (CU), fulfilling the objectives of King Ananda Mahidol (Rama VIII). Now, it is a major tertiary care hospital with a capacity of 1,492 beds providing service to approximately 4,000 outpatients per day[6]. It is a well-known modern hospital occupying fifty acres of land in the center of Bangkok. However, it could not escape the challenge of financial and trends of technological development of the world. In contrast, it needs to transform crisis into opportunity. The clinical laboratory service at the Faculty of Medicine and KCMH is also challenged by a new management concept. In an effort to improve laboratory efficiencies, cost analysis of laboratory tests is one of the basic data that should be focused on[1].

The authors propose a study project on cost analysis and management of the laboratory. The laboratory is the responsibility of the Department of Laboratory Medicine. It has been a modern laboratory since it was established, and processed under the good quality monitor system. It has been ISO 9002 certified since September 2000. Then in November, the Laboratory Information System (LIS) was installed for its working process. Since KCMH is the leading hospital for medical doctors and paramedical personnel, the Central Laboratory has to be audited and certified by the Royal College of Pathologists of Thailand (RCPT). Our findings should provide useful basic information for the management of the Central Laboratory of KCMH as well as other huge complicated hospitals, not only in Thailand but also in other developing countries.

Material and Method

The authors studied and analyzed data of income, expenditure, and laboratory service of the Central Laboratory of KCMH. Our study was descriptive and processed after receiving the approval of the study protocol and consent form (number 201/2002) by the Ethics Committee of the Faculty of Medicine, Chulalongkorn University. The certification of the Committee complied with the ICH/GCP. With an aim to provide the data on cost analysis of laboratory test parameters for the Central Laboratory management, the authors collected the data of number and details of samples, statistics information, and laboratory test parameters. Data of the expenditure on personnel, materials, reagents, instruments, quality control, quality management, laboratory information system (LIS), telephone, electricity and water supply were also collected.

The total direct cost (TDC) of laboratory service was calculated from labor cost (LC), material cost (MC), and capital cost (CC)[7]. LC was calculated from the total salaries of laboratory employees including welfare expenditure. MC was calculated from materials, reagents, LIS, QC, telephone, including electricity and water supply. CC is the cost of two main categories, the instruments and buildings. It was calculated using 10% annual depreciation. The total of indirect costs (TIC) was shared from the non-revenue producing cost centers (NRPCC) (e.g. security, housekeeping, and payroll) by the simultaneous equation method, using appropriate criteria for allocation[8-11]. Thus, the full cost of laboratory tests was calculated from the sum of TDC and TIC. The unit cost of each laboratory test parameter was then calculated by dividing the full cost by the total number of each test parameter requested during one year (January 1, 2002 to December 31, 2002). The breakeven point of each test parameter was calculated by the following equation, total fixed cost (TFC)/[(price/parameter)-(variable cost/parameter)][12]. The authors analyzed the number of tests, the total fixed cost, variable cost, unit cost, price per test or charge price, breakeven point, the difference between charge price and unit cost, and the profitability ratio of each parameter. The profitability ratio of each parameter was calculated from the ratio of its income over expense. The income used for the calculation of the ratio was the calculated income that occurred from the number of tests, since the authors could not assess the actual income of each parameter. If the number is equal to 1, it means that there is no profit and no loss. If the number is higher than 1, it means profit. In contrast, if the number is lower than 1, it means loss. The higher is the value of the ratio, the better is the laboratory's financial condition[1].

Results

Data of the number of tests, total fixed cost, variable cost, unit cost, price per test, and breakeven point of laboratory parameters of the Central Laboratory are demonstrated in Table 1. Data of charge price, the difference between charge price and unit cost, and the profit of service appear are shown Table 2. The distribution of cost from annual expenditure of the Central Laboratory is presented in Fig. 1.

The Central Laboratory provided 53 laboratory parameters (Table 1), which could be split into 10

parameters of hematology, 2 urinalysis parameters, and 41 chemistry parameters. In the year 2002, it performed 2,157,275 tests, which can be factored into 315,581 hematology tests (14.6% of total tests), 139,328 urinalysis tests (6.5% of total tests), and 1,702,366 chemistry tests (78.9% of total tests). The highest price parameter is the test on LDH isoenzyme electrophoresis with the price of 350.00 baht (Table 2). The lowest charge per test is 30.00 baht, and there are many parameters charged at this price, such as, hematocrit (manual), blood group, erythrocyte sedimentation rate (ESR), malaria, reticulocyte count (manual), and ketone. The ten most requested tests were CBC, creatinine, blood urea nitrogen (BUN), glucose, routine urinalysis (UA), potassium (K), sodium (Na), chloride (CL), carbon dioxide (CO_2), and alanine aminotransferase (ALT), respectively (Table 1). CBC was the most requested test; there were 180,396 CBC tests performed in the year 2002 (57.1% of total hematology test or 8.4% of total laboratory test). Our LC was 4,319,230.45 baht, shared by LC of the Thai Red Cross (TRC) 3,778,899.07 baht (87.5% of total LC) and by the Faculty of Medicine for 540,331.38 baht (12.5% of total LC). LC of TRC was calculated from salaries and welfare of 67 TRC employees in the year 2002 after deduction of expenses calculated from working for other departments, while LC of the Faculty of Medicine was calculated from working load (20% of total expense) of 13 personnel of the Faculty of Medicine in the same year. The MC was 27,775,729.79 baht. It could be split into MC of hematology and urinalysis 12,942,201.43 baht (46.6% of total MC), chemistry 12,482,098.65 baht (44.9% of total MC), and LIS and ISO 2,351,429.71 baht (8.5% of total MC). The CC and TIC was 618,093.31 baht. In the year 2002, the total expenditure of the Central Laboratory was 32,094,960.24 baht. Total fixed cost was 5,607,818.02 baht and variable cost was 26,487,142.22 baht. Details of the results on tests, total fixed cost, variable cost, unit cost, price per test, and breakeven point are shown in Table 1. The income of the regular laboratory service in the year 2002 of the Central Laboratory was 97,393,244.40 baht. However, the financial system of the hospital is difficult to assess as parts of the income of the Central Laboratory were allocated to other clinics or projects. In addition, the total approximate income of the Central Laboratory calculated from the total number of tests performed in the year 2002 should be 122,159,010.00 baht. According to Table 2, the ten best laboratory parameters that gave the highest profitability were ABO blood group, globulin, alanine aminotransferase (ALT), low-density lipoproteins (LDL), triglyceride (Tg), aspartate aminotransferase (AST), malaria, creatinine (Cr), UA, and LE preparation, respectively. The profitability ratios of these laboratory parameters were 18.65, 17.83, 8.27, 8.26, 8.25, 8.20, 8.10, 8.09, 7.60, and 7.60, respectively (Table 2). The average of the profitability ratio was 4.46, while the highest loss was 0.22. Actually, total actual income was divided by total expense: it was 3.03. There were 6 laboratory parameters that the profitability ratio did not reach 1, which led to loss. The 6 laboratory parameters that led to loss were acid phosphatase, lactic dehydrogenase (LDH) isoenzyme electrophoresis, ammonia, ketone, ceruloplasmin, and glusoce-6-phosphodehydrogenase deficiency quality test (G-6-PD qualitative), respectively. The profitability ratios of these laboratory parameters were 0.22, 0.23, 0.25, 0.38, 0.67, and 0.88, respectively.

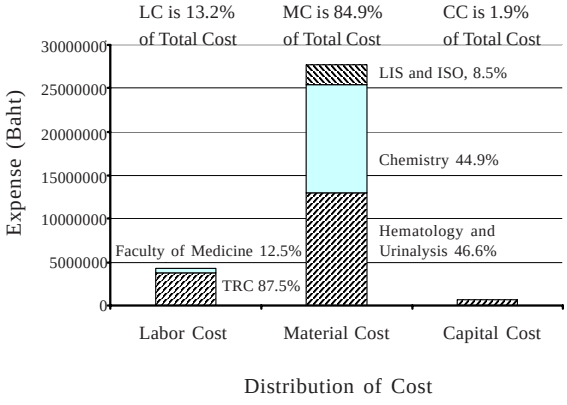

Fig. 1 Distribution of cost of the Central Laboratory, KCMH

Discussion

From the present study, the sketch map of the laboratory requested of the Central Laboratory of KCMH in the year 2002, was demonstrated. The distribution of the cost of expenditure is shown in Fig. 1. Our data demonstrated that LC, MC, and CC were 13.2%, 84.9%, and 1.9% of the total cost, respectively. Most of the budget was used for MC. The component was different from developed countries where most of the budget was used for LC[13-15]. The data demonstrated that LC in developing countries were still cheaper and should be one of the benefit factors for laboratory management. However, the annual salary increase is at least 5%, and the trend of the cost of living has been shifting to the same

Table 1. Data of number of tests, total fixed cost, variable cost, unit cost, price per test, and breakevent point of laboratory parameters of the Central Laboratory, King Chulalongkorn Memorial Hospital, in year 2002

Laboratory Parameters	Test	Total Fixed Cost (Baht)	Variable Cost (Baht)	Unit Cost (Baht)	Price / Test (Baht)	Break Event Point
I. Clinical Microscopy						
Hematology						
1. Routine CBC	180,396	443,790.23	49.51	51.41	80.00	14,554
2. Hematocrit (manual)	1,575	5,613.16	1.90	5.46	30.00	200
3. ABO Blood group	57,578	12,571.62	1.39	1.61	30.00	439
4. E.S.R	5,991	14,133.89	7.90	10.26	30.00	639
5. LE. Preparation (LE cell)	63	413.67	1.32	7.89	60.00	7
6. Thin film Malaria	4,254	10,113.64	1.32	3.70	30.00	353
7. P.T.	36,450	87,540.54	27.50	29.90	60.00	2,694
8. P.T.T.	28,350	68,793.28	34.98	37.41	60.00	2,750
9. Reticulocyte count	873	2,288.40	1.32	3.95	30.00	80
10. G-6-PD Qualitative	51	385.90	106.40	113.97	100.00	-
Total Hematology	315,581	645,644.30	233.54	265.56	510.00	21,716
Urinalysis						
11. Routine Urinalysis	136,682	221,338.76	10.14	11.49	50.00	5,143
12. Pregnancy test	2,646	6,391.96	18.37	20.78	60.00	154
Total Urinalysis	139,328	227,730.7	28.51	32.27	110.00	5,297
II. Clinical Chemistry						
13. Glucose	143,501	31,4473.40	4.41	6.60	40.00	8,835
14. BUN	146,081	320,444.75	8.49	10.69	40.00	10,171
15. Creatinine	161,132	355,279.94	3.98	6.18	50.00	7,719
16. Uric acid	66,938	137,270.11	6,26	8.32	50.00	3,139
17. Sodium	107,832	279,527.11	5.46	8.05	50.00	6,275
18. Potassium	110,190	284,984.65	5.39	7.98	50.00	6,388
19. Chloride	106,524	276,499.78	5.49	8.09	50.00	6,213
20. Carbon dioxide	106,068	275,444.38	23.16	25.76	50.00	10,263
21. Calcium	12,450	58,767.68	10.26	14.98	50.00	1,479
22. Magnesium	4,653	40,721.71	32.95	41.70	50.00	2,389
23. Phosphorus	10,884	55,143.21	9.19	14.26	50.00	1,351
24. Total protein	21,165	78,938.35	8.28	12.01	50.00	1,892
25. Albumin	30,546	100,650.46	5.13	8.42	50.00	2,243
26. Globulin	14,301	63,051.78	2.32	6.73	120.00	536
27. Total Bilirubin	30,201	99,851.96	6.20	9.51	50.00	2,280
28. Direct Bilirubin	28,551	96,033.07	4.81	8.17	50.00	2,125
29. Alkaline phosphotase	87,566	185,013.14	8.75	10.87	70.00	3,021
30. AST	99,236	212,023.08	6.40	8.54	70.00	3,334
31. ALT	102,770	220,202.44	6.32	8.46	70.00	3,458
32. Amylase	3,294	37,576.33	52.90	64.31	70.00	2,197
33. Lipase	687	31,542.49	96.24	142.15	250.00	205
34. LDH	3,975	39,152.49	15.97	25.82	70.00	725
35. CPK	9,282	51,435.42	35.10	40.64	100.00	793
36. Acid phosphatase	78	30,132.97	63.09	449.41	100.00	816
37. Ammonia	138	30,271.84	386.37	605.73	150.00	-
38. Ketone	402	30,882.86	1.53	78.35	30.00	1,085
39. Total cholesterol	101,081	216,293.29	6.89	9.03	50.00	5,017
40. Triglyceride	75,950	158,128.17	7.61	9.69	80.00	2,184
41. HDL Cholesterol	61,749	172,869.08	21.01	23.81	70.00	3,529
42. Protein Electrophoresis	330	30,716.22	51.53	144.61	200.00	207
43. LDH Isoenzyme Electrophoresis	24	30,007.99	276.53	1526.86	350.00	408
44. Gamma GT	2,817	36,472.33	23.95	36.90	70.00	792
45. Blood gas	12,906	57,943.37	47.33	51.82	250.00	286
46. CK-MB	6,501	44,998.86	32.10	39.02	100.00	663
47. Ceruloplasmin	87	30,153.80	101.53	448.13	300.00	152
48. C.S.F Total protein	5,553	42,804.74	25.01	32.72	50.00	1,713
49. C.S.F Sugar	1,416	33,229.74	4.76	28.23	40.00	943
50. LDL	19,479	75,036.14	8.26	12.11	100.00	818
51. TNT	4,404	40,145.40	202.63	211.74	320.00	342
52. Fructosamine	581	30,146.86	5.94	57.83	100.00	320
53. HbA1C	1,043	30,181.58	13.83	42.76	200.00	162
Total Clinical Chemistry Test	1,702,366	4,734,443	1,637.10	4,306.99	4,110.00	106,468
Total Laboratory Tests	2,157,275	5,607,818	1,899.15	4,604.82	4,730.00	133,481

Table 2. Data of charge price, the difference between charge price and unit cost, and the profit of the Central Laboratory, King Chulalongkorn Memorial Hospital, in year 2002

Laboratory Parameters	Unit Cost (Baht)	Price / Test (Baht)	Difference	Total Income	Total Expense	Profitability Ratio
I.Clinical Microscopy						
Hematology						
1. Routine CBC	51.41	80.00	28.59	14,431,680.00	9,274,877.07	1.56
2. Hematocrit (manual)	5.46	30.00	24.54	47,250.00	8,599.11	5.49
3. ABO Blood group	1.61	30.00	28.39	159,480.00	8,550.29	18.65
4. E.S.R	10.26	30.00	19.74	179,730.00	61,440.46	2.92
5. LE.Preparation (LE cell)	7.89	60.00	52.11	3,780.00	497.11	7.60
6. Malaria	3.70	30.00	26.30	127,620.00	15,747.71	8.10
7. P.T	29.90	60.00	30.10	2,187,000.00	1,090,019.50	2.01
8. P.T.T	37.41	60.00	22.59	1,701,000.00	1,060,544.47	1.60
9. Reticulocyte count	3.95	30.00	26.05	26,190.00	3,444.61	7.60
10. G-6-PD Qualitative	113.97	100.00	-13.97	5,100.00	5,812.22	0.88
Urine						
11. Routine Urinalysis	11.49	50.00	38.51	4,221,000.00	673,828.54	6.26
12. Pregnancy test	20.78	60.00	39.22	158,760.00	54,989.06	2.89
II.Clinical Chemistry						
13. Glucose	6.60	40.00	33.40	5,740,040.00	946,632.71	6.06
14. BUN	10.69	40.00	29.31	5,843,240.00	1,561,110.55	3.74
15. Creatinine	6.18	50.00	43.82	8,056,600.00	995,805.73	8.09
16. Uric acid	8.32	50.00	41.68	3,346,900.00	556,606.92	6.01
17. Sodium	8.05	50.00	41.95	5,391,600.00	867,849.65	6.21
18. Potassium	7.98	50.00	42.02	5,509,500.00	878,784.04	6.27
19. Chloride	8.09	50.00	41.91	5,326,200.00	861,784.26	6.18
20. Carbon dioxide	25.76	50.00	24.24	5,303,400.00	2,732,076.22	1.94
21. Calcium	14.98	50.00	35.02	622,500.00	186,552.91	3.34
22. Magnesium	41.70	50.00	8.30	232,650.00	194,053.08	1.20
23. Phosphorus	14.26	50.00	35.74	544,200.00	155,216.14	3.51
24. Total protien	12.01	50.00	37.99	1,058,250.00	254,090.14	4.16
25. Albumin	8.42	50.00	41.58	1,527,300.00	257,305.70	5.94
26. Globulin	6.73	120.00	113.27	1,716,120.00	96,268.27	17.83
27. Total Bilirubin	9.51	50.00	40.49	1,510,050.00	287,163.88	5.26
28. Direct Bilirubin	8.17	50.00	41.83	1,427,550.00	233,288.59	6.12
29. Alkaline phosphotase	10.87	70.00	59.13	6,129,620.00	951,541.96	6.44
30. AST	8.54	70.00	61.46	6,946,520.00	847,617.45	8.20
31. ALT	8.46	70.00	61.54	7,193,900.00	869,783.13	8.27
32. Amylase	64.31	70.00	5.69	230,580.00	211,826.20	1.09
33. Lipase	142.15	250.00	107.85	171,750.00	97,659.16	1.76
34. LDH	25.82	70.00	44.18	278,250.00	102,634.10	2.71
35. CPK	40.64	100.00	59.36	928,200.00	377,263.93	2.46
36. Acid phosphatase	449.41	100.00	-349.41	7,800.00	35,054.14	0.22
37. Ammonia	605.73	150.00	-455.73	20,700.00	83,590.37	0.25
38. Ketone	78.35	30.00	-48.35	12,060.00	31,497.88	0.38
39. Total cholesterol	9.03	50.00	40.97	4,025,550.00	726,685.02	5.5
40. Triglyceride	9.69	80.00	70.31	4,430,400.00	536,741.85	8.25
41. HDL Cholesterol	23.81	70.00	46.19	4,322,430.00	1,470,126.06	2.94
42. Protein Electrophoresis	144.61	200.00	55.39	66,000.00	47,721.08	1.38
43. LHD Izoenzyme Electrophoresis	1,526.86	350.00	-1,176.86	8,400.00	36,644.71	0.23
44. Gamma GT	36.90	70.00	33.10	197,190.00	103,942.28	1.90
45. Blood gas	51.82	250.00	198.18	3,226,500.00	668,747.99	4.82
46. CK-MB	39.02	100.00	60.98	650,100.00	253,661.53	2.56
47. Ceruloplasmin	448.13	300.00	-148.13	26,100.00	38,986.90	0,67
48. C.S.F Total protein	32.72	50.00	17.28	277,650.00	181,695.02	1.53
49. C.S.F Sugar	28.23	40.00	11.77	56,640.00	39,976.64	1.42
50. LDL	12.11	100.00	87.89	1,947,900.00	235,839.41	8.26
51. TNT	211.74	320.00	108.26	1,409,280.00	932,521.99	1.51
52. Fructosamine	57.83	100.00	42.17	58,100.00	33,596.33	1.73
53. HbA_1C	42.76	200.00	157.24	208,600.00	44,602.92	4.68
Maximum	1,526.86	350.00	198.18	14,431,680.00	9,274,877.07	18.65
Average	86.88	89.24	4.30	2,181,410.89	584,161.67	4.46
Minimum	1.61	30.00	-1,176.86	3780.00	497.11	0.22

structure as the developed countries. The authors suggested that the structure of cost distribution structure should be followed and monitored. Our finding CC was much lower than MC which was not unexpected. Firstly, most of the instruments are rented. Our previous study supported that there was not much difference in the budget between purchasing and renting of the laboratory instruments[16]. Secondly, the investment on the premises was not included in the present study, since the government and TRC had already provided these parts by subsidizing the budget. Thirdly, all buildings were over 20 years old. Addition of such investment could change the results substantially.

The authors combined the requested frequency of CBC, Cr, BUN, glucose, UA, K, Na, CL, CO_2, and ALT together, which attributed to 1,301,176 performances (60% of total laboratory tests). These data suggested that the laboratory manager should monitor the expense and income of these ten parameters closely to achieve the highest effectiveness of laboratory management. The authors also analyzed for the reason of the ten best profitable laboratory parameters that have already been mentioned. Our ABO blood group is the slide-screening method[17] using ABO antibody reagents that are produced by TRC. Globulin is calculated from total protein and albumin[18], so the cost is mainly from the sample collection and labor cost. ALT, Tg, AST, and Cr, are in the most ten requested laboratory parameters, so the profit of these tests was taken from the high number of orders that are above the breakeven point[12]. LDL was calculated from lipid profile test if the result of Tg was lower than 400 mg/dL. If Tg was higher than 400 mg/dL, then the direct method was processed[19] Malaria, LE preparation, and reticulocyte count were done mainly by labor [20-22], so the unit cost was mainly from the sample collection and labor cost as well as Globulin. These data suggested that the laboratory methods were also important and could affect the laboratory investment.

From Table 2, the highest losing parameter was acid phosphatase (the profitability ratio was 0.22). In the year 2002, the laboratory invested 35,054.14 baht and gained 7,800.00 baht from this parameter. However, the highest difference was -1,176.86 baht, from LDH isoenzyme electrophoresis. These data showed that for every request of LDH isoenzyme electrophoresis, the Central Laboratory lost 1,176.86 baht. Fortunately, this parameter was the least requested, it was requested only 24 times in the year 2002. Its breakeven point was 408 tests, so it was not easy to uplift the 24 requests to 408. The authors also combined the requests of these parameters together, it was 780 times or 0.04% of total laboratory test requested. With these small numbers of request, the productivity of the Central Laboratory of KCMH in the year 2002 was not much affected. However, the improvement of these losing parameters should be done through all involved factors such as, changing technique, increasing the frequency of request to reach breakeven point. If needed, increasing the fee of the test may be considered; nevertheless it depends on the policy of the administration of KCMH and the Faculty of Medicine. On the contrary, more effective management that could help to reduce unit costs, the laboratory test price could be made cheaper. However, the laboratory charges have been set according to the policy of the executive administration based on the ethics of health-care. The average fee for the whole parameter is 89.24 baht (Table 2) and standard deviation (SD) is 76.76 while the average expense is 86.88 baht and the SD is 233.52. From the SD values, the authors noticed more homogeneity of charge fee than unit cost. These data suggested that the expensive tests were buffered by the cheap tests. With this pattern, the Central laboratory could provide tests with the prices that were not so different. The highest fee was 350.00 baht and the lowest was 30.00 baht. However, this pattern may not be suitable for the future, because of the deviation of technological development and the future trend of laboratory services[23,24]. Fortunately, most parameters were requested over the breakeven point and routine uncomplicated laboratory parameters were requested much more often than the complicated ones. Furthermore, G-6-PD quality test and ammonia are two parameters that the increment of the number of requests could not help reaching the breakeven, since the variable costs of both parameters are higher than the actual cost of the test[12]. To minimize loss, the price of both tests needs to be readjusted. Another way is the improvement of the efficiency of both tests. In fact, many health care activities or services in the government health care providers are free of charge although there are expenses such as, routine patient care, doctor visit, emergency task care, etc. To adjust the laboratory prices, the hospital administration should also reconsider a charge for the activities or services; otherwise the hospital could not service. In addition, the expense of NRPCC in

government-run hospitals has never been charged to the patients, but partly subsidized by the annual governmental budget. If the policy on the annual budget is changed, the health care service charge will need to be reorganized too.

The authors also compared the present study with other previous studies and found that the result of our cost analysis was different from the other studies[8,13,14]. This may possibly be due to the following: the completeness of data, the study method, place and duration of time of the study, number of tests, the test technology and its management, including the changing of rate of the currencies. Hence, the authors suggested that every laboratory should calculate their unit cost periodically. As a matter of fact, nothing could be stable for a long time and nobody can understand laboratory works better than the one who works in the laboratory. To complete the study of the expenditure of laboratory expenses precisely, the laboratory manager should run its own cost analysis.

The approximate income of the Central Laboratory calculated from the total number of tests performed in 2002 should be 122,159,010.00 baht, but the actual income was 97,393,244.40 baht. The discrepancy of 24,765,765.60 baht (20% of total income) was due to the repeated tests, internal and external quality control, and allocation of laboratory income to other clinics or projects. In fact, KCMH has a policy to help poor patients so some patients will receive their health care and investigations free of charge or at a lower affordable price. However, with the investment of 32,713,053.55 baht, and income of 97,393,244.40 baht for the Central Laboratory service in 2002, or almost thrice the income over the expenditure, suggested that laboratory service was the very effective RPCC for the hospital. In addition, the profit from laboratory services was organized to support other services or activities, the expense of which could not be charged to the patients. This is a sample of how the government-run hospitals provide their services.

In addition, the authors found that the complicated system of the hospital and the faculty caused difficulties on data assessment. The structure of the organization and data management system of the hospital and the faculty should be reorganized and simplified for future management. Furthermore, useful data, annual income and expenditure should be reorganized and be easier assessed from the LIS or Hospital Information System (HIS) so that the data will be managed and monitored efficiently[25-26]. The authors also found that the expense for LIS and ISO did not affect the cost of management much, our data show that it causes an increase in the cost of each test by 1.09 baht. Selection of appropriate LIS and HIS is very important not only for laboratory management but also for hospital management. Recently, a study on the condition of laboratory instruments demonstrated that a number of instruments might be over supplied[27]. Appropriate management is required to solve the complicated overlapping services. To respond to this loss, the policy on instrument and laboratory technology should be revised and seriously considered in order to improve the laboratory efficiency. Expansion of computer capabilities, client services, specimen handling, marketing, and sales, the adjustment of all these are also required to optimize the patient care[28].

Conclusion

The present study demonstrated the profit and benefit of laboratory and confirmed that the Central Laboratory is a good RPCC of the hospital. The laboratory service has a very good potentiality to increase its efficiency, given that the complex administrative process is simplified. In fact, the price of laboratory tests has been stable for more than ten years and was just increased a few years ago when the exchange rate fell almost 100% when compared to the US currency. The increment of price rate of the Central Laboratory was less than the falling rate of the Thai currency. In another words, general laboratory services of the big hospital are cheaper than ever before. This might be the consequence of technology and good quality management system that has developed gradually for many years. In addition, we need to discuss the currency since nowadays most of laboratory services in Thailand as well as many developing countries depend on technology and reagents from developed countries. The authors also found that most of the routine laboratory parameters have higher profitability ratios than complicated tests. These complicated tests required special techniques and are usually requested in small number, new technology or management concept to improve the efficiency is required. It is suggested that before adding any new parameter, not only the benefit of the treatment needs to be considered carefully, but also its cost analysis needs to be closely followed and monitored. In addition, the good LIS and HIS could support the laboratory management not only by

providing valuable data but also to reduce repeated and complicated systems[25,26]. It is strongly suggest that the organization structure and the data management system of the hospital and the faculty should be reorganized and simplified for future management.

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วิเคราะห์หาค่าใช้จ่ายของรายการตรวจทางห้องปฏิบัติการ: การศึกษาของห้องปฏิบัติการกลาง โรงพยาบาลจุฬาลงกรณ์

นวพรรณ จารุรักษ์, แสงทิพา ชำนาญไพร, ธาดา สืบหลินวงศ์

วัตถุประสงค์ *: เพื่อวิเคราะห์หาค่าใช้จ่ายที่ใช้สำหรับรายการตรวจทางห้องปฏิบัติการกลาง โรงพยาบาลจุฬาลงกรณ์ สำหรับนำมาใช้ในการบริหารห้องปฏิบัติการ*

วิธีการ *: ศึกษาจากค่าใช้จ่ายและรายได้โดยวิธีพรรณนา*

ผลการศึกษา *: ในปี พ.ศ. 2545 ห้องปฏิบัติการกลาง โรงพยาบาลจุฬาลงกรณ์ ให้บริการการตรวจประจำ ได้แก่ การตรวจทางโลหิตวิทยา การตรวจปัสสาวะ และการตรวจด้านเคมีคลินิก เป็นจำนวน 2,157,275 ครั้ง โดยมีค่าใช้จ่ายทั้งสิ้น 32,094,960.24 บาท และมีรายได้เกิดขึ้นทั้งสิ้น 97,393,244.40 คิดเป็นกำไรค่าเฉลี่ยของอัตรากำไรที่ปรากฏจริงเท่ากับ 3.03*

สรุป *: คณะผู้วิจัยสรุปผลการทำงานของห้องปฏิบัติการกลางเป็นหน่วยงานที่ดีในการสร้างรายได้ให้แก่โรงพยาบาล การเพิ่มประสิทธิภาพการบริการของห้องปฏิบัติการ ผู้บริหารห้องปฏิบัติการมีความจำเป็นที่จะต้องเข้าถึงข้อมูลที่จำเป็นสำหรับการบริหารจัดการโดยง่าย คณะผู้วิจัยมีข้อเสนอแนะให้มีการจัดโครงสร้างและระบบข้อมูลที่ง่ายแก่การบริหารจัดการในอนาคต และผู้บริหารห้องปฏิบัติการควรวิเคราะห์ค่าใช้จ่ายของตนเอง*