CHAPTER VI

CONCLUSION AND RECOMMENDATIONS

6.1 PROCESS BENCHMARKING:

Process benchmarking is used as the last tool in the proposed BPR to provide and evaluate best practices for the new process implementation. The total measure is to quantify the results, in measuring improvement of the condition before and after, as the 200 healthcare patients were put to test the hypothesis of which the existing condition has been significantly improved, after implementing the regulatory framework. The answers will be compared and measured the improvement in environment conditions. Numbers of stringency measures are set in two categories (Glen, 1994), in which are performance indicator, in a form of waiting/response time, and output indicator, in a form of ALOS and unnecessary admission (IPD):

Project Indicators: i) **Waiting/Response Time**
ii) **ALOS**
iii) **Unnecessary Admission (IPD)**

i) **Waiting/Response Time:** Performance indicator

To maximise a net profit per square foot of the front-reception area, generally speaking, after the implementation, a number of waiting chairs is virtually available in the waiting area, to match the concept of increasing the working area, while increasing in service area (Figure 6.1):

Figure 6.1: Condition After Implementation

By increasing capacity of working processes, high sales volume per square foot of facility was increased. Thus, the figure shown below is derived from the monthly OPD of the condition before, in which it equals to 14,268 patients/ 30 days/ 24 hours = 19.82 patients/hours. And the *service rate* was calculated from the average lead time table for patient waiting for the service is in average 13.35 minutes (Appendix H), thus in one hour the reception would be able to serve roughly 4.49 patients (per personnel). Thus, the cycle time is 13.35 minutes per unit, and the production rate is P = 1/(13.35 minutes per patient) = 4.49 units per hour. The traffic intensity after implementation of regulatory framework is as shown:

$$\frac{a}{s}$$; a: arrival rate (19.82 patients/hour)

s: service rate (4.49 patients/hour)

Register Queuing Model Results	Condition After
Average number of patients arrival in the reception	19.82
Average number of waiting patients (Traffic intensity value)	4.49
Average time spent in reception (workstation # 1) (min)	13.35
Average time spent in filing room (workstation # 2) (min)	3.90
Average time spent in gatekeeper nurses (workstation # 3) (min)	9.94
Average time spent in the system—throughput time (min)	27.18‡

Table 6.1: New Queuing Performance of the Front Reception
Note: 27.18‡ minutes is cumulative time from 13.35, 3.90, and 9.94 minutes; from the lead time table (Appendix H)

The average number of waiting patients came out to 4.49, which was reduced from 5.64 (Table 4.4), as a reduction of 20.4% after the implementation of the regulatory framework. As this helps the hospital in setting up time and doctors can tailor best programs to benefit the patients. Then, the average response time of completing the entire registration process in the front reception counter has significantly reduced, with fewer mistakes. It also benefits the doctors to be able to support more consultation time and he/she can generate print-out doctor's reports and can authorise sick leave and provide better advice as well. Overall, the lead time for healthcare patients has been reduced from 37 minutes to 27.18 minutes, or a reduction of 26.5%. As improved outcomes are developed, only infrequent errors were made, leading to less nursing time and therefore lower in costs. In which, it allows some patients to be discharged from the hospital earlier in the process as well, and this would lead to the measuring of the ALOS.

ii) **ALOS:** Measuring reduction of ALOS

The result is satisfactory, the healthcare status (Discharge Summary (IPD): Appendix C) can be used as an indicator to identify the customer satisfaction, as the indicator ALSO improvement. While also, good communication through accurate consulted information between reception personnel and the patients can lead to good healthcare outcomes. The result from this study demonstrated that after controlling of the beneficiaries (cost containment) of each program, it has resulted in change in most figures of regular-basis operations especially the ALOS. The condition is as shown below:

Out-Patients Department (OPD):		
General patients are booked monthly in/out via front-reception		
New patients appointments	=	4,087
Old patents appointments	=	10,181
Total OPD	=	14,268
In-Patients Department (IPD):		
General patients are admitted monthly via admission forms		
Accident & Emergency (AE) admission	=	1,892
Waiting-List admission (Non-AE)	=	754
Total IPD	=	2,646
Average Length of Stay (ALOS):		
General patients are discharged monthly via discharge summary (IPD)		
ALOS (include UC and other programs)	=	7-45 Days
Total Patients (OPD & IPD)	=	16,914

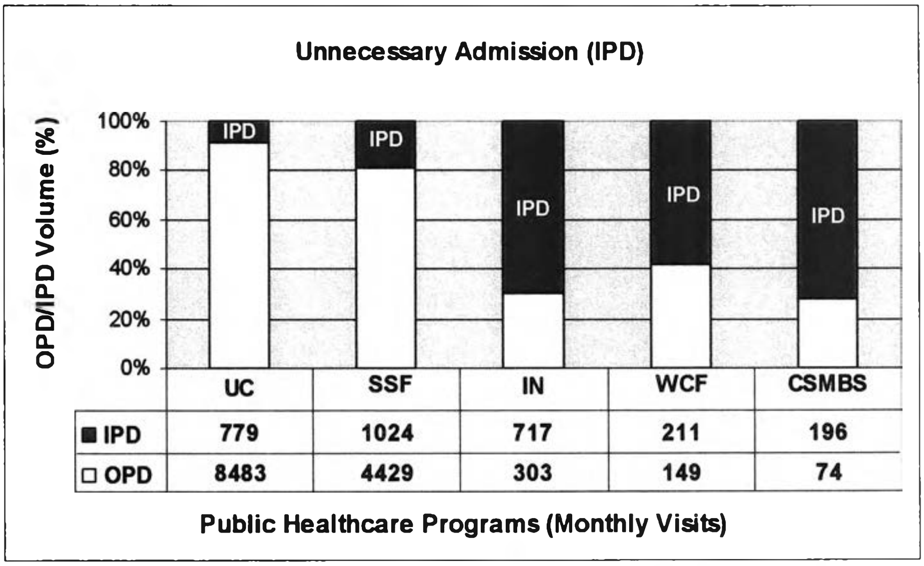
Table 6.2: Improved Condition Figures (As of end-of-April 2005)

As a result, fewer patients stay overnight and the rate of admission have been found to be shortening than the pre-implementation. The ALOS was significantly reduced from 10-60 days to 7-45 days respectively or in other word reduction by

24% (averaging by the mid points). This has led to a reduction in total cost containment and therefore led to the unnecessary admission.

iii) **Unnecessary Admission:** Measuring rate of admission (IPD)

Noting that access to inpatient care (IPD) and unnecessary admission are to be minimised altogether. The entitlement of a beneficiary is now verified by the front reception personnel. Inefficiency was then reflected directly from unnecessary admission (Table 6.3 and 6.4), causing from the relaxation of priorities checked before the admission. The existing condition of service mix between ODP and IPD is as shown:

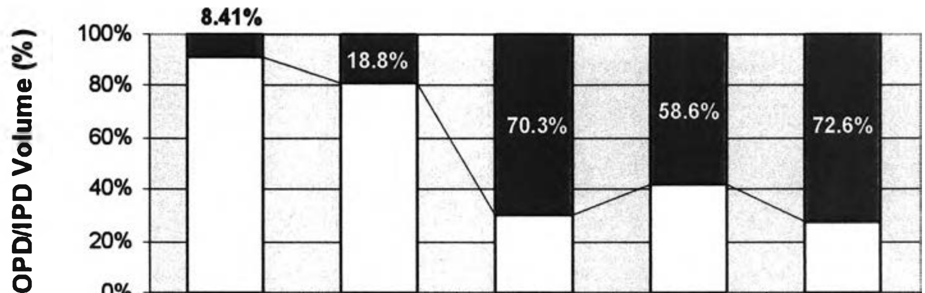


Healthcares	OPD Volume No.	IPD Volume No.
UC	8,483	779
SSF	4,429	1,024
IN	303	717
WCF	149	211
CSMBS	74	196
TOTAL	13.528 (82.66%)	2.837 (17.34%)

Table 6.3: Services Mixed Proportion (Jan-March, 2005)
Note: The total patients is a total volume of OPD and IPD

The averages of unnecessary admission (IPD) of healthcare patients were measured by both forms between nursing admission assessment form and admission form (Appendix D). Thus, the results came out as shown (Table 6.4):

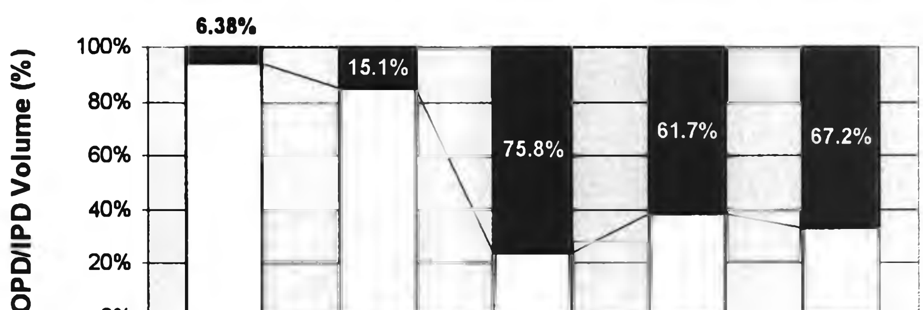
Unnecessary Admission (IPD): Before



	UC	SSF	IN	WCF	CSMBS
■ IPD	779	1024	717	211	196
□ OPD	8483	4429	303	149	74

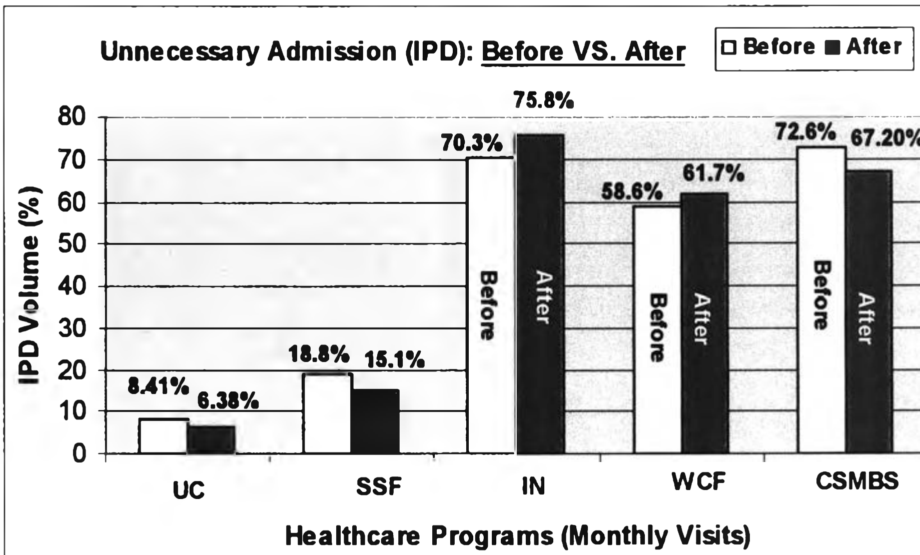
Healthcare Programs (Monthly Visits)

Unncessary Admission (IPD): After



	UC	SSF	IN	WCF	CSMBS
■ IPD	628	815	733	187	283
□ OPD	9212	4568	234	116	138

Healthcare Programs (Monthly Visits)



Healthcares	OPD (Before VS. After)		IPD (Before VS. After)	
UC	8,483	9,212	779	628
SSF	4,429	4,568	1,024	815
IN	303	234▼	717	733▲
WCF	149	116	211	187
CSMBS	74	138▲	196	283▲
TOTAL	13.528 (82.66%)	14.268 (84.36%)▲	2.837 (17.36%)	2.646 (15.64%)▼

Table 6.4: Services Mixed Proportion between Before and After (As of the end-of-April 2005)

From the table 6.2, it can be confirmed that the OPD volume is obviously increasing from 13,528 patients to 14,268 patients, which implies that small improvement has been noticed to lower down the IPD. In which, it lowers from 2,837 to 2,646 or decreasing 6.73% subjectively. The possible downsides of this result may be that due to the regulatory framework does not permit the hospital to offer all the services. But dump some high-cost admissions onto low-cost services, due to its actual regulations, where the hospitals used to have high rate of chronic-diseases patients (high ALOS). And also the cost charge per admission in which it is costly. However, in order to reflect these results onto the statistical model, those figures should be transferred into the table 6.5 to verify improvement in each specific program.

6.2 DISCUSSION OF RESULTS:

Comparison Results of Condition, Before and After:

Interpretation of the results highlight the improved condition between before and after and the results should be verified against those existing conditions. As to clarify the issues and support the claim of significant improvement, presented data below are analysed and described the improvement of unnecessary admission in each program. The statement that the regulatory framework has reduced the unnecessary admission (IPD), are illustrated in the table and the following:

Healthcares	Condition Before (%)	Condition After (%)	Different (Increase)	Different (Decrease)
UC	8.41	6.83	-	-1.58
SSF	18.8	15.1	-	-3.70
IN	70.3	75.8	+5.50	-
WCF	58.6	61.7	+3.10	-
CSMBS	72.6	67.2	-	-5.40

Table 6.5: Condition before and after of the Unnecessary Admission (IPD)

In this unnecessary admission (IPD), healthcare patients and general patients were selected over a period of time, calculated and reported in the true figures, measuring by two forms of surveys (Appendix D). Thus, we want to find that the figures shown above can support the claim, by a 95% confidence level; using $\alpha = 0.05$.

Solution of Service Mix in the Unnecessary Admission (IPD):

At first, by eyeballing the Table 6.4, we cannot tell that the condition after can reduce the unnecessary admission. However, to support the implementation results, we need to clarify each program's figures that may be differ only in their means $\bar{x}_1$ and $\bar{x}_2$, since the condition after shows only slightly improvement.

Carry Out Analysis and Report the Result (s):

$$H_0: \quad \bar{x}_1 = \bar{x}_2 \text{ (No improvement)}$$
$$H_1: \quad \bar{x}_1 > \bar{x}_2 \text{ (Improvement)}$$

At one-tail 5 % (from Table 7, RCMSE: ASM, 2004), we find that the two set of condition being studied are either normally distributed or populated. Then, to further test for a significant different between two means, is to apply Aspin-Welch Test:

Healthcares	Condition Before	Condition After	$(x_1 - \bar{x}_1)$	$(x_1 - \bar{x}_1)^2$	$(x_2 - \bar{x}_2)$	$(x_2 - \bar{x}_2)^2$
UC	8.41	6.83	-37.33	1393.53	-38.5	1482.25
SSF	18.8	15.1	-26.94	725.76	-30.23	913.85
IN	70.3	75.8	24.56	603.19	30.47	928.42
WCF	58.6	61.7	12.86	165.38	16.37	267.98
CSMBS	72.6	67.2	26.86	721.46	21.87	478.30
	$\bar{X}_1 = 45.74$	$\bar{X}_2 = 45.33$		$\Sigma = 3609.33$		$\Sigma = 4070.80$

Table 6.6: Test of the Unnecessary Admission (Before VS. After)

$\overline{X}_1$ = Mean of Condition Before

= 45.74

σ_1 = Standard deviation of Condition Before

= 26.87 (Appendix A)

$\overline{X}_2$ = Mean of Condition After

= 45.33

σ_2 = Standard deviation of Condition After

= 28.53 (Appendix A)

Test Statistic:

$$t \sim \frac{(\bar{x}_1 - \bar{x}_2) - k}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}} \quad ; \ k = 0$$

$$= \frac{(45.74 - 45.33)}{\sqrt{\frac{26.87^2}{5} + \frac{28.53^2}{5}}}$$

$$= \frac{0.41}{17.53}$$

$$= 0.023$$

Degree of Freedom:

$$\nu = \frac{\left(\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}\right)^2}{\frac{1}{n_1 - 1}\left(\frac{\sigma_1^2}{n_1}\right)^2 + \frac{1}{n_2 - 1}\left(\frac{\sigma_2^2}{n_2}\right)^2}$$

$$\nu = \frac{\left(\frac{26.87^2}{5} + \frac{28.53^2}{5}\right)^2}{\frac{1}{4}\left(\frac{26.87^2}{5}\right)^2 + \frac{1}{4}\left(\frac{28.53^2}{5}\right)^2}$$

$$= \frac{94366.65}{(5212.8 + 6625.32)}$$

$$= 7.97 \quad (\nu = 8)$$

From Table 7 (RCMSE: ASM, 2004): using $\alpha = 0.05$, $\nu = 8$: we find that the value is 1.860 and therefore, $H_0: \bar{x}_1 = \bar{x}_2$ is to be accepted. That is, we do not have any evidence to conclude that condition after can reduce the unnecessary admission. Thus, there is strongly evidence that there is no improvement between before and after. In other word, we note that the figure of 0.023 lies very much inside the 95% interval in which it is officially proven that the regulatory framework cannot improve the unnecessary admission (IPD).

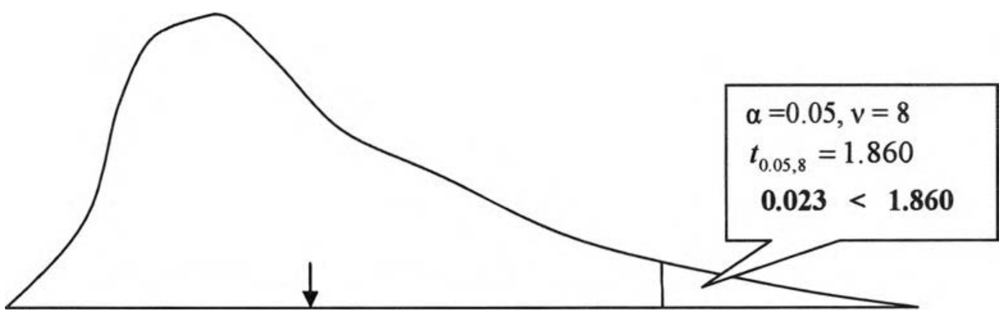


Figure 6.2: 95% Interval of the Unnecessary Admission

Provide Conclusion Showing Results Related to Hidden Factors:

In this section, the data collection reflects how output indicator was measured with number of hidden factors. Factors that reveal that source of error were occurring during the implementation process. The main reason of this is to clarify validity of conclusion for the efficiency improvement. These will determine whether which factors will be set as major error.

Hospital Factors:

1. Inaccurate of the waiting/response time before the implementation, since the hospital has never been established with such average waiting/response time benchmarking, especially the average time in between each workstation (Front-reception process chart).

2. Different time periods of surveys: the waiting/response time survey was conducted at day time (April 2005), while the number of AE

cases, often comes to at night time. While the ALOS and unnecessary admission surveys were conducted during January until March. However, set of patients should have been the same throughout the entire surveys.

3. Front-reception personnel performance; it was difficult to train every personnel the new designed regulatory frameworks, while having to routinely work with patients. Thus, some AE cases were exempted due to the inconvenience and disruption of the patients and their relatives.

Patient's Factors:

1. Sudden changing of regulations and requirements (national healthcare authorities) during the surveys period, one feature of SSF beneficiary (unemployment) was uncoordinatedly launched; this has caused some patients profiles to change (add more priority).

2. Preferred and informed choices; patients were told to use specific healthcare program for their specific reasons.

6.3 CONCLUSION:

This thesis presents comparative framework based on the current industrial practices which provides the hospital management with an objective method of comparing healthcare management based on existing condition and figures and condition after the implementation, with current practices. As of this comparative framework is based on objective method of comparing different attributes of industrial practices, as to be evaluated from three attributes; production systems, operations management, and BPR. This framework also provides an indication of whether or not the public healthcare management in Thailand is in line with the current industrial best practices.

This comparative framework also redesigns the hospital process for healthcare programs in a form of block-flow diagrams and decision-tree diagram as to provide decision support provision (DSP) in a form of suggested nodes illustrations, based on maximum benefits received of patients to the front-reception personnel, which requires information flow in order to improving efficiency of the hospital system. As it offers negotiation guidance in decision making in interaction situations, which can direct and deliver the CRM. The goal of this is to enhance interaction between the front-reception personnel and the patients.

We have also discovered that the industrial practices model of production systems and operations management can be applied to this medical discipline effectively to improve the reliability and effectiveness of the healthcare service system in especially the job-shop process. The effectiveness of the frameworks enables to guide each personnel and medical staff to simplify the process thoroughly. At first, we have only adopted the industrial practices and its related disciplines as to assist the hospital to solving with healthcare complex regulations and requirements and assist in initial support for the front reception personnel. Thus, it turns out that it has improved the condition results to some satisfactory extent.

Furthermore, the industry needs efficient HIS, to solve inadequate public healthcare information and improve perception of all aspect of the healthcare system. The increasing threats especially of punishing contracted hospital with poor standard of healthcare system have posed many concerns on the state of preparedness of the hospital management, especially accidental and emergency (AE) cases. While, the current levels of patient satisfaction of this sector is low. Desire to provide every patients correct and trustworthy information in their equal right and priorities in using the service, and as well as the consultation tool, are needed to be used by the reception personnel. Whereas, this will reduce the risk of number of malpractice and mistreat risks from the hospital.

Role of Hospital Management:

1. For everyday practice, the transient period of production drop will be expected, as a common result of change management, but this period will expect to be in reverse, depending on the level of effectiveness; communication, personnel training, and organisation impact assessment.

1.1 Negotiated works is removed, the front reception personnel and the patients need not to negotiate and evaluate no more, with a known number of patients of each program and faster in waiting/response time.

1.2 Reliable and trustworthy healthcare information promised, in every single case (job-shop process).

2. Output performance improved, since the overall lead time was reduced and therefore the ALOS.

Role of Industrial Practices:

1. Given that this comparative framework represents information management that specifically explains hospital management process in comparison with industrial practices. That it will lead to more effective and efficiency upon controlling of cost containment. Thus, the result of the implementation from the regulatory framework, incorporated with designed processes that the main arriving conclusion is, to prevent the hospital from losing its strategic position and to cope with such governmental intervention situation.

2. The OPD card system can be interpreted into processes controlled with the kanban production system and resulting in productivity improvement, where the JIT environment provides improving the ongoing functional layout.

6.4 RECOMMENDATIONS AND FURTHER STUDY:

Further research should undertake into finding a better method of developing production planning and control system to change face from manual front-reception classifying process for public healthcare service mix to the new paradigm of HIS, which can promote productivity, quality, and reduce the cost. This comparative framework enables the hospital to evaluate various industrial practices. Also, this comparative method provides the hospital with the means of comparing and ensuring system implementation that it is in line with the industrial practices.

In the downside situation of government intervention in healthcare management, as a goal for this, is to select the right solution to cope with the highly regulated inputs (patients) and implement on the practices thoroughly. However, at this level, the results condition could productively cope with current demand of the hospital, by leveraging the patients' type to balance level between hospital personnel and the OPD/IPD visits and develop its own processes to achieve higher efficiency of managing public healthcare programs and bettering the condition.

The practical illustration of the comparative framework has also highlighted that there is still further study in the field to find the best practice methods for managing public healthcare programs in term of continually to the national interest scale. There is still research potential in aligning healthcare management to the industrial best practices, while the further study in industrial engineering approach can be addressed in detail for this hospital discipline.