

Chapter 4

Research Results

The information on incremental cost-effectiveness, between autologous skin graft and cultured skin graft from the view point of services provider, will be presented in 4 sections: 1) general information of population under study, 2) cost analysis for patients treated with autologous skin graft and cost estimation for patients treated with cultured skin graft, 3) effectiveness analysis for patients treated with autologous skin graft and cultured skin graft, and 4) incremental cost-effectiveness analysis for patients treated with cultured skin graft, comparing to patients treated with autologous skin graft.

4.1 General Information of Population under Study

Population under this study is burnt and scalded patients in the Burn unit at the Chulalongkorn Hospital, between January 1st, 1998 to December 31st, 1998. From the retrospective patient registration records, there were 55 burnt and scalded patients in the Burn Unit, of which 27 were treated with autologous skin graft. These 27 patients are selected as population under study, since they falls under the research inclusion criteria.

4.1.1 Age Distribution

Age distribution for the population under study is as follow: Patients age range from 1 to 64 years old, with majority falls between 1 – 15 years old at 37.04%, 29.63% for 16 – 30 years old, 14.81% for 31 – 45 years old, 14.81% for 46 – 60 years old, and 3.70% for 60 and above years old. Patients treated with autologous skin graft have an average age 20.03 years old.

Distribution of age in terms of the patients' gender shows that male patients range from 1 – 60 years of age, with majority falls between 1 – 15 years old at 42.11%, 31.58% for 16 – 30 years old, 15.79% for 46 – 60 years old, and 10.53% for 31 – 45 years old. For female patients, age range is from 1 – 64 years old, with majority falls between 1 – 15 years old at 25%, 25% for 16 – 30 years old, 25% for 31 – 45 years old, 12.5% for 46 – 60 years old, and 12.5% for 60 and above years old. The oldest male patient is 57 years old, and the youngest male patient is 1 years old, while the oldest female patient is 64 years old. The youngest female patient is 3 years old.

4.1.2 Sex Distribution

Sex distribution shows that the ratio of male to female patients is 2 : 1. Male patients are 19 at 70.37%, while female patients are 8 at 29.63%.

4.1.3 Distribution in Terms of Severity of Burn

There are 3 types of burn in the population under study: electrical, scalp and flame. From the patient registration records, majority of burn caused by electricity (short circuited) at 29.6%, scalp at 22.2%, flame at 11.1%, and unknown due to lack of records at 37%.

The depth of burn is divided into 4 types: second degree burn, third degree burn, second and third degree burn, and second or third degree burn. Majority of patients has second and third degree burn at 37%, second degree burn at 29.6%, second or third degree burn at 29.6%, and third degree burn at 3.71%.

Extent of burn or the percentage of Body Surface Area, (%BSA) is as follow: 0 – 20% BSA at 44.4%, 21 – 40% BSA at 7.4%, 41 –60% BSA at 3.7%, more than 60% BSA at 7.4%, and unknown extent of burn due to lack of records at 37%. The percentage of BSA is 22.12% by average.

4.1.4 Distribution in Terms of Length of Stay

Length of stay for patients varies from 18 – 131 days. Majority of patients have a length of stay of 1 – 2 months at 59.26%, 2 weeks – 1 months at 25.93%, and more than 2 months at 14.81%. The average length of stay for patients is 45.55+25.58 days.

Table 4.1: The General Characteristics of the Studied Subjects

Characteristics	Mean	Median	Mode	Range
1. Age (years)	20.03 ± 16.82	18	6	1 – 64
2. LOS. (days)	45.55 ± 25.58	41	41	18 - 131
Number of Subjects = 27				
Sex Ratio (M : F) = 2 : 1				
Diagnosis:				
	First degree burn	-	case	
	Second degree burn	8	cases	(29.6%)
	Third degree burn	1	case	(3.71%)
	Both 1 & 2	-	case	
	Both 2 & 3	10	cases	(37%)
	2 or 3	8	cases	(29.6%)
Types of Burn:				
	Flame	3	cases	(11.1%)
	Scalp	6	cases	(22.2%)
	Electrical	8	cases	(29.6%)
	NA	10	cases	(37%)
Percentage of Body Surface Area (%BSA):				
	0 – 20	12	cases	(44.4%)
	21 – 40	2	cases	(7.4%)
	41 – 60	1	case	(3.7%)
	> 60	2	cases	(7.4%)
	NA	10	cases	(37%)
Result:	Survival	27	cases	(100%)
Demographic Information				
Region:	Bangkok	17	cases	(63.0%)
	Central (East & West)	3	cases	(11.1%)
	North	1	case	(3.7%)
	Northeast	6	cases	(22.2%)

Sources: Chulalongkorn Hospital, 1998.

4.2 Cost Analysis for Burn Therapy

Cost analysis for autologous and cultured skin graft is made, based on the provider's view point. The results of the cost analysis are presented separately for each method of therapy.

4.2.1 Cost analysis for autologous skin graft burn therapy

In the study of cost incurred to the provider, due to the fact that the process of burn therapy consists of the general and the specific activities, calculation thus made by dividing the total cost of both activities with the number of patients treated with autologous skin graft method. The result is the average cost of autologous skin graft burn therapy per one patient.

From Table 4.2, the total cost of autologous skin graft method is separated into cost of general activities and cost of specific activities. Cost of general activities incurred at the Burn Unit, while the cost of specific activities incurred in the operating room. These costs for both places are divided into capital cost, material cost and labor cost relating to burn therapy. From the information shown in the table, the capital cost has the highest share in the total cost at 51.25%, following are the labor cost at 42.70% and 6.05% for material cost.

Table 4.2: Total Provider Costs of Autologous Skin Graft During 1998

Types of Input	Capital Cost (Bht.)	Material Cost (Bht.)	Labor Cost (Bht.)	Total Cost (Bht.)
General	1,879,223.92	45,948.35	1,314,870.74	3,240,043.01 (72.14%)
Specific to Autograft	422,729.08	225,592.80	602,922.89	1,251,244.77 (27.86%)
Total	2,301,953.00 (51.25%)	271,541.15 (6.05%)	1,917,793.63 (42.70%)	4,491,287.78 (100%)

Sources: Chulalongkorn Hospital, 1998.

1.) The capital cost

The capital cost for autologous skin graft burn therapy is calculated based on the calculations of the cost of building and structure, and equipment and tools, from the general and specific activities. The cost of general activities incurred at the Burn Unit, is calculated based on one building and 54 types of equipments. The cost of specific activities incurred in the operating room, is calculated based on one building and 12 types of equipments. Both the Burn Unit and the operating room are in the same building. The equipments are listed in Appendix A.

Table 4.3 shows that the total capital cost of autologous skin graft therapy is Baht 2,301,953.00. The capital cost is divided into capital cost for general activities at Baht 1,879,223.92, which made up of Baht 1,696,874.19 on building cost and Baht 182,349.73 on equipment cost. The capital cost for specific activities at Baht 422,729.08, which made up of Baht 325,594.49 on building cost and Baht 97,134.59 on equipment cost. Information in the table shows that the highest total cost is the cost of building at Baht 2,022,468.68 or 87.86% of the total capital cost, followed by the cost of equipment at Baht 279,484.32 or 12.14%. The total capital cost of general activities is Baht 1,879,223.92, comparing to Baht 422,729.08 for the total capital cost of specific activities.

(1) The cost of building

This study assumes a 50 years of useful life for the building and 10 years of useful life for the equipments. A discount rate of 10% based on World Bank standard discount rate is used for calculating the present value and annual depreciation of building and equipment (See Appendix A).

Allocation of the cost of building for burn therapy is done by dividing the working area of unit associating with burn therapy, with the total working area of the building. Since, a burn therapy process consists of 2 steps, 2 calculations is made. The calculation for the first step at the Burn Unit is done by dividing the working area of the Burn Unit with the total working area of the building ($273.6 \text{ m}^2/2,178 \text{ m}^2 = 12.56\%$). The calculation for the second step in the operating room is done by dividing the working area of the operating room with the total working area of the building ($52.5 \text{ m}^2/2,178 \text{ m}^2 = 2.41\%$).

Proportion of the capital cost for autologous skin graft is estimated from dividing the total length of stay of patients treated with autologous skin graft in the year of study, with the annual capacity for burn therapy. In 1998, there were 27 patients treated with autologous skin graft (Total LOS = 1,230 days), and the annual capacity was 2,190 (estimated from 6 patient beds multiplied by 365 days). Thus, the proportion of patients treated with autologous skin graft is 56.16%. This 56.16% figure is then use for the calculation of the cost of building and equipment for autologous skin graft method.

The depreciation cost for building is Baht 24,056,525.74. The allocation of building cost for burn therapy at the Burn Unit is Baht 3,021,976.79. The proportion of building cost for autologous skin graft at the Burn Unit is Baht 1,696,874.19. The allocation of building cost for burn therapy at the operating room is Baht 579,762.27. The proportion of

building cost for autologous skin graft at the operating room is Baht 325,594.49.

(2) The cost of equipment

The calculation for the present value and depreciation cost for equipment (See Appendix A) is similar to the calculation for the cost of building. Equipment is assumed to have 10 years of useful life, discount rate of 10% based on World Bank standard discount rate, and the proportion 56.16% of total length of stay is used for finding the cost of equipments for autologous skin graft.

Proportion of equipment cost for autologous skin graft at the Burn Unit is Baht 182,349.73. Proportion of equipment cost for autologous skin graft at the operating room is Baht 97,134.59.

Table 4.3: The Capital Costs of Autologous Skin Graft by Component

Items	General	Specific to Autograft	Total Cost	%
1	2	3	4	5
1. Building	1,696,874.19	325,594.49	2,022,468.68	87.86
2. Equipment	182,349.73	97,134.59	279,484.32	12.14
Total	1,879,223.92	422,729.08	2,301,953.00	100.00

Sources: Table 4.2

Notes: Information in column 1 from Appendix A
 Information in column 2 from Table A.1 in Appendix A
 Information in column 3 from Table A.2 in Appendix A

2.) The recurrent cost

The recurrent cost for autologous skin graft involves the calculation for the cost of labor and material for both general activities and specific activities.

(1) The cost of labor

The cost of labor for autologous skin graft is calculated for the Burn Unit and the operating room. There were 17 personnel at the Burn Unit, and 8 personnel in the operating room. The cost of labor is calculated based on proportion of time spent for autologous skin graft.

Time spent for burn patients is 1,722 hours¹.

This study assumed that an equal amount of time is spent for each patients, thus the time spent for autologous skin graft is 49.09%² of 1,722 hours which equals to 845.35 hours (or 49.09%). The time spent for other method of burn treatment is 50.91% of 1,722 hours, which equals to 876.65 hours.

¹ See detail on page 31, section 3.5.6

² Ibid.

The total cost of labor for autologous skin graft is the summation of the total income of all personnel. The total labor cost for each personnel involving with autologous skin graft is the multiplication of annual unit cost of payment, with the time spent for burn therapy (1,722 hours). The obtained result is multiplied by the proportion of time spent for autologous skin graft (49.09%) (See Appendix B).

The total cost of labor incurred at the Burn Unit is Baht 2,678,498.00. The total cost of labor for autologous skin graft at the Burn Unit is equal to Baht 1,314,870.74 or 49.09%. The total cost of labor incurred in the operating room is Baht 1,228,199.00. The total cost of labor for autologous skin graft in the operating room is equal to Baht 602,922.89 or 49.09%. The total cost of labor for autologous skin graft both at the Burn Unit and operating room is Baht 1,917,793.63.

(2) The cost of material

The cost of material for autologous skin graft is categorized into medical cost, non-medical cost and facilities cost depending on the volume for used for both general and specific activities.

The medical cost and non-medical cost are calculated from multiplying the cost per volume of each type of material, with the volume for used. Exception is in the case of cost incurred in specific activities, which calculated from the charge price. Facilities cost, such as, electricity and water, is calculated from the proportion of each unit in total working area (See Appendix C).

Table 4.4 shows the total material cost for autologous skin graft in 1998. General activities comprise of Baht 18,203.30 for medical cost, Baht 10,063.70 for non-medical cost, and Baht 17,681.35 for facilities cost. Specific activities comprise of Baht 222,200.00 of medical cost, and Baht 3,392.80 of facilities cost. The total cost of material for both activities under autologous skin graft is Baht 271,541.15, made up of Baht 240,403.30 for medical cost, Baht 10,063.70 for non-medical cost, and Baht 21,074.15 for facilities cost.



Table 4.4: The Recurrent Costs of Autologous Skin Graft by Component

Items	General	Specific to Autograft	Total Cost	%
1	2	3	4	5
Labor Cost	1,314,870.74	602,922.89	1,917,793.63	87.60
Material Cost	45,948.35	225,592.80	271,541.15	12.40
1. Medical	18,203.30	222,200.00	240,403.30	10.98
2. Non-Medical	10,063.70	-	10,063.70	0.46
3. Facilities	17,681.35	3,392.80	21,074.15	0.96
Total	1,360,819.09 (62.16%)	828,515.69 (37.84%)	2,189,334.78 (100%)	100.00

Sources: Table 4.2

Notes: Information in column 1 from Appendix B (Labor cost), and Appendix C (Material cost)
Information in column 2 from Table B.1 in Appendix B (Labor cost), Table C.1, and Table C.4 in Appendix C (Material cost)
Information in column 3 from Table B.2 in Appendix B (Labor cost), Table C.2.1, and Table C.5 in Appendix C (Material cost)

Table 4.5 shows the component of provider cost for autologous skin graft, categorized in terms of process characteristics or “by activities” into general and specific activities, and in terms of manufacturing factor characteristics or “by input” into capital cost, labor cost, and material cost. Information in the table shows that the total provider cost for autologous skin graft is Baht 4,491,287.78. This total provider cost is made up of Baht 3,240,043.01 or 72.14% for general activities and Baht 1,251,244.77 or 27.86% for specific activities. The highest total cost for autologous skin graft is the capital cost at Baht 2,301,953.00 or 51.25%, follow by labor cost of Baht 1,917,793.63 or 42.70%, and material cost of Baht 271,541.15 or 6.05% of the total cost.

In this study, 27 patients were treated with autologous skin graft. The total provider cost for autologous skin graft is Baht 4,491,287.78. The average cost of autologous skin graft per patient is Baht 166,343.99.

Table 4.5: The Component of Provider Costs for Autologous Skin Graft During 1998

Types of Input	General	Specific to Autograft	Total Cost	%
1. Capital Cost	1,879,223.92	422,729.08	2,301,953.00	51.25
1.1 Building	1,696,874.19	325,594.49	2,022,468.68	45.03
1.2 Equipment	182,349.73	97,134.59	279,484.32	6.22
2. Labor Cost	1,314,870.74	602,922.89	1,917,793.63	42.70
3. Material Cost	45,948.35	225,592.80	271,541.15	6.05
3.1 Medical	18,203.30	222,200.00	240,403.30	5.35
3.2 Non-Medical	10,063.70	-	10,063.70	0.22
3.3 Facilities	17,681.35	3,392.80	21,074.15	0.47
Total Provider Cost	3,240,043.01 (72.14%)	1,251,244.77 (27.86%)	4,491,287.78	100

Sources: Table 4.3 and Table 4.4

4.2.2 Cost analysis for cultured skin graft burn therapy

In this study, the cost analysis for cultured skin graft is depending on the length of stay of the patient. Based on the claim made by Culture Technology Inc., LifeSKINTM, a Cultured Composite Autografts (CCA) that is similar to cultured skin graft, decreases the length of stay of a patient up to 41%. This 41%³ is an advertising claim made with an intention for selling a product that may be exaggerated. In this study the length of stay is assumed to be 30 days (i.e. a 34.14% reduction) if cultured skin graft method is used instead of autologous skin graft method. For the sake of conservative objectivity in calculation, this study will use the length of stay of 30 days for the rest of the calculation. Length of stay will affect all cost including capital, material, and labor cost. If in the future, data on length of stay of cultured skin graft patients is available, it will be used to readjusted the percentage (34.14%) to obtain a more accurate results. The cost components that will be changed by the length of stay are general capital cost, general material cost, and general labor cost. For example, if the actual length of stay of cultured skin graft patient is 21 days, these cost components must be multiplied by the ratio 21/30.

The calculation of the provider cost for cultured skin graft uses the same cost incurred with autologous skin graft, since both method involves 2 steps of activities, the general and the specific activities, in 2 similar places of the Burn Unit and the operating room. There are some differences regarding the details of the burn therapy process, for example, the decreased cost of material and more technicalities in treatment. Thus, the calculation of the provider cost is done by summing the total cost from both steps of activities. The average cost per patient is done by dividing provider cost with the number of patients treated with cultured skin graft method.

Table 4.6 shows the total cost for cultured skin graft burn therapy, categorized into general activities and specific activities. The cost of general activities means cost incurred at the Burn Unit, while the cost of specific activities means the cost incurred in the operating room and the Biomaterial Laboratory, due to skin-cell culturing process. Both of these costs of general and specific activities are divided into capital cost, labor cost and material cost related to the burn therapy. Information in the table shows that the highest cost component is the cost of labor at 41.73%, followed by the capital cost at 33.37% and the material cost of 24.90% respectively.

³ 41% of 45.55 days (45.55 days; LOS of autograft) = 18.68 days, LOS of cultured skin graft method = 45.55-18.68 = 26.87 days

Table 4.6: Total Provider Costs of Cultured Skin Graft Treatment During 1998

Types of Input	General (Ward)	Specific to Cultured Graft			Total
		O.R.	Laboratory Room	Total	
1	2	3	4	5	6
1. Capital Cost	1,237,688.64	374,663.43	323,755.39	698,418.82	1,936,107.46 (33.37%)
2. Material Cost	30,262.36	95,592.80	1,318,960.92	1,414,553.72	1,444,816.08 (24.90%)
3. Labor Cost	865,996.10	602,922.89	952,400.00	1,555,322.89	2,421,318.99 (41.73%)
Total	2,133,947.10 (36.78%)	1,073,179.12 (18.50%)	2,595,116.31 (44.73%)	3,668,295.43 (63.22%)	5,802,242.53 (100%)

Sources: Specific to cultured graft-Biomaterial Laboratory, BIOTEC, NSTDA.

Notes: Information in column 1 from Appendix A (Capital cost), Appendix B (Labor cost), and Appendix C (Material cost)

Column 2 from Table 4.5

Information in column 3 from Table A.3 in Appendix A (Capital cost), Table B.2 in Appendix B (Labor cost), Table C.2.2 and Table C.5 in Appendix C (Material cost)

Information in column 4 from Table A.4 in Appendix A (Capital cost), Table B.3 in Appendix B (Labor cost), Table C.3 and Table C.6 in Appendix C (Material cost)

Column 5 = Column 3 + Column 4

Column 6 = Column 2 + Column 5

1.) The capital cost

The capital cost for cultured skin graft burn therapy is calculated based on the calculations of the cost of building, and equipment, from the general and specific activities of Autologous skin graft. The cost of general activities incurred at the Burn Unit, and is calculated based on one building and 54 types of equipments, which is similar to the autologous skin graft therapy. The cost of specific activities that incurred in the operating room is calculated based on one building and 7 types of equipments, while the cost of specific activities that incurred in the Biomaterial Laboratory is calculated based on one building and 14 types of equipments. In this study, both the Burn unit and the operating room are in the same building.

Table 4.7 shows that the total capital cost of cultured skin graft therapy is Baht 1,936,107.46. The capital cost is divided into capital cost for general activities at Baht 1,237,688.64, which made up of Baht 1,117,590.03 on building cost and Baht 120,098.61 on equipment cost. The capital cost for specific activities at Baht 698,418.82, which made up of Baht 452,262.91 on building cost and Baht 246,155.91 on equipment cost. Information in the table shows that the highest cost component is the cost of building at Baht 1,569,852.94 or 81.08% of the total cost. Meanwhile, for specific activities, the total capital cost is Baht 698,418.82, comparing to Baht 1,237,688.64 for the total capital cost of general activities.

(1) The cost of building

Calculation for the cost of building for cultured skin graft is similar to those for autologous skin graft, with the exception on cost of building relating to specific activities at the Biomaterial Laboratory. The allocation of the cost of building for burn therapy is done by dividing the working area of the Biomaterial Laboratory with the total working area of the building ($50.62 \text{ m}^2/14,261.15 \text{ m}^2 = 0.35\%$). The Biomaterial Laboratory cultured skin graft used directly for burn therapy; thus this study assumed it utilized 100% of the building and equipment cost for burn therapy, event though at this point surplus capacity is still existed. The depreciation for building cost is Baht 35,686,237.72. The allocation of building cost for burn therapy is Baht 126,668.42. (See Appendix A)

(2) The cost of equipment

The calculation for the cost of equipment for cultured skin graft is similar to those for autologous skin graft. (See Appendix A)

Proportion of equipment cost for cultured skin graft at the Burn Unit is Baht 120,098.61. Proportion of equipment cost for cultured skin graft at the operating room is Baht 49,068.94. The cost of equipment used for skin graft culturing in the Biomaterial Laboratory is Baht 197,086.97.

Table 4.7: The Capital Costs of Cultured Skin Graft by Component

Types of Input	General (Ward)	Specific to Cultured Graft			Total
		O.R.	Laboratory Room	Total	
1. Building	1,117,590.03	325,594.49	126,668.42	452,262.91	1,569,852.94 (81.08%)
2. Equipment	120,098.61	49,068.94	197,086.97	246,155.91	366,254.52 (18.92%)
Total	1,237,688.64 (63.93%)	374,663.43 (19.35%)	323,755.39 (16.72%)	698,418.82 (36.07%)	1,936,107.46 (100%)

See Appendix A for Details of Capital Cost

2.) The recurrent cost

The recurrent cost for cultured skin graft involves the calculation for the cost of labor and material in both general activities and specific activities.

(1) The cost of labor

The calculation for the cost of labor for cultured skin graft is similar to those for autologous skin graft. The exception is that cultured skin graft has an additional specific activity cost incurred at the Biomaterial Laboratory during skin graft culturing. There were 4 personnels at the

Biomaterial Laboratory, and the laboratory cultured skin grafts were used directly for burn therapy; thus it utilized 100% of the labor cost for burn therapy. The cost of labor is calculated in a similar manner to those for Autologous skin graft. (See details in Appendix B)

The total cost of labor for autologous skin graft incurred at the Burn Unit is Baht 1,314,870.74. The total cost of labor for cultured skin graft is 65.86% (30/45.55) of the labor cost for autologous skin graft method or Baht 865,996.10. The total cost of labor for cultured skin graft incurred in the operating room is Baht 602,922.89. The total cost of labor incurred at the Biomaterial Laboratory is Baht 952,400.00 (See details of calculation in Appendix B: Table B.3). The sum of labor cost from both activities for cultured skin graft is Baht 2,421,318.99.

(2) The cost of material

The cost of material for cultured skin graft is categorized into medical cost, non-medical cost, chemical cost and facilities cost, depending on the volume used for both general and specific activities.

The medical cost, non-medical cost and facilities cost used in general activities of cultured skin graft method are calculated from the material cost for general activities of autologous skin graft. And, since the material list used for the general activities of autologous skin graft was averaged from the length of stay for the patient, which in this study assumed to be 45.55 days, the proportion of material used will be based on 45.55 days. But, cultured skin graft is assumed to have a length of stay of 30 days for each patient. Thus the percentage of material used in the general activities for cultured skin graft is $30/45.55 = 65.86\%$ (ratio = 6:9.11) of the material used in the general activities for autologous skin graft method.

There are 2 costs that incurred from the specific activities of cultured skin graft. One incurred at the operating room and another in the Biomaterial Laboratory. In the case of operating room, cost is calculated from charge price, similar to Autologous skin graft. Some differences for this is the decreased quantity in material used (See Table 4.5, medical cost under specific to autograft, and Table 4.9, medical cost under O.R.). The decrease in cost arises from the difference in anesthetic procedure. Facilities cost, such as, electricity and water, is calculated from the proportion of each area in total working area (See Appendix C). In the case of Biomaterial Laboratory, the medical cost, non-medical cost and chemical cost relating to skin graft culturing are calculated by multiplying the cost per volume, with the volume for used (quantity used) in the Biomaterial Laboratory. Facilities cost, such as, electricity and water, is also calculated from the proportion of each unit in total working area stated above.

Table 4.8 shows the material cost for cultured skin graft in 1998. The cost of material for general activities is Baht 30,262.36, divided into Baht 11,989.00 for medical cost, Baht 6,628.12 for non-medical cost and Baht 11,645.24 for facilities cost. The cost of material for specific activities comprises of Baht 95,592.80 for the operating room, Baht 92,200.00 for medical cost, and Baht 3,392.80 for facilities cost. The cost of material incurred at the Biomaterial Laboratory is Baht 284,258.82, divided into Baht 122,604.35 for medical cost, Baht 12,165.85 for non-medical cost, Baht 122,137.49 for chemical cost and Baht 27,351.13 for facilities cost.

In 1998, the Biomaterial Laboratory cultured 384 skin graft sheets utilizing Baht 284,258.82 of material cost. (One cultured skin graft sheet is 58 cm².)

In this study, the average wound for a patient is 22.12% of the total body surface area (%TBSA). Normally, a person has an average total body surface area of 1.73 m² or 17,300 cm². Thus an average wound of 22.12%TBSA is approximately 3,826.76 cm² of wound per patient. One patient requires 66 cultured skin graft sheets (3,826.76 cm² / 58 cm²) for therapy. The total cultured skin graft sheets of 384 can be used only for 5.82 patients. In order to supplyment 27 burnt and scalded patients, which require a total of 1,782 cultured skin graft sheets (27 patients * 66 sheets), the Biomaterial Laboratory must utilized its surplus capacity to culture an additional 1,398 skin graft sheets (1,782 – 384) or another 364% of the total required cultured skin graft sheet.

For this reason, the material cost of skin graft culturing must increase by another 364% or 3.64 times of the cost in 1998. Increased costs include, Baht 446,279.83 for medical cost, Baht 44,283.69 for non-medical cost, Baht 444,580.46 for chemical cost and Baht 99,558.11 for facilities cost as shown in column 5 of Table 4.8.

The total material cost incurred at the Biomaterial Laboratory during skin graft culturing is Baht 1,318,960.92, divided into Baht 568,884.18 for medical cost, Baht 56,449.54 for non-medical cost, Baht 566,717.95 for chemical cost and Baht 126,909.24 for facilities cost.

The total material cost for both activities relating to cultured skin graft is Baht 1,444,816.08, divided into Baht 673,073.18 for medical cost, Baht 63,077.66 for non-medical cost, Baht 566,717.95 for chemical cost and Baht 141,947.28 for facilities cost.

Table 4.8: The Recurrent Costs of Cultured Skin Graft by Components

Items	General (Ward)	Specific to Cultured Graft				Total	Total
		O.R.	Laboratory Room				
			1998	Add 3.64 times	Total		
1	2	3	4	5	6	7	8
Labor Cost	865,996.10	602,922.89	952,400.00	-	952,400.00	1,555,322.89	2,421,318.99 (62.63%)
Material Cost	30,262.36	95,592.80	284,258.82	1,034,702.10	1,318,960.92	1,414,553.72	1,444,816.08 (37.37%)
1. Chemical	-	-	122,137.49	444,580.46	566,717.95	566,717.95	566,717.95 (14.66%)
2. Medical	11,989.00	92,200.00	122,604.35	446,279.83	568,884.18	661,084.18	673,073.18 (17.41%)
3. Non-Medical	6,628.12	-	12,165.85	44,283.69	56,449.54	56,449.54	63,077.66 (1.63%)
4. Facilities	11,645.24	3,392.80	27,351.13	99,558.11	126,909.24	130,302.04	141,947.28 (3.67%)
Total Cost	896,258.46 (23.18%)	698,515.69 (18.07%)	1,236,658. 82 (31.99%)	1,034,702.10 (26.76%)	2,271,360.92 (58.75%)	2,969,876.60 (76.62%)	3,866,135.06 (100%)

Note: See Appendix B for Details of Labor Cost, Appendix C for Details of Material Cost
 Column 6 = Column 4 + Column 5
 Column 7 = Column 3 + Column 6
 Column 8 = Column 2 + Column 7

Table 4.9 shows the component provider cost of Cultured skin graft categorized in term of treatment process or “by activities” into general and specific activities and categorized in term of manufacturing factor or “by input” into capital cost, labor cost, and material cost. The information in the table shows that the total provider cost for cultured skin graft is Baht 5,802,242.52. Divided in term of treatment process or “by activities” into Baht 2,133,947.10 or 36.78% for general activities and Baht 3,668,295.42 or 63.22% for specific activities. Divided in term of manufacturing factor or “by input” into Baht 2,421,318.99 or 41.73% for labor cost, Baht 1,936,107.46 or 33.37% for capital cost, and Baht 1,444,816.07 or 24.90% for material cost.

The total cost of skin graft culturing at the Biomaterial Laboratory is Baht 2,595,116.30. The total skin grafts cultured are 1,782 sheets. The average cost per sheet of 58 cm² is Baht 1,456.29 or Baht 96,115.42 for 22.12% TBSA. This is much lower than the cost of imported skin substitute of at least around Baht 800,000 (Table 2).

In this study, there are 27 patients treated with cultured skin graft. The total provider cost for cultured skin graft is Baht 5,802,242.52. The average cost per patient for cultured skin graft is Baht 214,897.87.

Table 4.9: The Component Provider Costs of Cultured Skin Graft During 1998

Types of Input	General	Specific to Cultured Graft			Total
	Ward	O.R.	Laboratory Room	Total	
1	2	3	4	5	6
1. Capital Cost					
1.1 Building	1,117,590.03	325,594.49	126,668.42	452,262.91	1,569,852.94 (27.06%)
1.2 Equipment	120,098.61	49,068.94	197,086.97	246,155.91	366,254.52 (6.31%)
Total Capital Cost	1,237,688.64	374,663.43	323,755.39	698,418.82	1,936,107.46 (33.37%)
2. Labor Cost					
Total Labor Cost	865,996.10	602,922.89	952,400.00	1,555,322.89	2,421,318.99 (41.73%)
3. Material Cost					
3.1 Chemical	-	-	566,717.95	566,717.95	566,717.95 (9.77%)
3.2 Medical	11,989.00	92,200.00	568,884.18	661,084.18	673,073.18 (11.60%)
3.3 Non-Medical	6,628.12	-	56,449.54	56,449.54	63,077.66 (1.09%)
3.4 Facilities	11,645.24	3,392.80	126,909.24	130,302.04	141,947.28 (2.45%)
Total Material Cost	30,262.36	95,592.80	1,318,960.91	1,414,553.71	1,444,816.07 (24.90%)
Total Provider Cost	2,133,947.10 (36.78%)	1,073,179.12 (18.50%)	2,595,116.30 (44.73%)	3,668,295.42 (63.22%)	5,802,242.52 (100%)

Sources: Table 4.7 and Table 4.8

Column 5 = Column 3 + Column 4

Column 6 = Column 2 + Column 5

Table 4.10: Total Cost of Provider Between Autologous Skin Graft and Cultured Skin Graft for Wound Therapy in Burn Patient By Component

Cost Items	Autograft			Cultured Graft			
	General	Specific to Autograft	Total	General	Specific to Cultured Graft		Total
					O.R.	Laboratory Room	
1	2	3	4	5	6	7	8
Capital Cost							
- Building	1,696,874.19	325,594.49	2,022,468.68	1,117,590.03	325,594.49	126,668.42	1,569,852.94
- Equipment	182,349.73	97,134.59	279,484.32	120,098.61	49,068.94	197,086.97	366,254.52
Total Capital Cost	1,879,223.92	422,729.08	2,301,953.00	1,237,688.64	374,663.43	323,755.39	1,936,107.46
Labor Cost							
Total Labor Cost	1,314,870.74	602,922.89	1,917,793.63	865,996.10	602,922.89	952,400.00	2,421,318.99
Material Cost							
- Chemical	-	-	-	-	-	566,717.95	566,717.95
- Medical	18,203.30	222,200.00	240,403.30	11,989.00	92,200.00	568,884.18	673,073.18
- Non-Medical	10,063.70	-	10,063.70	6,628.12	-	56,449.54	63,077.66
- Facilities	17,681.35	3,392.80	21,074.15	11,645.24	3,392.80	126,909.24	141,947.28
Total Material Cost	45,948.35	225,592.80	271,541.15	30,262.36	95,592.80	1,318,960.91	1,444,816.07
Total Provider Cost	3,240,043.01	1,251,244.77	4,491,287.78	2,133,947.10	1,073,179.12	2,595,116.30	5,802,242.52

Sources: Table 4.5 and Table 4.9

Note: Column 4,8 used for 27 burn patients

Column 4 = Column 2 + Column 3

Column 8 = Column 5 + Column 6 + Column 7

4.3 Effectiveness Analysis for Burn Therapy

4.3.1 Effectiveness Analysis for Autologous Skin Graft

In this study, the effectiveness-measuring index for autologous skin graft is the length of stay of the patient. The analysis of the autologous skin graft information shows that the length of stay for patients treated with the autologous skin graft is 18 – 131 days. Meanwhile, the average length of stay for burn therapy patients is 45.55 days.

4.3.2 Effectiveness Analysis for Cultured Skin Graft

Due to the fact that the duration of information gathering phase in this study is not sufficient for a clinical trial on individual patient, this study uses a length of stay of 30 days which base on the percentage of 34.14 reduction from 45.55 days for autologous skin graft⁴. If sufficient duration for research exists, in order to carry out the clinical trial on individual patient and follow up on patient without any constraint, the finding of cost effectiveness on study group would yield a much more accurate result.

4.4 Incremental Cost-Effectiveness Analysis for Autologous Skin Graft and Cultured Skin Graft

Table 4.11 shows that the average total cost of autologous skin graft per patients is Baht 166,343.99, divided into Baht 85,257.52 for capital cost, Baht 71,029.39 for labor cost, and Baht 10,057.08 for material cost. The average length of stay for patients treated with autologous skin graft is 45.55 days.

The average total cost of cultured skin graft per patients is Baht 214,897.87, divided into Baht 71,707.68 for capital cost, Baht 89,678.48 for labor cost, and Baht 53,511.71 for material cost. The average length of stay for patients treated with cultured skin graft is 30 days.

⁴ See detail on page 45, section 4.2.2

Table 4.11: Average Total Cost of Provider Between Autologous Skin Graft and Cultured skin graft for Wound Therapy in Burnt Patients

Cost Items	Autologous skin graft		Cultured Graft	
	Total Cost	Average Cost	Total Cost	Average Cost
1	2	3	4	5
- Capital	2,301,953.00	85,257.52	1,936,107.46	71,707.68
- Material Cost	271,541.15	10,057.08	1,444,816.07	53,511.71
- Labor Cost	1,917,793.63	71,029.39	2,421,318.99	89,678.48
Total	4,491,287.78	166,343.99	5,802,242.52	214,897.87

Sources: Table 4.10 that is used for 27 burnt patients.

Note: Column 3 = Column 2 / 27

Column 5 = Column 4 / 27

From Table 4.12, the difference in the total cost between the two methods of therapy is Baht - 48,553.88, and the difference of the length of stay between the two methods of therapy is 15.55 days. Thus, the incremental cost is Baht - 3,122.44 for a length of stay of 1 day. Which means, if one desired to switch from autologous skin graft therapy to cultured skin graft therapy, an additional Baht 3,122.44 is needed to decrease the length of stay in the hospital by 1 day. However, the ability and willingness to pay of patients depend on many factors such as age, income, and other socio-economic background. The benefit of this cultured skin graft technique may not be equally share among burn patients.

Table 4.12: Incremental Cost-Effectiveness Analysis (Incremental CEA)

Types of Treatment	Average Cost (Bht.)	Length of Stay (Day)	Incremental CEA
Autologous Skin Graft	166,343.99	45.55	-
Cultured Skin Graft	214,897.87	30	-
Difference	- 48,553.88	15.55	- 3,122.44

Sources: Table 4.11