CHAPTER 6

Results and Discussion

6.1 Data analysis and interpretation of morbidity model

6.1.1 Regression analysis

According to empirical malaria morbidity model, the Least Square estimation method is used. The source of data comes from different channels. 1992 cross sectional data consists of information from 73 provinces of Thailand from the National Statistical Office. Malaria epidemiological data and malaria control measure data obtained from the Malaria Report 1992, socio-economic data are calculated from a household database derived from a socio-economic household survey conducted in 1992. Other data are obtained from the books of 'Thailand in Figures, 1995-1996' and 'Statistics Year Book 1992'. As we consider some of provinces had very low malaria morbidity rates or were even malaria free. If we put all these provinces data into the regression, it would dilute the actual effects of independent variables. So in running the regression we exclude the provinces of which the API are less than 0.5 in 1992.

Multiple regression allows us to study how several independent variables act together to determine the value of dependent variable. The coefficients of these independent variables quantified the nature of these independent variables. The standard errors associated with each of the regression coefficients are used to quantify the precision with which we estimate how the different independent variable affect the dependent variable.

The conclusion we draw from regression analyses will be acceptable when the independent variables are statistically independent of each other, i.e., when the value of one of the independent variables does not depends on the values of any of the other independent variables. Unfortunately, as we see in the Table 6.1.4 (correlation matrix table, Appendix A), the independent variables may contain some redundant information and tend to vary together, this situation called multicollinearity. Severe multicollinearity indicates that a substantial part of information in one or more of the independent variables is redundant. This makes it difficult to separate the effects of the different independent variables on the dependent variables.

The regression results of morbidity model is presented in Table 6.1.2(Appendix A). Through testing the multicollinearity, the model is modified by deleting two independent variables (API91, ABER92), which are high correlated with other independent

variables. The result of fitting these data to the morbidity model is presented in Table 6.1.1

Table 6.1.1 Results of Regression Analysis
(Malaria Morbidity Model)

Dependent variable: ΔLogAPI92

Variables	Coefficient	Standard error
Constant	2.176	1.666
ABER91	-0.044***	0.011
NEXP	-3.212E-06	1.496E-04
DOCT	7.185E-04	1.598E-04
NURS	-1.069E-04*	1.725E-04
HBED	-1.245E-04	5.357E-04
AVIN	9.549E-05	4.080E-05
GPP	-3.744E-06	3.941E-06
EDUC	-0.942***	0.664
FARM	0.034	0.042
PDEN	-1.048E-04	0.001
FSIZ	-0.373*	1.389
FRST	0.100**	0.264
TEMP	0.011	0.024
RAIN	-3.790E-04	4.195E-04
TELE	0.004	0.002
CAR	0.021**	0.004
R Square	0.69	Observations: 45
Adjusted R Square	0.61	

*** denotes significant at 1% level
** denotes significant at 5% level
* denotes significant at 10% level

The regression result in Table 6.1.1 demonstrates that 69% of the variation of dependent variable can be explained by these independent variables. The relatively small R square indicates some of explanatory variables are not accounted for in this model, and/or some of selected independent variables may not be good proxies of mentioned aspects for determining the disease.

Since we use ΔLogAPI92 as the dependent variable here, so the coefficient of each independent variables(X) will be explained as: the impact of one unit change in X on the change in the percentage change(rate of growth) in API between the two years.

6.1.2 Morbidity rate

Both lagged and current annual blood examination rates are significant in the explanation of the change in percentage change of morbidity rate between the two years (Table 6.1.1, Table 6.1.3 in Appendix A). As we expected, a negative sign for lagged annual blood examination rate is obtained. It indicates that an increase in the level of malaria surveillance measure in one year will cause significant reduction in morbidity rate in the following year. As the result shows, the coefficient of current annual blood examination rate is also negative, but the significant level is less than lagged blood examination rate. Since malaria is not directly transmitted from person to person, there is a time lag between the malaria control measures and effect observed, some of the effects could be observed as the reduction of incidence rate in the next year.

As expected, the coefficient of gross provincial product is negative for morbidity rate. This is consistent with general understanding that poor areas always suffer more from the disease. However, our statistical result does not show this at a significant level. Another economic variable (average household income) gives the opposite result than we anticipated. It seems that the simple conclusion cannot be made from this analysis that poor areas have higher malaria morbidity rate.

6.1.3 Health care resources

National health expenditure, the numbers of population to a doctor, a nurse and a hospital bed are regarded as proxies of general health resources investment. From the regression result, the population to a nurse is a significant explanatory variable for dependent variable, but the sign of the coefficient is just opposite to what we expected. Another three variables are not significant, only the coefficients of national health expenditure and population to a doctor gives the sign as anticipated. It may imply that general health care services do not have a significant effect on the specific disease(malaria) morbidity rate, or it may be a long term effect on disease. Just using cross sectional data cannot find out the correlation, longitudinal data comparisons are needed.

6.1.4 Education

Education level is a significant explanatory variable for dependent variable. It shows that if the education level can increase by one more year on average, the malaria morbidity rate can be reduced by 0.94 percent. Our understanding is that the malaria disease is highly dependent on the people's behavior, and education status of people can affect their knowledge, attitude and practice. So strengthening education, especially health education, will reduce the risk behaviors of individuals as well

as the community; in turn, the malaria morbidity rate will be reduced.

6.1.5 Population effect

The correlation between population density and morbidity rate is not significant. The sign of the coefficient is just opposite to that anticipated. The null hypothesis cannot be rejected. It doesn't show malaria is more concentrated in populated areas. This indicator may be a better proxy of urban and rural population.

The family size is a significant determinant of malaria morbidity rate at 10% level, the coefficient is positive which indicates the bigger the family size, the more malaria cases may occur in the population. The family size reflects the living conditions of the population, it implies that crowding and poor sanitation contribute to malaria transmission.

Generally, the proportion of the population in the agricultural sector should increase the risk for contracting malaria. However, in this study the proportion of population in the agricultural sector is not a significant variable either. There is no statistical evidence from the data that agricultural activities have more risk for contracting malaria or that rural populations suffer more malaria disease than urban, which is somewhat surprising.

6.1.6 Forestation

As already anticipated, forest density is highly correlated with malaria morbidity rate. This finding is consistent with other studies in Thailand. The positive coefficient indicates that the higher the forest density, the more malaria cases may occur. Rainfall and temperature are not significantly correlated with malaria rate from the result, which is consistent with what we discussed above.

6.1.7 Infrastructure

Population to a telephone and to a passenger car represent the status of transportation and communication infrastructure. They are regarded as proxies of the ability of people to access health care services. Both coefficients from the results are positive, which means that the better infrastructure of transportation and communication enables people to have access to health care services and, thus, lower the morbidity rate. Population to a passenger car is a statistically significant explanation of the dependent variable. Population per telephone is not significant. Therefore, telephone may not be a good proxy of communication indicators for representing the accessibility of population to health services.

6.1.8 Summary

In summary, malaria incidence seems to be more associated with specific malaria epidemiological as well as social factors. These results obtained with cross sectional data at macro level are similar to those reported by Harold Banguero[7] in the microanalysis of the problem, where malaria control measures and education level showed the most significant association with morbidity rate.

This result does show that an increase in malaria control measures will significantly reduce the malaria morbidity rate both in current year and following years. Malaria surveillance measure(blood examination and radical treatment) should be a basic element of any malaria control program. Early and correct treatment of malarial disease will shorten its duration and prevent the development of complications and the great majority of death from malaria. So access to early diagnosis and treatment should be seen not only as a component in any malaria control program, but as a fundamental right of all populations affected by malaria.

Statistical results show the education level is highly and negatively correlated with malaria morbidity rate. Increase in education level of the whole population should be a long-term condition of eradication of malaria. Health education in malaria-endemic areas is very important, it will enable people to understand about how to prevent malaria, where and when to seek care and when to come back for further treatment. It should be integrated with health education for related disease control programs, in planning as well as implementation and evaluation.

The result of this analysis also shows very strong correlations between the density of forest cover and malaria incidence rate. As shown in the map presented in Fig 2 (Chapter 7), most of high density forest areas are located in the border provinces, where also have very high malaria incidence. National anti-malaria campaigns should be more emphasized in these areas, especially the activities of vector control and health education, in order to reduce the vector density and to modify risk behaviors of contacting malaria. Studies at local level should be conducted to identify high risk groups, so as to implement target interventions which is more effectively in malaria prevention and control.

Infrastructure and demographic factors(transportation and family size) have shown some impacts on malaria. These factors are out of control of health authorities, intersectoral collaboration is needed to ensure malaria control more effective. These information is also useful to strengthen the local capacity for negotiation with other sectors.

6.2 Results of allocative efficiency of health resources

Based on the theoretical framework in section 5.3, a computer program(Appendix C) has been developed to calculate the efficient level of health resources distribution among provinces. The national health budget is used to measure how redistribute the budget will cause an decrease in incidence rate of the country. The principle is to put the limited resources into the most needed areas. Though comparing the marginal effects of each provinces, the additional resource will give to the province which has greatest marginal effect.

The results of optimal allocation of resources are presented in Table 6.2.1. From this table, we find that the resource distribution is emphasized on the endemic provinces, and the amounts of the health budget distributed in these endemic provinces are much higher than their shared on a population basis. For example, in Trat province, the malaria incidence rate was 169.86 per 1,000 population at the original level of resource distribution. If its health budget can be increased to 4,099 million Baht in 1992, the malaria incidence rate would be reduced to 8.08 per 1,000 population, by estimation from the model. The provinces with lower incidence rates could have a small increase in incidence because of lower investment, e.g. Chon Buri, from 1.32 to 1.62; Chumphon, from 7.71 to 8.09. But the increase in the number of cases due to lower investment is not as great as the number of cases reduced in those high endemic provinces. So the national total number of cases or incidence rate will decrease. As shown, the actual national incidence rate is 3.03 per 1000 population, and the estimated value is 2.74 with the original budget allocation. If the budget can be distributed at optimal level as shown in the table, the estimated incidence will be 1.53. This is much lower than both actual and estimated incidence rates at pre-allocation of health resources.

Since the national health expenditure is not a significant variable in malaria incidence from the results in Table 6.1.1, so the marginal effect is very small. This makes the resource distribution at optimal level very concentrated in some endemic provinces. In practice, the general health budget cannot be distributed in such a way. However, it can provide a direction where the resources should be distributed to get the most effect. This method is also useful, for example, if there are extra budgetary funds available, to find out how to distribute of this extra budget among provinces to generate the greatest effects in terms of preventing more malaria cases.

This allocative model can be improved by adding more health resource indicators (instead of only NEXP), such as physicians, nurses, etc. As the health care resources include not only money, but also personnel and materials, redistribution of all these resources will influence the disease incidence. If

Table 6.2.1 Estimated Annual Parasite Incidence Rate at Efficient Level

Code	Province	Population	Allocated Budget	Budget per capita	Budget at Optimal Level	Actual Cases 1991	Actual Cases 1992	Act. API 1992	Esti. cases 1992	Esti. API 1992	Esti. cases (optimal level)	Esti. API,1992 (optimal level)
1	Bangkok Metropolis	5562141	2526345693	454.20	0	56	56	0.01	52	0.01	56	0.01
2	Nakhon Pathom	671386	282299247	420.47	0	175	161	0.24	140	0.21	149	0.22
3	Nonthaburi	698704	169889869	243.15	0	42	35	0.05	41	0.06	43	0.06
4	Pathum Thani	484586	86384136	178.26	0	29	39	0.08	28	0.06	29	0.06
5	Samut Prakan	871806	145500242	166.90	0	192	0	0.00	184	0.21	189	0.22
6	Samut Sakhon	372605	89834574	241.10	0	272	201	0.54	242	0.65	251	0.67
7	Chai Nat	339329	159802496	470.94	0	54	17	0.05	40	0.12	42	0.12
8	Ayutthaya	693230	248958340	359.13	0	76	49	0.07	58	0.08	61	0.09
9	Lop Buri	738370	658211826	891.44	0	465	258	0.00	324	0.44	369	0.50
10	Saraburi	546044	355011167	650.15	0	704	453	0.82	551	1.01	606	1.11
11	Sing Buri	221407	159082119	718.51	0	15	20	0.09	12	0.05	13	0.06
12	Ang Thong	284138	177970808	612.10	0	23	17	0.06	16	0.06	18	0.06
13	Chanthaburi	455158	302770635	665.14	4216000000	15753	11825	25.98	13149	28.89	3680	8.09
14	Chachoengsao	593170	201918367	340.38	0	2171	1133	1.88	1687	2.84	1775	2.99
15	Chon Buri	927458	346568693	373.68	0	1669	1224	1.32	1427	1.54	1507	1.62
16	Trat	201639	129596112	642.71	4099000000	40993	34250	169.86	30089	149.22	1630	8.08
17	Nakhon Nayok	230333	113924603	494.61	0	286	286	1.24	233	1.01	251	1.09
18	Prachin Buri	893360	303358262	339.57	0	6405	5146	5.76	4481	5.02	4712	5.27
19	Rayong	437552	197710108	451.86	0	3374	1938	4.43	2659	6.08	2844	6.50
20	Kanchanaburi	724435	117750597	162.54	2439000000	13612	13685	18.89	9415	13.00	5858	8.09
21	Prachuap Khiri Kha	451155	169489116	375.68	681000000	5716	5301	11.75	4316	9.57	3648	8.09
22	Phetchaburi	438615	231243595	527.21	0	1566	2452	5.59	1149	2.62	1242	2.83
23	Ratchaburi	777105	401390403	516.52	0	3435	4818	6.20	2779	3.58	3000	3.86
24	Samut Songkhram	206712	111121823	537.52	0	105	105	0.51	76	0.37	82	0.40
25	Suphan Buri	825451	312717118	378.84	0	644	660	0.79	468	0.57	495	0.60

(Table 6.2.1 continued)

Code	Province	Population	Allocated Budget	Budget per capita	Budget at Optimal Level	Actual Cases 1991	Actual Cases 1992	Act. API 1992	Esti. cases 1992	Esti. API 1992	Esti. cases (optimal level)	Esti. API,1992 (optimal level)
26	Kalasin	925254	273109497	295.17	0	592	342	0.37	367	0.40	384	0.42
27	Khon Kaen	1662512	327053629	193.00	0	599	416	0.25	597	0.36	615	0.37
28	Chaiyaphum	1086331	182135351	167.66	0	619	293	0.00	379	0.35	388	0.36
29	Nakhon Phanom	649933	218807777	336.63	0	702	429	0.66	426	0.66	448	0.69
30	Nakhon Ratchasima	2467366	583617481	233.03	0	2097	1209	0.49	1588	0.64	1645	0.67
31	Buri Ram	1417329	307101156	216.68	0	1389	893	0.63	784	0.55	809	0.57
32	Maha Sarakham	869118	302033835	347.52	0	174	122	0.14	142	0.16	150	0.17
33	Mukdahan	299280	566107891	1891.57	0	581	473	1.58	283	0.95	374	1.25
34	Yasothon	528277	152544671	288.76	0	190	116	0.22	121	0.23	126	0.24
35	Roi Et	1238930	331860098	267.86	0	372	211	0.17	216	0.17	225	0.18
36	Loci	595444	143941858	241.74	0	655	387	0.65	420	0.71	435	0.73
37	Si Sa Ket	1335487	311630570	233.35	0	4420	3819	2.86	2372	1.78	2455	1.84
38	Sakon Nakhon	1014343	317197948	312.71	0	933	690	0.68	612	0.60	641	0.63
39	Surin	1341385	161844083	120.64	0	3300	2039	1.52	2401	1.79	2444	1.82
40	Nong Khai	836693	191878002	229.32	0	510	284	0.34	292	0.35	302	0.36
41	Udon Thani	1846154	351596103	190.45	0	462	369	0.20	338	0.18	348	0.19
42	Ubon Ratchathathan	1945179	696152895	357.89	0	3813	3190	1.64	2523	1.30	2661	1.37
43	Kamphaeng Phet	731355	154918324	211.82	0	2611	1697	2.27	1890	2.58	1951	2.67
44	Chiang Rai	1229415	310756612	249.02	0	1475	1869	1.52	1059	0.86	1099	0.89
45	Chiang Mai	1530779	266149701	173.87	0	3750	3659	2.39	3546	2.32	3638	2.38
46	Tak	425668	196434315	461.47	6025000000	34986	30078	70.66	26148	61.43	3442	8.09
47	Nakhon Sawan	1093973	334800712	306.04	0	689	372	0.34	592	0.54	620	0.57
48	Nan	457626	284820668	622.39	0	668	618	1.32	469	1.02	514	1.12
49	Phayao	512473	123846103	241.66	0	333	184	0.36	231	0.45	239	0.47
50	Phichit	587414	796679743	1356.25	0	53	23	0.04	28	0.05	35	0.06

(Table 6.2.1 continued)

Code	Province	Population	Allocated Budget	Budget per capita	Budget at Optimal Level	Actual Cases 1991	Actual Cases 1992	Act. API 1992	Esti. cases 1992	Esti. API 1992	Esti. cases (optimal level)	Esti. API,1992 (optimal level)
51	Phitsanulok	842016	377797294	448.68	0	808	446	0.53	664	0.79	710	0.84
52	Phetchabun	996256	206121671	206.90	0	468	379	0.00	256	0.26	264	0.26
53	Phrae	493532	125698014	254.69	0	676	627	1.27	503	1.02	522	1.06
54	Mae Hong Son	206863	103231026	499.03	1985000000	8961	9911	47.91	6432	31.09	1672	8.08
55	Lampang	776251	259388537	334.13	0	745	598	0.77	591	0.76	621	0.80
56	Lamphun	397712	152597306	383.69	0	298	306	0.77	209	0.53	221	0.56
57	Sukhothai	606823	204286836	336.65	0	601	364	0.60	429	0.71	451	0.74
58	Uttaradit	475564	200362294	421.32	0	523	238	0.50	349	0.73	372	0.78
59	Uthai Thani	318595	685107089	2150.40	0	752	628	1.97	457	1.43	629	1.97
60	Krabi	311310	352455661	8.35	943000000	5053	1887	6.06	3334	10.71	2517	8.09
61	Chumphon	416048	170593145	410.03	38000000	4435	3224	7.75	3209	7.71	3364	8.09
62	Trang	540079	130937702	242.44	0	1215	340	0.63	899	1.66	932	1.73
63	Nakhon Si Thammara	1477417	803198885	543.65	0	6028	1625	1.07	3657	2.48	3964	2.68
64	Narathiwat	576593	541223928	938.66	0	3200	1736	3.01	1839	3.19	2114	3.67
65	Pattani	541166	570339740	8.23	0	2170	1310	2.42	1206	2.23	1410	2.61
66	Phang-nga	217870	153986448	706.78	0	1155	919	4.22	883	4.05	981	4.50
67	Phatthalung	474564	157199801	331.25	0	470	185	0.00	304	0.64	319	0.67
68	Phuket	188535	102603065	544.21	0	132	87	0.46	111	0.59	120	0.64
69	Yala	375482	524596105	8.42	1159000000	5384	2110	5.62	3900	10.39	3037	8.09
70	Ranong	130787	82107678	627.80	1144000000	4572	3904	29.85	3521	26.92	1058	8.09
71	Songkhla	1130073	436056362	385.87	0	3051	1062	0.94	2793	2.47	2957	2.62
72	Satun	230563	130536487	566.16	0	906	228	0.99	622	2.70	677	2.94
73	Surat Thani	791259	373143612	471.58	0	1116	4835	6.11	902	1.14	968	1.22
	National Total	57788965	22729437658	393.32	22729000000	216524	174860	3.03	158510	2.74	88418	1.53

we also consider these variables in that allocative model, the outcomes could be further improved by the redistribution of all these health resources.

6.3 Results of analysis of equity in health resources allocation

Based on the theoretical framework discussed in Chapter 5, the equity measure of health care resources is employed. Several results are generated using the data from Thailand. These health resources data include the national health care budget data collected from National Health Report 1992, the health resources of physician, nurse and hospital beds (including both public and private sector) obtained from the report of 'Thailand in Figure, 1994-1995'. The analyses conducted are based on the 1992 data.

6.3.1 Budget distribution by province

General health care budget includes the budget for health personnel, supplementary material, public utilities, subsidies and special health programs. This indicator reflects the level of preventive and maintenance activities in the health districts. The difference in budget share per capita among provinces can be viewed as a part of inequality of health resources distribution. The measure of GINI Coefficient is used as an index of equity.

It appears from Table 6.3.1 that the national health care budget is distributed relatively equitably in terms of the population in Thailand. Bangkok province, for example, has about one-tenth of country's population, a slightly larger share of the health care budget. Most provinces have a close correlation between population and budget share. Some provinces have relatively large gaps in the proportion of population and health budget shared, such as Nakhon Ratchasima, Surin and Udon Thani provinces. The Gini Coefficient of inequality-coefficient is 0.14, which is relative small. It indicates that the level of inequality of budget distribution among provinces is small.

Although the results show that the health resources, in terms of health budget, are distributed relatively equitably, it still has some room for improvement. The optimal level of the health budget for each province is calculated based on the national average budget to a population and presented in Table 6.3.1. Through comparing the optimal situation with the actual allocation of health budget, the gaps between actual and optimal distribution are identified. These gaps can be used to pinpoint which provinces are over-supplied or under-supplied. It could lead to the making of decisions to redistribute or add more resources to less supplied provinces. In such a way, the health care budget can be distributed more equitably. In the optimal

conditions of budget distribution, the Gini Coefficient will reach the figure of zero.

6.3.2 Comparison of resource allocation among regions

Table 6.3.4 presents the Gini Coefficient measures of resources allocation among provinces within different regions. We found that the inequality levels of these four mentioned resources in regions give the similar pattern as we measured for the whole country. For the national health budget distribution, the North region seems to be the most inequitable among these four regions, the Gini coefficient is much greater than in the other three regions and the national inequitable level. In terms of provision of health care service, the most inequitable distribution of physicians, nurse, hospital beds is the central region, it indicates that the resources are more concentrated in the central region than others. Comparing all of the four health resources distribution in the regions, the South region is the best in terms of equal distribution of resources, the nurses are very equally distributed among provinces in this region.

Table 6.3.4 Measures related to equity in health care, by region, Thailand, 1992
Health care resources: National Health Budget, Physicians, Nurses, Hospital Beds

Region	Province Code	Gini Coefficient			
		Health Budget	Physician	Nurse	Hospital Bed
Central	1 - 25	0.09	0.46	0.23	0.24
Northeast	26 - 42	0.10	0.26	0.08	0.09
North	43 - 59	0.24	0.31	0.18	0.15
South	60 - 73	0.09	0.25	0.04	0.08
National	1 - 73	0.14	0.48	0.21	0.20

6.3.3 Distribution of personnel and hospital beds

In comparing different provinces, the analysis refers to the share of population to such health care resources as physicians, nurses and hospital beds. As illustrated in Table 6.3.2, this comparison shows that physicians are very highly concentrated, especially in Bangkok, which has just about one-tenth of the country's population, but almost half of all the physicians in Thailand. Nurses are much more equally distributed, although still concentrate in the same provinces as

Table 6.3.1 Measures related to equity in health care, Thailand, 1992
Health care resources: General Health Care Budget

Code	Province	% of Population	% of Health care Budget	Health Budget Allocated (million Baht)	Equity Level of Budget (million Baht)	Health Budget Gap (million Baht)
1	Bangkok Metropolis	9.62	11.11	2,526.35	2,187.69	338.66
2	Nakhon Pathom	1.16	1.24	282.30	264.07	18.23
3	Nonthaburi	1.21	0.75	169.89	274.81	-104.92
4	Pathum Thani	0.84	0.38	86.38	190.60	-104.21
5	Samut Prakan	1.51	0.64	145.50	342.90	-197.40
6	Samut Sakhon	0.64	0.40	89.83	146.55	-56.72
7	Chai Nat	0.59	0.70	159.80	133.46	26.34
8	Ayutthaya	1.20	1.10	248.96	272.66	-23.70
9	Lop Buri	1.28	2.90	658.21	290.41	367.80
10	Saraburi	0.94	1.56	355.01	214.77	140.24
11	Sing Buri	0.38	0.70	159.08	87.08	72.00
12	Ang Thong	0.49	0.78	177.97	111.76	66.21
13	Chanthaburi	0.79	1.33	302.77	179.02	123.75
14	Chachoengsao	1.03	0.89	201.92	233.30	-31.39
15	Chon Buri	1.60	1.52	346.57	364.79	-18.22
16	Trat	0.35	0.57	129.60	79.31	50.29
17	Nakhon Nayok	0.40	0.50	113.92	90.59	23.33
18	Prachin Buri	1.55	1.33	303.36	351.37	-48.02
19	Rayong	0.76	0.87	197.71	172.10	25.61
20	Kanchanaburi	1.25	0.52	117.75	284.93	-167.18
21	Prachuap Khiri Khan	0.78	0.75	169.49	177.45	-7.96
22	Phetchaburi	0.76	1.02	231.24	172.52	58.73
23	Ratchaburi	1.34	1.77	401.39	305.65	95.74
24	Samut Songkhram	0.36	0.49	111.12	81.30	29.82
25	Suphan Buri	1.43	1.38	312.72	324.66	-11.95
26	Kalasin	1.60	1.20	273.11	363.92	-90.81
27	Khon Kaen	2.88	1.44	327.05	653.90	-326.84
28	Chaiyaphum	1.88	0.80	182.14	427.27	-245.14
29	Nakhon Phanom	1.12	0.96	218.81	255.63	-36.82
30	Nakhon Ratchasima	4.27	2.57	583.62	970.46	-386.84
31	Buri Ram	2.45	1.35	307.10	557.46	-250.36
32	Maha Sarakham	1.50	1.33	302.03	341.84	-39.81
33	Mukdahan	0.52	2.49	566.11	117.71	448.40
34	Yasothon	0.91	0.67	152.54	207.78	-55.24
35	Roi Et	2.14	1.46	331.86	487.29	-155.43
36	Loci	1.03	0.63	143.94	234.20	-90.26

(Table 6.3.1 Continued)

Code	Province	% of Population	% of Health care Budget	Health Budget Allocated (million Baht)	Equity Level of Budget (million Baht)	Health Budget Gap (million Baht)
37	Si Sa Ket	2.31	1.37	311.63	525.27	-213.64
38	Sakon Nakhon	1.76	1.40	317.20	398.96	-81.76
39	Surin	2.32	0.71	161.84	527.59	-365.75
40	Nong Khai	1.45	0.84	191.88	329.09	-137.21
41	Udon Thani	3.19	1.55	351.60	726.13	-374.53
42	Ubon Ratchathathani	3.37	3.06	696.15	765.07	-68.92
43	Kamphaeng Phet	1.27	0.68	154.92	287.66	-132.74
44	Chiang Rai	2.13	1.37	310.76	483.55	-172.79
45	Chiang Mai	2.65	1.17	266.15	602.08	-335.93
46	Tak	0.74	0.86	196.43	167.42	29.01
47	Nakhon Sawan	1.89	1.47	334.80	430.28	-95.48
48	Nan	0.79	1.25	284.82	179.99	104.83
49	Phayao	0.89	0.54	123.85	201.56	-77.72
50	Phichit	1.02	3.51	796.68	231.04	565.64
51	Phitsanulok	1.46	1.66	377.80	331.18	46.62
52	Phetchabun	1.72	0.91	206.12	391.85	-185.72
53	Phrae	0.85	0.55	125.70	194.11	-68.42
54	Mae Hong Son	0.36	0.45	103.23	81.36	21.87
55	Lampang	1.34	1.14	259.39	305.31	-45.92
56	Lamphun	0.69	0.67	152.60	156.43	-3.83
57	Sukhothai	1.05	0.90	204.29	238.67	-34.39
58	Uttaradit	0.82	0.88	200.36	187.05	13.31
59	Uthai Thani	0.55	3.01	685.11	125.31	559.80
60	Krabi	0.54	1.55	352.46	122.44	230.01
61	Chumphon	0.72	0.75	170.59	163.64	6.95
62	Trang	0.93	0.58	130.94	212.42	-81.49
63	Nakhon Si Thammarat	2.56	3.53	803.20	581.09	222.10
64	Narathiwat	1.00	2.38	541.22	226.78	314.44
65	Pattani	0.94	2.51	570.34	212.85	357.49
66	Phang-nga	0.38	0.68	153.99	85.69	68.29
67	Phatthalung	0.82	0.69	157.20	186.65	-29.45
68	Phuket	0.33	0.45	102.60	74.15	28.45
69	Yala	0.65	2.31	524.60	147.68	376.91
70	Ranong	0.23	0.36	82.11	51.44	30.67
71	Songkhla	1.96	1.92	436.06	444.48	-8.42
72	Satun	0.40	0.57	130.54	90.68	39.85
73	Surat Thani	1.37	1.64	373.14	311.22	61.93
	National total	100.00	100.00	22,729.44	22,729.44	0.00
	Gini Coefficient of inequality-coefficient:			0.14	0.00	

Remark: Positive Resource Gap means the amount of resource being allocated to the province is greater than the equity level.

Negative Resource Gap means the amount of resource being allocated to the province is less than the equity level.

Table 6.3.2 Measures related to equity in health care, Thailand, 1992
Health care resources: Physician, Nurse, Hospital beds

Code	Province & region	% of Population	% of Physician	% of Nurse	% of Hospital beds
1	Bangkok Metropolis	9.62	45.83	24.76	23.86
2	Nakhon Pathom	1.16	0.83	1.30	1.20
3	Nonthaburi	1.21	1.74	1.87	1.00
4	Pathum Thani	0.84	0.71	0.84	0.49
5	Samut Prakan	1.51	1.37	1.12	1.11
6	Samut Sakhon	0.64	0.52	0.61	0.53
7	Chai Nat	0.59	0.31	0.64	0.55
8	Ayutthaya	1.20	0.57	0.91	0.80
9	Lop Buri	1.28	0.79	1.30	1.63
10	Saraburi	0.94	0.94	1.41	1.82
11	Sing Buri	0.38	0.43	0.79	1.04
12	Ang Thong	0.49	0.28	0.57	0.47
13	Chanthaburi	0.79	0.96	1.12	1.14
14	Chachoengsao	1.03	0.50	0.71	0.69
15	Chon Buri	1.60	2.06	2.89	2.96
16	Trat	0.35	0.24	0.58	0.44
17	Nakhon Nayok	0.40	0.39	0.53	0.60
18	Prachin Buri	1.55	0.68	1.17	1.36
19	Rayong	0.76	0.51	0.77	0.75
20	Kanchanaburi	1.25	0.51	0.89	1.09
21	Prachuap Khiri Khan	0.78	0.43	0.63	0.77
22	Phetchaburi	0.76	0.42	0.82	0.69
23	Ratchaburi	1.34	1.46	2.28	2.62
24	Samut Songkhram	0.36	0.22	0.50	0.47
25	Suphan Buri	1.43	0.66	1.12	1.12
26	Kalasin	1.60	0.45	0.88	0.77
27	Khon Kaen	2.88	4.01	2.79	2.44
28	Chaiyaphum	1.88	0.47	0.98	0.76
29	Nakhon Phanom	1.12	0.33	0.65	0.64
30	Nakhon Ratchasima	4.27	1.89	2.52	3.01
31	Buri Ram	2.45	0.59	0.99	1.23
32	Maha Sarakham	1.50	0.60	0.79	0.64
33	Mukdahan	0.52	0.17	0.43	0.37
34	Yasothon	0.91	0.28	0.54	0.49
35	Roi Et	2.14	0.54	1.10	1.02
36	Loci	1.03	0.31	0.55	0.58

(Table 6.3.2 Continued)

Code	Province & region	% of Population	% of Physician	% of Nurse	% of Hospital beds
37	Si Sa Ket	2.31	0.48	0.84	0.93
38	Sakon Nakhon	1.76	0.57	0.85	1.06
39	Surin	2.32	0.76	1.04	1.13
40	Nong Khai	1.45	0.36	0.77	0.68
41	Udon Thani	3.19	1.15	1.60	1.76
42	Ubon Ratchathathani	3.37	1.16	2.22	2.04
43	Kamphaeng Phet	1.27	0.36	0.33	0.58
44	Chiang Rai	2.13	0.86	1.22	1.53
45	Chiang Mai	2.65	4.96	4.03	4.19
46	Tak	0.74	0.39	0.42	0.74
47	Nakhon Sawan	1.89	1.29	1.03	1.69
48	Nan	0.79	0.42	0.73	0.83
49	Phayao	0.89	0.39	0.89	0.81
50	Phichit	1.02	0.34	0.75	0.68
51	Phitsanulok	1.46	1.21	1.36	1.77
52	Phetchabun	1.72	0.39	0.78	0.75
53	Phrae	0.85	0.42	0.80	0.74
54	Mae Hong Son	0.36	0.19	0.46	0.32
55	Lampang	1.34	0.86	1.36	1.32
56	Lamphun	0.69	0.27	0.54	0.42
57	Sukhothai	1.05	0.42	0.41	0.87
58	Uttaradit	0.82	0.36	0.81	0.79
59	Uthai Thani	0.55	0.31	0.29	0.51
60	Krabi	0.54	0.26	0.41	0.44
61	Chumphon	0.72	0.38	0.83	0.71
62	Trang	0.93	0.45	0.67	0.84
63	Nakhon Si Thammarat	2.56	0.90	1.90	2.13
64	Narathiwat	1.00	0.36	0.92	0.86
65	Pattani	0.94	0.29	0.74	0.54
66	Phang-nga	0.38	0.31	0.76	0.48
67	Phatthalung	0.82	0.28	0.66	0.49
68	Phuket	0.33	0.44	0.59	0.58
69	Yala	0.65	0.66	1.13	0.85
70	Ranong	0.23	0.19	0.40	0.33
71	Songkhla	1.96	3.37	2.84	2.85
72	Satun	0.40	0.16	0.37	0.23
73	Surat Thani	1.37	1.07	1.89	1.42
	National total	100.00	100.00	100.00	100.00
	Gini Coefficient of inequality-coefficient:		0.48	0.21	0.20

Table 6.3.3 Measures related to equity in health care, Thailand, 1992
Health care resources: Physician, Nurse, Hospital beds

Code	Province	Population	Resource allocated			Equity level			Resource gap		
			Physician	Nurse	Hospital beds	Physician	Nurse	Hospital beds	Physician	Nurse	Hospital beds
1	Bangkok Metropolis	5,562,141	6,154	16,824	19,805	1293	6539	7990	4861	10285	11815
2	Nakhon Pathom	671,386	111	883	1,000	156	789	964	-45	94	36
3	Nonthaburi	698,704	234	1,270	834	162	821	1004	72	449	-170
4	Pathum Thani	484,586	96	572	410	113	570	696	-17	2	-286
5	Samut Prakan	871,806	184	761	923	203	1025	1252	-19	-264	-329
6	Samut Sakhon	372,605	70	413	444	87	438	535	-17	-25	-91
7	Chai Nat	339,329	42	432	453	79	399	487	-37	33	-34
8	Ayutthaya	693,230	76	616	661	161	815	996	-85	-199	-335
9	Lop Buri	738,370	106	884	1,357	172	868	1061	-66	16	296
10	Saraburi	546,044	126	961	1,514	127	642	784	-1	319	730
11	Sing Buri	221,407	58	534	866	51	260	318	7	274	548
12	Ang Thong	284,138	37	386	394	66	334	408	-29	52	-14
13	Chanthaburi	455,158	129	761	945	106	535	654	23	226	291
14	Chachoengsao	593,170	67	484	571	138	697	852	-71	-213	-281
15	Chon Buri	927,458	277	1,962	2,457	216	1090	1332	61	872	1125
16	Trat	201,639	32	396	365	47	237	290	-15	159	75
17	Nakhon Nayok	230,333	52	361	496	54	271	331	-2	90	165
18	Prachin Buri	893,360	91	795	1,125	208	1050	1283	-117	-255	-158
19	Rayong	437,552	68	521	625	102	514	629	-34	7	-4
20	Kanchanaburi	724,435	68	606	908	168	852	1041	-100	-246	-133
21	Prachuap Khiri Khan	451,155	58	428	639	105	530	648	-47	-102	-9
22	Phetchaburi	438,615	56	555	573	102	516	630	-46	39	-57
23	Ratchaburi	777,105	196	1,549	2,171	181	914	1116	15	635	1055
24	Samut Songkhram	206,712	30	343	390	48	243	297	-18	100	93
25	Suphan Buri	825,451	89	764	928	192	970	1186	-103	-206	-258
26	Kalasin	925,254	60	600	640	215	1088	1329	-155	-488	-689
27	Khon Kaen	1,662,512	539	1,896	2,023	386	1955	2388	153	-59	-365
28	Chaiyaphum	1,086,331	63	663	635	252	1277	1561	-189	-614	-926
29	Nakhon Phanom	649,933	44	441	530	151	764	934	-107	-323	-404
30	Nakhon Ratchasima	2,467,366	254	1,714	2,495	573	2901	3544	-319	-1187	-1049
31	Buri Ram	1,417,329	79	675	1,019	329	1666	2036	-250	-991	-1017
32	Maha Sarakham	869,118	81	535	530	202	1022	1249	-121	-487	-719
33	Mukdahan	299,280	23	292	310	70	352	430	-47	-60	-120
34	Yasothon	528,277	37	369	405	123	621	759	-86	-252	-354
35	Roi Et	1,238,930	73	749	847	288	1457	1780	-215	-708	-933
36	Loci	595,444	42	373	480	138	700	855	-96	-327	-375

(Table 6.3.3 Continued)

Code	Province	Population	Resource allocated			Equity level			Resource gap		
			Physician	Nurse	Hospital beds	Physician	Nurse	Hospital beds	Physician	Nurse	Hospital beds
37	Si Sa Ket	1,335,487	65	570	771	310	1570	1918	-245	-1000	-1147
38	Sakon Nakhon	1,014,343	76	580	876	236	1193	1457	-160	-613	-581
39	Surin	1,341,385	102	707	938	312	1577	1927	-210	-870	-989
40	Nong Khai	836,693	48	522	564	194	984	1202	-146	-462	-638
41	Udon Thani	1,846,154	155	1,086	1,461	429	2170	2652	-274	-1084	-1191
42	Ubon Ratchathathani	1,945,179	156	1,511	1,695	452	2287	2794	-296	-776	-1099
43	Kamphaeng Phet	731,355	49	227	478	170	860	1051	-121	-633	-573
44	Chiang Rai	1,229,415	115	829	1,270	286	1445	1766	-171	-616	-496
45	Chiang Mai	1,530,779	666	2,740	3,476	356	1800	2199	310	940	1277
46	Tak	425,668	52	286	613	99	500	611	-47	-214	2
47	Nakhon Sawan	1,093,973	173	703	1,399	254	1286	1572	-81	-583	-173
48	Nan	457,626	56	497	691	106	538	657	-50	-41	34
49	Phayao	512,473	52	602	672	119	602	736	-67	0	-64
50	Phichit	587,414	45	510	562	137	691	844	-92	-181	-282
51	Phitsanulok	842,016	162	923	1,469	196	990	1210	-34	-67	259
52	Phetchabun	996,256	52	532	624	232	1171	1431	-180	-639	-807
53	Phrae	493,532	57	541	614	115	580	709	-58	-39	-95
54	Mae Hong Son	206,863	25	310	264	48	243	297	-23	67	-33
55	Lampang	776,251	116	927	1,092	180	913	1115	-64	14	-23
56	Lamphun	397,712	36	364	348	92	468	571	-56	-104	-223
57	Sukhothai	606,823	56	278	720	141	713	872	-85	-435	-152
58	Uttaradit	475,564	48	549	658	111	559	683	-63	-10	-25
59	Uthai Thani	318,595	41	194	420	74	375	458	-33	-181	-38
60	Krabi	311,310	35	280	364	72	366	447	-37	-86	-83
61	Chumphon	416,048	51	565	587	97	489	598	-46	76	-11
62	Trang	540,079	60	457	695	126	635	776	-66	-178	-81
63	Nakhon Si Thammarat	1,477,417	121	1,290	1,771	343	1737	2122	-222	-447	-351
64	Narathiwat	576,593	49	627	710	134	678	828	-85	-51	-118
65	Pattani	541,166	39	501	448	126	636	777	-87	-135	-329
66	Phang-nga	217,870	42	517	396	51	256	313	-9	261	83
67	Phatthalung	474,564	37	448	405	110	558	682	-73	-110	-277
68	Phuket	188,535	59	399	483	44	222	271	15	177	212
69	Yala	375,482	88	765	704	87	441	539	1	324	165
70	Ranong	130,787	26	275	278	30	154	188	-4	121	90
71	Songkhla	1,130,073	452	1,931	2,363	263	1329	1623	189	602	740
72	Satun	230,563	21	248	190	54	271	331	-33	-23	-141
73	Surat Thani	791,259	144	1,281	1,179	184	930	1137	-40	351	42

Remark: Positive Resource Gap means the amount of resource being allocated to the province is greater than the equity level.

Negative Resource Gap means the amount of resource being allocated to the province is less than the equity level.

physicians. Hospital beds are slightly more equally distributed than nurse. In general, expensive and high-cost resources seem to be more concentrated than cheaper ones. That is 0.48 for physician, 0.21 for nurse and 0.20 for hospital bed.

Similar to the analysis conducted for health budget distribution, the optimal number of physicians, nurses and hospital beds are calculated based on the proportion of population in each province. At optimal level, the resources would be distributed most equally, the ratio between resource and population would be equal among provinces and also equal to the national average, and the inequality measure of Gini Coefficient would be zero for all these three indicators.

By looking at actual allocation patterns and optimal allocation patterns of physicians, nurses and hospital beds, the resources gap can be measured through calculating the difference between them. For example, the gap of physicians is equal to actual number of physicians minus the optimal number of physicians in the province. So a negative number indicates that the level of resources allocated in the province is lower than the optimal level, where consideration should be given to adding more resources. A positive sign indicates the resource is over supplied in the province, which should be transferred to other provinces. The absolute number of the gap shows how much of these resources need to be added or removed in order to achieve the optimal level. These results presented in Table 6.3.3.

6.3.4 Policy determination

Health policy should be made which will lead to the most equitable distribution of the general health resources. Some policies should be made to encourage health personnel to move from over-supplied areas move to under-supplied areas, or to change the location of hospitals and other health care facilities, as well as to redistribute the health budget to improve equity in health care. This optimal level of equitable resource distribution is a direction that health policies should be made toward to it. In practice such policies are difficult to enforce, but having an accurate data base will assist the process.

In summary, this analysis emphasizes the differences of general health resources distributed among provinces, since any of these differences may be particularly important for the interpretation of how equitable or inequitable a health care system is, and where its inequities are concentrated. Physicians, nurses and hospital beds are used to produce health care services, but none alone is an adequate measure of resource use in health care. The overall health budget is an additional resources indicator of providing those services. These group

indicators will give an overview of health care system in the country.

The measure of inequality can be used to form overall judgments about whether one distribution represents a more or less equitable situation than another. The optimal resource allocation situation and resource gaps are very useful for guiding redistribution of resources more equitably.

6.3.5 Interpretation of outputs

However, these indicators, which only look at the location of population and resources, also have some limitations as measures of equity. First, it is implicitly assumed that needs are uniformly distributed. This is probably questionable for health needs, because the incidence or prevalence of health problems may differ substantially from one province to another. Since equity is regarded as equal access for equal needs, an equitable distribution of resources would in fact be unequal. Secondly, it is also presumed that the peoples' accessibility to the health care facilities are the same within provinces. This may also be questionable, since many factors may influence the people's access to health care facilities, such as the distance to the hospitals or clinics, transportation situation, as well as economic barriers. Without knowing who actually consults physicians, one cannot assess the appropriateness of their distribution according to other dimensions of population. Thus while these measures say something about equality in the distribution of resources, they should not be considered as the best indicator of the equity of the system.

6.3.6 The incidence rate at equity level of resource distribution

Equal distribution of health resources does not ensure the improvement of efficiency. We start by assuming equal needs across provinces in this study, but population based resources distribution may not be efficient. The estimation of incidence rates is calculated by using the coefficients of above regression model; the results are presented in Table 6.2.5. These results show that the estimated malaria incidence rates at actual health resources allocation and that if health resources(budget, physicians, nurses, hospital beds) are equally distributed. The estimated incidence rate is 3.32 per 1000 population if health resources are equally distributed, it is greater than that in actual resources distribution. It implies that equity and efficiency are generally need trade-off, and decisions have to be made based on the objective to achieve either equity or efficiency.

Table 6.3.5 Estimated Annual Parasite Incidence Rate at Equity Level

Code	Province	Population	Cases 1991	Cases 1992	Esti. cases 1992	Esti. cases 1992 (equity level)	API 1992	Esti. API 1992	Esti. API 1992 (equity level)
1	Bangkok Metropolis	5562141	56	56	52	50	0.01	0.01	0.01
2	Nakhon Pathom	671386	175	161	140	155	0.24	0.21	0.23
3	Nonthaburi	698704	42	35	41	37	0.05	0.06	0.05
4	Pathum Thani	484586	29	39	28	26	0.08	0.06	0.05
5	Samut Prakan	871806	192	0	184	170	0.00	0.21	0.19
6	Samut Sakhon	372605	272	201	242	241	0.54	0.65	0.65
7	Chai Nat	339329	54	17	40	48	0.05	0.12	0.14
8	Ayutthaya	693230	76	49	58	68	0.07	0.08	0.10
9	Lop Buri	738370	465	258	324	412	0.35	0.44	0.56
10	Saraburi	546044	704	453	551	624	0.83	1.01	1.14
11	Sing Buri	221407	15	20	12	14	0.09	0.05	0.06
12	Ang Thong	284138	23	17	16	20	0.06	0.06	0.07
13	Chanthaburi	455158	15753	11825	13149	13967	25.98	28.89	30.69
14	Chachoengsao	593170	2171	1133	1687	1924	1.91	2.84	3.24
15	Chon Buri	927458	1669	1224	1427	1480	1.32	1.54	1.60
16	Trat	201639	40993	34250	30089	36345	169.86	149.22	180.25
17	Nakhon Nayok	230333	286	286	233	254	1.24	1.01	1.10
18	Prachin Buri	893360	6405	5146	4481	5679	5.76	5.02	6.36
19	Rayong	437552	3374	1938	2659	2991	4.43	6.08	6.84
20	Kanchanaburi	724435	13612	13685	9415	12056	18.89	13.00	16.64
21	Prachuap Khiri Kha	451155	5716	5301	4316	5067	11.75	9.57	11.23
22	Phetchaburi	438615	1566	2452	1149	1388	5.59	2.62	3.16
23	Ratchaburi	777105	3435	4818	2779	3045	6.20	3.58	3.92
24	Samut Songkhram	206712	105	105	76	93	0.51	0.37	0.45
25	Suphan Buri	825451	644	660	468	571	0.80	0.57	0.69
26	Kalasin	925254	592	342	367	525	0.37	0.40	0.57
27	Khon Kaen	1662512	599	416	597	530	0.25	0.36	0.32
28	Chaiyaphum	1086331	619	293	379	548	0.27	0.35	0.50
29	Nakhon Phanom	649933	702	429	426	622	0.66	0.66	0.96
30	Nakhon Ratchasima	2467366	2097	1209	1588	1858	0.49	0.64	0.75
31	Buri Ram	1417329	1389	893	784	1231	0.63	0.55	0.87
32	Maha Sarakham	869118	174	122	142	154	0.14	0.16	0.18
33	Mukdahan	299280	581	473	283	515	1.58	0.95	1.72
34	Yasothon	528277	190	116	121	169	0.22	0.23	0.32
35	Roi Et	1238930	372	211	216	329	0.17	0.17	0.27
36	Loci	595444	655	387	420	580	0.65	0.71	0.97

(Table 6.3.5 Continued)

Code	Province	Population	Cases 1991	Cases 1992	Esti. cases 1992	Esti. cases 1992 (equity level)	API 1992	Esti. API 1992	Esti. API 1992 (equity level)
37	Si Sa Ket	1335487	4420	3819	2372	3916	2.86	1.78	2.93
38	Sakon Nakhon	1014343	933	690	612	827	0.68	0.60	0.82
39	Surin	1341385	3300	2039	2401	2925	1.52	1.79	2.18
40	Nong Khai	836693	510	284	292	452	0.34	0.35	0.54
41	Udon Thani	1846154	462	369	338	409	0.20	0.18	0.22
42	Ubon Ratchathathan	1945179	3813	3190	2523	3378	1.64	1.30	1.74
43	Kamphaeng Phet	731355	2611	1697	1890	2314	2.32	2.58	3.16
44	Chiang Rai	1229415	1475	1869	1059	1308	1.52	0.86	1.06
45	Chiang Mai	1530779	3750	3659	3546	3324	2.39	2.32	2.17
46	Tak	425668	34986	30078	26148	31015	70.66	61.43	72.86
47	Nakhon Sawan	1093973	689	372	592	611	0.34	0.54	0.56
48	Nan	457626	668	618	469	592	1.35	1.02	1.29
49	Phayao	512473	333	184	231	295	0.36	0.45	0.58
50	Phichit	587414	53	23	28	47	0.04	0.05	0.08
51	Phitsanulok	842016	808	446	664	716	0.53	0.79	0.85
52	Phetchabun	996256	468	379	256	415	0.38	0.26	0.42
53	Phrae	493532	676	627	503	600	1.27	1.02	1.22
54	Mae Hong Son	206863	8961	9911	6432	7939	47.91	31.09	38.38
55	Lampang	776251	745	598	591	660	0.77	0.76	0.85
56	Lamphun	397712	298	306	209	264	0.77	0.53	0.66
57	Sukhothai	606823	601	364	429	532	0.60	0.71	0.88
58	Uttaradit	475564	523	238	349	464	0.50	0.73	0.98
59	Uthai Thani	318595	752	628	457	666	1.97	1.43	2.09
60	Krabi	311310	5053	1887	3334	4473	6.06	10.71	14.37
61	Chumphon	416048	4435	3224	3209	3933	7.75	7.71	9.45
62	Trang	540079	1215	340	899	1078	0.63	1.66	2.00
63	Nakhon Si Thammara	1477417	6028	1625	3657	5340	1.10	2.48	3.61
64	Narathiwat	576593	3200	1736	1839	2836	3.01	3.19	4.92
65	Pattani	541166	2170	1310	1206	1924	2.42	2.23	3.56
66	Phang-nga	217870	1155	919	883	1025	4.22	4.05	4.70
67	Phatthalung	474564	470	185	304	416	0.39	0.64	0.88
68	Phuket	188535	132	87	111	117	0.46	0.59	0.62
69	Yala	375482	5384	2110	3900	4769	5.62	10.39	12.70
70	Ranong	130787	4572	3904	3521	4040	29.85	26.92	30.89
71	Songkhla	1130073	3051	1062	2793	2705	0.94	2.47	2.39
72	Satun	230563	906	228	622	804	0.99	2.70	3.49
73	Surat Thani	791259	1116	4835	902	989	6.11	1.14	1.25
	National Total	57788965	216524	174860	158510	191904	3.03	2.74	3.32

The knowledge of equity redistribution and efficiency allocation of health resource is worth of having the information network. Since this information is very useful for planning the health care system for each countries. Without timely and accurate data collected from the information network, it is impossible to provide such information to the planners. Considering the regional network (Southeast Asian countries and China), allocative efficiency for the region as a whole won't be possible, e.g. if China is better off and Thailand is worse off. They cannot interchange their national resources. One resource allocation of a country may seem to be more efficient by looking at only that country, but may not be efficient by looking at the region as a whole. For example, if a province in the border area has a low malaria incidence, but its neighboring province of an other country is endemic, the risk of disease transmission could be high if there is increase of population movement between the countries. The regional network can help us to have the whole picture of the region, and help planners of each country to allocate resources more efficiently and equitably within their own nation in relation to the impact of resource allocation and disease pattern within subdivisions of neighboring countries.