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COST PROJECTIONS FOR THE COMPLEMENTARY PACKAGE OF ACTIVITIES FOR REFERRAL HOSPITALS

MINISTRY OF HEALTH
ROYAL GOVERNMENT OF CAMBODIA

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The photograph appearing on the cover of this report was taken and provided by David Collins.

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The photograph on the cover of this report was taken and provided by David Collins.

EXECUTIVE SUMMARY

The Cambodian Ministry of Health (MOH), with assistance from several key donors, has developed an overarching strategic plan for the health sector for the years 2008 through 2015, called the Health Strategic Plan, 2008-2015 (commonly referred to as HSP2). This strategic plan is intended to serve as a basis for the preparation of the MOH's operating plans. Hospital services are a key element of these plans and the MOH needs to know the cost of these services so that resources can be made available and allocated appropriately to enable the hospitals to contribute to the achievement of the HSP2 goals and targets.

The services that should be provided at the different levels of hospital have been defined in a Complementary Package of Activities (CPA) (except for national hospitals). A CPA 1 hospital is a small district hospital without major surgical services, a CPA 2 hospital is a larger district hospital with major surgical services, and a CPA 3 hospital is the equivalent of a provincial hospital which acts as a secondary referral facility. The CPA was used as the basis for costing the services and cost models have been developed for the different types and sizes of the hospitals. Normative costs were used, using normative staffing levels provided in the CPA Guidelines and on cost data collected from a small sample of contracting hospitals, which are believed to be more adequately resourced.

The resources needed to provide the CPA at the hospitals vary significantly depending on the level of hospital (CPA 1, 2 or 3) and the number of occupied beds. Based on the norms and assuming a Bed Occupancy Rate (BOR) of 85%, the number of staff needed to operate a hospital and provide a good quality package of services varies from 49 persons for a 40-bed CPA 1 hospital to 255 persons for a 250-bed CPA 3 hospital. The annual cost of the hospitals should range from around $200,000 for the 40-bed CPA 1 hospital to around $1.1 million for the 250-bed CPA 3 hospital.

These figures are sensitive to the staffing ratios used. For example, for CPA 1 hospitals we used normative ratios of 1 doctor (Medical Doctor or Medical Assistant) to 8 occupied beds, 1 nurse to 2.8 beds and 1 midwife to 7.5 beds (based on the CPA Guidelines). Using those ratios, a 60-bed CPA 1 hospital would need a total of 60 staff and a budget of around $260,000. If we change the staffing ratios to 1 doctor to 16 occupied beds, 1 nurse to 5.6 beds and 1 midwife to 15 beds, the total number of staff at the same 60-bed hospital would be reduced to 45 and the budget to around $234,000. However, this reduction is likely to affect quality of care. It should be noted that the staffing numbers have been fixed for certain categories of staff, such as laboratory technicians, where a minimum number is needed to run a hospital.

The cost per capita depends on the size of the catchment population, the level of hospital, and the number of occupied beds. For a 60-bed CPA 1 hospital serving a population of 100,000 people the per capita cost would be $2.62. For an 80-bed CPA 2 hospital serving a catchment population of 200,000 people the per capita cost would be $1.88. For a CPA 3 hospital serving a province of 2,000,000 people and acting as a second-level provincial referral hospital, the per capita cost would be $0.59 cents. This last figure would have to be added to the per capita cost of the various district hospitals in the province to arrive at a total per capita cost for hospital services for the province. Note that we did not have norms for numbers of beds per thousand population and these figures do not, therefore, represent normative per capita costs.

The normative cost per service can be measured as the cost per inpatient day equivalent (IDE), which uses a combination of inpatient bed days and outpatient services. Based on the modeled costs, the cost per IDE would range from $13.19 at a 60-bed CPA 1 hospital to $17.53 at a 100-bed CPA 3 hospital. The cost per IDE of a CPA 3 hospital would be less for larger hospitals due to economies of scale. At the same 60-bed CPA 1 hospital, assuming an Average Length of Stay (ALOS) of 4.6 days this would translate to an average cost of $60.70 per admission. At the 100-bed CPA 3 hospital with an ALOS of 7.3 days the average cost per admission would be $127.96.

The HSP 2 targets could not be translated into specific hospital targets for all services. The HSP 2 costing assumed that increases in hospital services would be necessary but that these could be provided to some degree through greater and more efficient use of existing capacity. This seems reasonable since there is a significant gap between the average BOR of 68% for all CPA hospitals in 2007 and the optimal BOR of 85%, meaning that more inpatients can be treated without having to increase the numbers of beds. Lowering the average ALOS from the national average of 7.4 days in 2007 to the rates achieved in the sample of contracting hospital would allow even more inpatients to be treated.

However, the additional cost of bringing the resources of the existing hospitals up to the normative levels would be significant, especially for staffing. For example, Ang Roka Hospital, a 60-bed CPA 1 hospital in Takeo Province, had a BOR of 84% and an ALOS of 4.6 days in 2007 and was already operating at close to optimal capacity. However, it only had 26 staff and spent $175,231 in that year, whereas according to the norms it should have had 59 staff and a budget of around $258,000.

As another example, Prey Chhor Hospital, a 70-bed CPA 1 hospital in Kampong Cham Province, had a BOR of 61% and an ALOS of 6.3 days in 2007. It had 28 staff and spent $170,160 in that year, whereas for the number of services that it provided it should have had 54 staff and a budget of around $227,000. If it operated at 85% capacity and reduced its ALOS to 4.6 days (the level at Ang Roka) it would treat almost twice as many inpatients but would require 65 staff and a budget of around $290,000.

The funding for the sample of contracting hospitals used for this study came from a variety of sources. Between 67% and 83% of the funds came from the Government, most of which was in drugs and supplies. User fees, health equity funds and health insurance made up between 12% and 24% of total funding. Direct donor assistance made up between 5% and 9% of total funding. A portion of the Government funding and the health equity funds are also donor funded. Depending on the ability of the Government to finance the increased costs, it is likely that a significant portion of the increased funds needed would have to come from user fees and insurance and from donors, at least in the short term.

Both the actual 2007 costs and the normative costs estimated in this study are significantly higher than the costs used in HSP 2 and in the second child survival costing study, and may be higher than figures used in estimating the cost of the reproductive health, HIV/AIDS and TB strategic plans. The strategic plan costs need to be reviewed and, if necessary, adjusted.

This costing model can be used to estimate a budget for any referral hospital. However, it is important to note that the costs are rough estimates. The following recommendations are made regarding improving the quality of this information.

- For this study the staffing norms were developed from ranges shown in CPA Guidelines and drug and supply costs were based on actual amounts provided to the hospitals. They may not reflect accurately the needs of the hospitals and they do not take into account differences in patient mix. These figures should be reviewed by the MOH and an analysis and determination of standard clinical practices should also be carried out to develop more accurate staffing norms and standard drug and clinical supply needs.
- The figures used for staff remuneration were based on averages of actual payments at the sample of hospitals. These figures should be reviewed and, if necessary, adjusted.
- A more detailed analysis of the operating costs would also be advisable, since it is possible that some aspects, such as maintenance, are underfunded and that this may not have been fully taken into account by the hospital directors when they estimated the additional funds needed.

We also recommend that the HSP2 targets be translated into specific service delivery targets. This will assist the health centers and hospitals to set targets that will result in the achievement of HSP2 goals.

1. BACKGROUND

The Cambodian MOH, with assistance from several key donors, has developed an overarching strategic plan for the health sector for the years 2008 through 2015, called the Health Strategic Plan, 2008-2015 (commonly referred to as HSP2). Separate strategic plans for priority programs, such as Child Survival, Reproductive Health, Malaria and HIV/AIDS, have also been developed with the support of different donor agencies and have been taken into account in HSP2. HSP2 will serve as a basis for the preparation of 3-Year Rolling Plans and Annual Operating Plans (AOPs).

General cost estimates were prepared for HSP2 but these were not detailed enough to provide specific figures for the 2009/2011 Rolling Plan and the 2009 AOP, and in some cases the figures were not considered sufficiently accurate for that level of planning[1]. For example, the estimated costs of health centre and hospital services were based on a limited analysis of historical expenditure, services mixes and utilization levels at a very small sample of facilities.

The MOH has developed a Minimum Package of Activities (MPA), covering health centre and community services, and a Complementary Package of Activities (CPA), covering referral hospital services (excluding national hospitals). These packages include some services which may not have been adequately taken into account in the HSP2 costing, and the numbers of services required may differ significantly from those used in deriving the figures used in that costing. A modeling of MPA and CPA costs is, therefore, important, especially since the HSP2 plans and targets assume that these facilities have the capacity to scale up different priority services, such as child survival, significantly and simultaneously. An accurate modeling of these costs would provide cost estimates for different levels of activities and would indicate possible constraints to scaling up.

[1] See Costing of Health Strategic Plan (2008-2015) by Mark Pearson.

2. STUDY OBJECTIVES AND PHASING

Two studies have been undertaken to model the costs of the MPA and CPA. The models and cost estimates developed are intended to serve as a basis for preparing standard budgets for facilities that can be used in developing district and provincial plans and budgets for rolling plans and AOPs.

The studies have been done in two phases. The first phase was the costing of the MPA which has been completed[2].

The second phase was the costing the CPA which is described in this document. The main objective was to prepare a standard cost model of the package of services that will:

- provide estimates of resources required to implement the CPA in line with HSP 2 targets, and
- assist the MOH with the preparation of hospital budgets that can be used in the rolling plans and AOPs.

The costs produced by the study and by using the costing models may also be used in the future for other purposes, for example:

- to help set user fee levels and insurance reimbursement rates;
- to help set contract performance incentives;
- to help compare performance across hospitals.

[2] Cost and Funding Projections for the Minimum Package of Activities for Health Centres, Ministry of Health, Royal Government of Cambodia. David Collins, Zina Jarrah and Prateek Gupta. Draft 18 November 2008. USAID/BASICS.

3. METHODOLOGY

The main source document used for information on the CPA was the CPA Guidelines[3]. The costing was conducted in two steps. The first step was to estimate the actual costs of a small sample of hospitals and to estimate the costs of any additional resources needed by those hospitals[4]. The second step was to develop normative cost models using the information gathered from the sample of hospitals and norms from the GPA Guidelines. The results were then compared with the findings of other costing studies.

SAMPLE OF HOSPITALS

Due to the limited time available for the study, only a small sample of hospitals was used. Hospitals that are under contracting schemes were used since the data are generally more complete and the costs are more likely to reflect the resources needed to run the hospitals at a good level of quality. For example, staff remuneration levels are higher and include performance incentive payments.

The sample comprised 4 hospitals in Takeo and Kampong Cham provinces. In Takeo we used Ang Roka Hospital, a district-level CPA 1 hospital, and Kirivong Hospital, a district-level CPA 2 hospital. These are both supported under the contracting programme managed by Swiss Red Cross (SRC). In Kampong Cham we used Kampong Cham Provincial Hospital, a provincial-level CPA 3 hospital, and Prey Chhor, a district-level CPA 1 hospital. These are both supported under the contracting programme managed by Belgian Technical Cooperation (BTC).

Kampong Cham Hospital was given a good rating by University Research Corporation (URC) in 2007 in areas such as infrastructure and management[5]. An evaluation of Ang Roka Hospital and Kirivong Hospital by Swiss Red Cross concluded that both hospitals were "of higher standard than normally encountered in Cambodia with 24 hours coverage and routine monitoring of patient condition". The evaluation reported that surveys indicated close to 100% client satisfaction in both hospitals[6].

We made several visits to the hospitals and also collected data at the national level. The data collected were as follows:

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[3] National Guidelines on Complementary Package of Activities for Referral Hospital Development from 2006 to 2010. Second Version, 15 December 2006. Ministry of Health, Kingdom of Cambodia.

[4] Former District Hospitals (FDHs), which are large health centres with some inpatient services other than deliveries were not included under this study due to the lack of time.

[5] The assessment covered Hospital Management, Administration, infrastructure and equipment, organization of wards and departments, documentation and recording of information, referral system, staff satisfaction and general hygiene.

[6] Contracting of Health Services: Ang Rokar and Kirivong Operational Districts, Takeo Province, Cambodia. Final Evaluation Report. Sheryl Keller, Jean-Marc Thome and Jean-Yves Dekestier. April 2008. Swiss Red Cross.

- Numbers of services were obtained from the national Health Information System and some of these data, such as the numbers of beds, were confirmed at the hospitals.

- Income and expenditure data were obtained from routine reports prepared by the hospitals. In the case of the Takeo hospitals, the data were taken from records kept by SRC based on reports and other information provided by the District Offices.

- Details of staffing, including numbers and types of staff, assignments and pay, were taken from staffing reports and additional information was provided by the hospital managers,

- Information was also collected from a small sample of patient records at three of the four hospitals to allow us to estimate the resources used for some of the key interventions.

- The hospital directors provided verbal estimates of additional resources needed.

Our initial intention was to get sufficient information from the hospitals to allocate the staff, drugs and clinical supplies to the various inpatient departments. However, information on the allocation of staff was not always specific enough, especially where employees work in more than one department. We were also not able to get sufficient information on the cost of drugs and medical supplies issued to each department. It appears that records of these issues are not always kept, and if they are, they are not priced. Since we were not able to get sufficient information to allocate these costs accurately we grouped all the inpatient departments together.

We could only prepare rough estimates of the total pay for each staff member, which is made up of several elements, such as salary, overtime and shares of user fees and incentives. It appears that complete up to date records of total pay by employee may not always be maintained.

The study was aimed primarily at estimating the recurrent cost of the hospitals. We did not include capital costs or depreciation, or any expenditure required for upgrading the facilities. This was partly because these costs are not typically included in the recurrent budget for the hospital and partly because preparing these estimates is very time consuming and our time was limited. We also did not include costs incurred at other levels of the health system, such as training costs covered under other budgets or district or provincial management costs.

It is important to note that the actual cost figures obtained from the sample hospitals represent the expenditures made on resources provided to the hospitals. These costs were therefore constrained by the amounts of resources provided and did not represent the costs that should have been incurred to provide these services. In other words, these were not necessarily the costs of providing good quality services. Even when we include the additional needs estimated by the hospital directors it is not likely that these adjusted costs reflect the real resource needs of the hospitals.

NORMATIVE COST MODELS

The second step was to develop a simple model for each type of hospital, which was done using spreadsheets. A separate model was prepared for the CPA 1 and CPA 2 hospitals and three separate models were developed for the CPA 3 hospitals, based on the numbers of beds.

The costs are driven by several variables. The numbers of staff and the cost of drugs and supplies are driven by the numbers of services, which are defined as the number of inpatient days and the number of outpatient services. The number of inpatient days is a function of the number of official beds at the hospital multiplied by the bed occupancy rate. The number of outpatient services is entered directly.

An average cost per inpatient day for drugs and supplies was estimated using the actual figures for each level of hospital in the sample, taking into account the need for additional drugs identified by the hospital directors.

For the numbers of each type of staff, norms were derived from the ranges of staff shown in the CPA guidelines. The average compensation per type of employee was taken from the hospital sample, and since the hospitals were all operating under contracting programmes, it was assumed that these levels of compensation were adequate.

The operating costs were derived from the sample of hospitals using the actual costs and additional costs needed as identified by the hospital directors. For the CPA 1 and CPA 2 hospitals these were treated as fixed costs because the range of beds is relatively small. For the CPA 3 hospitals, where the range of beds is greater, we treated part of the operating costs as fixed and set the remainder to vary in proportion with the numbers of services.

The figures used in the model are the 2007 costs and have not been inflated.

Further details of the normative costs are provided on page 18.

4. SERVICES

The package of services that should be provided by the CPA 1, 2 and 3 hospitals is shown in Annex 1. In 2007 the sampled hospitals provided the services set out in the guidelines with the following exceptions:

- None of the hospitals reportedly had physiotherapists on staff and so could not, presumably, provide Kinetic Therapy services. They may, therefore, also lack equipment and supplies.
- Kirivong Hospital did not have emergency care beds or discharges according to the HIS, but it is assumed that other beds were used for those services.
- Ang Roka and Kirivong hospitals did not appear to have dental services.

In line with the Guidelines, Ang Roka and Prey Chhor hospitals did not have operating theatres, and yet they had surgical beds and reported surgical discharges. It is assumed that those beds were used for non-surgical patients. The HIS did not show if any of the beds were designated for AIDS patients and does not show discharges for AIDS other than at the clinic level.

5. ACTUAL UTILIZATION

A summary of the key utilization information derived from the HIS for the four hospitals is shown in Table 1. A breakdown on inpatient services by department is shown in Annex 2.

Table 1: Key utilization rates

Services	CPA 1 Ang Roka - Actual	CPA 1 Prey Chhor	CPA 2 Kirivong - Actual	CPA 3 Kampong Cham - Actual
Catchment population	133,056	178,296	226,994	1,673,307
Outpatient consultations	4,459	2,244	7,854	0
Inpatient discharges and deaths	4,031	2,492	6,502	13,983
Hospitalization days	18,381	15,596	35,439	101,749
Official number of beds	60	70	80	260
ALOS	4.6	6.3	5.5	7.3
BOR	84%	61%	121%	107%
Surgical activities - major	-	-	312	2,081
Minor surgery	165	-	225	-
Deliveries and abortions	149	207	899	1,522
Dental	-	618	-	1,050
Lab examinations (including malaria)	14,412	6,969	13,211	139,702
Blood bank - collected and consumed	-	-	26	4,951
Radiography etc	1,116	139	862	6,789

Of the two CPA 1 hospitals, Ang Roka hospital seems to have operated at a higher level of efficiency in 2007, with a bed occupancy rate (BOR) of 84% and an average length of stay (ALOS) of 4.6 days. This can be compared with Prey Chhor hospital which has a BOR of 61% and an ALOS of 6.3 days, and which had much lower numbers of inpatient discharges, outpatient consultations, laboratory examinations and radiography services. Prey Chhor had more Medicine beds and less TB beds than Ang Roka (Annex 2) but this would not appear to be a good reason for the apparent under-utilization of Prey Chhor services.

We compared the numbers of services with those in the previous year to see if 2007 was exceptional. The number of services at Ang Roka was higher in 2007 than in 2006, when it had 2,617 inpatient discharges, 15,050 bed days (hospitalization days) and a BOR of 69%. The ALOS shortened from 5.6 days in 2006 to 4.6 days in 2007. The number of services at Prey Chhor was slightly higher in 2007 than in 2006, when it had 1,981 inpatient discharges and 15,446 bed days. However, the BOR was almost the same at 60%. The ALOS shortened from 7.8 days in 2006 to 6.3 days in 2007. In both cases, these figures appear to be a reflection of a trend of increased use rather than 2007 being an exceptional year, although a major outbreak of dengue fever in 2007 was also a factor at Ang Roka.

In terms of the mix of inpatient services, pediatric services were the services most used at Ang Roka hospital in 2007, representing 57% of the discharges and 45% of the inpatient days. According to the HIS, 45% of these children were treated for dengue fever[7], 43% for ARI and

[7] Again note the major outbreak of dengue fever in 2007.

12% for diarrhea. 3% of inpatient discharges were deliveries, 2% were TB patients (24% of bed days) and 14% were classified as Other[8].

Pediatric services were also the services most used at Prey Chhor hospital in 2007, with 38% of the discharges and 33% of the inpatient days. According to the HIS, 52% of these children were treated for dengue fever, 33% for ARI and 15% for diarrhea and related conditions. 9% of inpatient discharges were deliveries, 1% were TB patients (10% of bed days) and 20% were recorded as Other.

Of these two CPA 1 hospitals, the costs of Ang Roka may provide a more reliable basis for the modeling since the overall performance is closer to optimal. It is not clear if the mix of services is close to that required to meet the HSP 2 targets since those targets have not been translated into numbers of hospital services. The number of deliveries may, however, have been on the low side.

Kirivong, the CPA 2 hospital, had a BOR of 121% in 2007 and an ALOS of 5.5 days[9]. The BOR increased from 101% in 2006 and the ALOS decreased from 6.2 days. Again the increase in utilization appears to be part of a trend although the outbreak of dengue fever also contributed. In terms of service mix, 39% of the discharges at Kirivong were Pediatric, 30% were Medicine, 17% were Maternity and 13% were Surgical. The breakdown of bed days was 37% Pediatric, 29% Medicine, 17% Surgical and 13% Maternity. 1% of total discharges were TB (4% of bed days) and 30% were Other. Of the Pediatric discharges, 36% were treated for ARI, 32% for diarrhea and related ailments, and 31% were treated for dengue fever.

At Kampong Cham Hospital the BOR was 107% in 2007, having increased from 94% in 2006. The number of discharges increased from 11,038 in 2006 and the ALOS decreased from 8.1 days in 2006 to 7.3 days in 2007. In terms of service mix, 28% of the discharges were Pediatric, 25% were Medicine, 24% were Surgical and 17% were Maternity. The breakdown of bed days was 31% Surgical, 28% Medicine, 16% Pediatric and 13% Maternity. 2% of total discharges were TB (9% of bed days) and 33% were Other. Of the Pediatric discharges, 53% were treated for dengue fever, 31% for ARI and 16% for diarrhea and related ailments.

To check the impact of the reported dengue fever outbreak in 2007 we compared pediatric discharges over the two years (dengue fever admission should all be pediatric). The comparison showed that the 2006 pediatric discharges were much lower than those figures for 2007. Ang Roka had 918 pediatric discharges in 2006 compared with 2,298 in 2007, Kirivong had 1,339 compared with 2,508, and Kampong Cham had 2,635 compared with 3,914. The figure for Prey Chhor was also lower in 2006, being 771 compared with 949, but the difference is less, perhaps because dengue fever was less prevalent in this area. However, the increases in pediatric discharges does not account for all the overall increases in services among the four hospitals among and it, therefore, confirms that there has been a general trend of increasing inpatient utilization.

In terms of patient mix, pediatric patients were the biggest patient category in all hospitals (partly because of the high number of dengue fever treatments). Pediatric services were also the largest user of bed days in the CPA 1 and 2 hospitals, with Surgical services the largest user in the CPA 3 hospital. TB patients accounted for only a small proportion of discharges, but a significant proportion of bed days at Ang Roka and Kampong Cham.

[8] The “Other” category in the HIS is presumably used when the diagnosis does not fit with one if the predetermined HIS categories.

[9] The BOR rate in excess of 100% is reportedly due to additional unofficial beds rather than sharing of beds. However, reporting errors may also be a factor.

A comparison of the ALOS across the hospitals shows that Kampong Cham had the highest with 7.3, which is to be expected since it is a higher level hospital and should be dealing with more complex cases. Kirivong had a rate of 5.5, which is less than at Kampong Cham and more than at Ang Roka, which should also reflect the level of complexity of cases. Kampong Cham and Kirivong both carry out major surgery, which should result in longer ALOS rates. At Ang Roka and Kampong Cham Hospitals the ALOS are figures are increased to some degree because they have more TB patients who have long ALOS.

Prey Chhor had higher ALOS levels than Ang Roka in all areas except for TB, which may indicate some inefficiency at Prey Chhor. Interestingly the TB ALOS is much shorter at Kirivong and Kampong Cham than at Prey Chhor. It can also be noted that the maternity ALOS was much lower at Ang Roka Hospital, at 1.4 compared with 4.2 at Prey Chhor and Kirivong. Differences among the Bed Occupancy Rates (BOR) for different wards may indicate that some beds are being used for services other than the designated ones.

In terms of outpatient services, Kirivong had the highest number of outpatient services (7,854) and of the two CPA 1 hospitals, Ang Roka had the highest number with 4,459. No outpatient services were recorded in the HIS for Kampong Cham Hospital but we heard that some CPA 3 hospitals may be providing outpatient services at specialty clinics. If so, it is not clear if, or how, these are reported in the HIS – hopefully not as inpatient services which would distort performance indicators, staffing ratios and costs.

6. ACTUAL COSTS

As stated in the methodology, the costs shown here reflect expenditures made on resources provided and are thus limited by the funds provided to, and generated by, each hospital. Lower costs do not, therefore, necessarily reflect greater efficiency – they might instead reflect lower quality. Also, despite our best efforts to collect all the data it is still possible that some costs have not been included – in particular drugs and donations in kind (e.g. the time of doctors) from Non-Governmental Organizations.

The actual total expenditures of the four hospitals are shown in Table 2. Ang Roka had slightly more expenditure than Prey Chhor ($175,231 compared with $170,160), which is related to the higher cost of drugs and clinical supplies provided by CMS. Kirivong and Kampong Cham had higher expenditures of $400,442 and $1,091,618, as befitting CPA 2 and CPA 3 hospitals. Well over 50% of the total cost relates to drugs and clinical supplies, ranging from $105,256 at Ang Roka to $584,779 at Kampong Cham. Staff costs are the second highest type of cost ranging from $39,542 at Ang Roka to $366,433 at Kampong Cham. Operating costs are the lowest type of cost ranging from $29,996 at Prey Chhor to $140,406 at Kampong Cham.

Table 2: Total Actual Costs for 2007 (US$)

	CPA 1 Ang Roka - Actual	CPA 1 Prey Chhor	CPA 2 Kirivong - Actual	CPA 3 Kampong Cham - Actual
Total Cost by Input Type (US$)				
Staff	39,542	42,090	100,166	366,433
Drugs and clinical supplies	105,256	98,074	250,579	584,779
Operating costs	30,433	29,996	49,697	140,406
Total	175,231	170,160	400,442	1,091,618

One way to compare costs is to calculate how much is spent on average for each person in the catchment population. This is done by dividing the total cost by the catchment population which produces a cost per capita. It is a broad measure of equity, since, all things being equal, the same levels of health resources should be provided for everyone in the population. However, comparisons can only be made across the same level of hospital. As can be seen from Table 3, between the two CPA 1 district hospitals, Ang Roka spent much more per capita than Prey Chhor, with $1.32 compared with $0.95. In other words, Ang Roka had more funding than Prey Chhor. This implies some inequity in resource allocation, either across provinces or districts within provinces.

Kirivong, as a CPA 2 district hospital, spent $1.76 per capita, which was more than Ang Roka. This appears reasonable since it provided a higher level of care, such as major operations. However, it also indicates some possible inequity since the higher level of care is available in one district but not in some others. Kampong Cham spent only $0.65 per capita because, as a provincial hospital, it serves the entire population of the province and, presumably, acts as a second-level referral hospital for the province.

Table 3: Cost per capita (US$)

	CPA 1 Ang Roka - Actual	CPA 1 Prey Chhor	CPA 2 Kirivong - Actual	CPA 3 Kampong Cham - Actual
Per Capita Cost by Input Type (US$)				
Staff	0.30	0.24	0.44	0.22
Drugs and clinical supplies	0.79	0.55	1.10	0.35
Operating costs	0.23	0.17	0.22	0.08
Total	**1.32**	**0.95**	**1.76**	**0.65**

Another important way to compare costs is to calculate how much is spent on average on each service. This is typically done by calculating the average cost per inpatient bed day or per discharge. Since these hospitals provide both outpatient and inpatient services, we used a ratio of outpatient costs to inpatient costs to produce a cost per inpatient day equivalent (IDE). We estimated this ratio for each hospital - in the case of Ang Roka it was 0.25, which means that four outpatient services had the equivalent cost of one inpatient bed day. To calculate the total number of bed days equivalent we, therefore, divided the number of outpatient services by 4 and added the result to the number of inpatient days. It should be noted that Kampong Cham does not officially have any outpatients and it is possible that any specialist outpatient visits are recorded as inpatient services in the HIS.

The cost per service varies with the total cost and with the total number of IDEs. However, it also varies with the mix of services, not just in terms of outpatient versus inpatient services, but also in terms of the type of inpatient treatment. For example, the relative numbers of TB cases and bed days will affect the cost, as will the prevalence of certain conditions, such as dengue fever. We would, however, expect that normally the cost per IDE for CPA 1 hospitals is broadly similar since the types of service provided should be the same. With a higher level of care at a CPA 2 hospital, we would expect the cost per IDE to be higher, and higher again at a CPA 3 hospital.

Although the cost per IDE should be similar at the two CPA 1 hospitals, it can be seen from Table 4 that the cost was much higher at Prey Chhor ($10.35) than at Ang Roka ($8.98). Since the total expenditure is similar at the two hospitals, the difference is mainly because Prey Chhor provided fewer services (16,438 IDEs compared with 19,509). Ang Roka operated with a reasonably efficient BOR of 84%, whereas the BOR for Prey Chhor was only 61%. Ang Roka had more TB patients but it is not clear what impact that would have on costs, except that TB drugs are expensive.

Kirivong had a cost per IDE of $10.67, which was higher than the cost for Ang Roka. This was appropriate because it is a CPA 2 hospital. However, the extra cost of the higher level of care was probably offset to some degree by the large number of services provided (37,526 IDEs). With a BOR of 121%, Kirivong operated in excess of full capacity[10], and assuming that the staffing level and operating expenditures were not increased to cover the additional patients, these unit costs per service would have been artificially low. Hopefully the quantity of drugs was

[10] As discussed later in this document a BOR of 85% is considered the optimal rate.

increased to cover the increased patient load, but if not that unit cost would also have been artificially low.

Kampong Cham had a cost of $10.73, which was slightly higher than the cost at Kirivong. As a CPA 3 hospital the difference should probably be greater, and it is notable that the drugs cost per IDE is lower, which should not be the case for a higher level hospital. Like Kirivong, Kampong Cham also operated in excess of full capacity (with a BOR of 107%), and, for the same reasons, the unit staffing cost, drugs cost and operating cost may have been artificially low.

Table 4: Cost per inpatient day equivalent (US$)

	CPA 1 Ang Roka - Actual	CPA 1 Prey Chhor	CPA 2 Kirivong - Actual	CPA 3 Kampong Cham - Actual
Cost per bed day equivalent (US$)				
Staff	2.03	2.56	2.67	3.60
Drugs and clinical supplies	5.40	5.97	6.68	5.75
Operating costs	1.56	1.82	1.32	1.38
Total	8.98	10.35	10.67	10.73
Ratio of OP visit to IP day cost	*0.25*	*0.29*	*0.27*	*na*
Inpatient Days Equivalent	*19,509*	*16,438*	*37,526*	*101,749*

The average cost per inpatient discharge should also be higher at a higher level hospital, because the higher level hospitals should have more complex services and higher average lengths of stay. As can be seen from the Table 5, the cost is indeed lowest at Ang Roka ($40.96), higher at Kirivong ($58.16) and highest at Kampong Cham ($78.07). The figure of $64.78 for Prey Chhor is, again, much higher than the figure for Ang Roka because the utilization level is much lower. It should be noted again that the Kirivong and Kampong Cham hospital costs may be artificially low, as explained above.

Table 5: Cost per discharge (US$)

	CPA 1 Ang Roka - Actual	CPA 1 Prey Chhor	CPA 2 Kirivong - Actual	CPA 3 Kampong Cham - Actual
Cost per discharge (US$)				
Staff	9.24	16.02	14.55	26.21
Drugs and clinical supplies	24.60	37.34	36.40	41.82
Operating costs	7.11	11.42	7.22	10.04
Total	**40.96**	**64.78**	**58.16**	**78.07**
Average Length of Stay	*4.56*	*6.26*	*5.5*	*7.3*

Table 6 shows the average cost per outpatient service. Since the costs are calculated using ratios, the relationship among these costs is similar to the relationship among the inpatient costs. No outpatient services were shown in the HIS for Kampong Cham Provincial Hospital. These costs are higher than the average cost of $1.40 per curative service across the 11 contracting health centres included in the MPA costing sample, which is expected since some of the hospital services are referrals and should, therefore, be more complex. Also the hospitals have higher operating costs.

Table 6: Cost per outpatient service

	CPA 1 Ang Roka - Actual	CPA 1 Prey Chhor	CPA 2 Kirivong - Actual	CPA 3 Kampong Cham - Actual
Cost per Outpatient service (US$)				
Staff	0.51	0.75	0.71	na
Drugs and clinical supplies	1.36	1.76	1.77	na
Operating costs	0.39	0.54	0.35	na
Total	**2.27**	**3.05**	**2.84**	**na**

We were able to compare the costs for the Ang Roka and Kirivong hospitals with the figures for the previous year. Ang Roka Hospital had a total cost of $175,231 in 2007 (Table 2), which was a significant increase from the total of $109,468 spent in 2006. The main reason was the increase in the cost of drugs provided by CMS which rose from $35,989 in 2006 to $105,256 in 2007. As noted in the previous section, the hospital provided many more services in 2007 than in 2006. Kirivong Hospital had a total cost of $400,442 in 2007 compared with $271,970 in 2006. The main reason was again the increased cost of drugs from CMS which rose from $149,528 in 2006 to $250,579 in 2007. This hospital also provided many more services in 2007 than in 2006.

We asked the hospital directors to provide rough estimates of the additional resources that they would have needed in 2007 to operate at full capacity with good quality of care. The additional estimated needs were $46,098 for Ang Roka, $56,098 for Prey Chhor, $44,852 for Kirivong and $99,034 for Kampong Cham. The increases were 26%, 33%, 11% and 9%, respectively. In terms of staff Ang Roka said they needed 14 more than the 26 they had, Prey Chhor needed 17 more than the 28 they had, Kirivong needed 19 more than the 49 they had, and Kampong Cham

needed 15 more than the 219 they had. The total costs per inpatient day equivalent including these additional resources are shown in Table 7.

Table 7: Cost per inpatient day equivalent including additional resource need estimates

	CPA 1 Ang Roka - Needed	CPA 1 Prey Chhor	CPA 2 Kirivong - Needed	CPA 3 Kampong Cham - Needed
Cost per bed day equivalent (US$)				
Staff	3.04	4.44	3.55	3.88
Drugs and clinical supplies	6.74	6.86	6.81	5.81
Operating costs	1.56	2.46	1.51	2.02
Total	11.35	13.76	11.87	11.70
Ratio of OP visit to IP day cost	*0.25*	*0.29*	*0.27*	*na*
Inpatient Days Equivalent	*19,509*	*16,438*	*37,526*	*101,749*

7. FUNDING SOURCES

The 2007 sources of funding for the four hospitals are shown in figures in Table 9 and in percentages in Table 10. These figures are slightly different from the total expenditures because some of the user fee income is transferred to Treasury and because, in some cases, hospitals can carry unspent balances forward.

Between 67% and 83% of the funds came from the Government, most of which was in drugs and supplies, and some of which is donor-funded. User fees, health equity funds and health insurance made up between 12% and 24% of total funding. Direct donor assistance made up between 5% and 9% of total funding.

The largest single source of funding for all four hospitals was the drugs and supplies received from CMS[11], which was over 50% of funding in all hospitals except for Kampong Cham, where it was 42%. It is notable that user fees were much lower at Prey Chhor (12%) than at the other 3 hospitals (20% to 24%). Direct donor funding was higher at Kampong Cham due to donated drugs.

Table 9: Funding sources 2007

US$	CPA 1 Ang Roka	CPA 1 Prey Chhor	CPA 2 Kirivong	CPA 3 Kampong Cham
User fees	19,957	6,280	55,019	208,644
Health Equity Funds	12,637	16,005	24,740	75,261
Health insurance	3,801	-	3,154	-
Fees for service	**36,394**	**22,286**	**82,913**	**283,905**
GoC Salaries	7,111	16,018	14,758	71,941
GoC Overtime	2,791	351	8,059	8,320
GoC Operating costs	24,779	23,190	33,619	165,232
GOC Incentives	615	2,623	2,000	42,862
CMS - drugs and clinical supplies	100,763	111,406	235,101	491,656
Government funds	**136,059**	**153,588**	**293,536**	**780,012**
Donor Salaries	1,527	-	1,541	-
Donor overtime	502	588	298	-
Donors - drugs and supplies	-	-	-	32,982
Donor incentives	7,015	9,138	22,704	67,792
Donor funds (not through Government)	**9,044**	**9,727**	**24,543**	**100,774**
TOTAL	**181,497**	**185,601**	**400,993**	**1,164,690**

Table 10: Funding sources for 2007 as a percentage of total funding

[11] Some of the drugs provided by CMS may also be provided by donors, but we do not have sufficient information to do this analysis thoroughly.

US$	CPA 1 Ang Roka	CPA 1 Prey Chhor	CPA 2 Kirivong	CPA 3 Kampong Cham
User fees	11%	3%	14%	18%
Health Equity Funds	7%	9%	6%	6%
Health insurance	2%	0%	1%	0%
Fees for service	**20%**	**12%**	**21%**	**24%**
GoC Salaries	4%	9%	4%	6%
GoC Overtime	2%	0%	2%	1%
GoC Operating costs	14%	12%	8%	14%
GOC Incentives	0%	1%	0%	4%
CMS - drugs and clinical supplies	56%	60%	59%	42%
Government funds	**75%**	**83%**	**73%**	**67%**
Donor Salaries	1%	0%	0%	0%
Donor overtime	0%	0%	0%	0%
Donors - drugs and supplies	0%	0%	0%	3%
Donor incentives	4%	5%	6%	6%
Donor funds (not through Government)	**5%**	**5%**	**6%**	**9%**
TOTAL	**100%**	**100%**	**100%**	**100%**

8. NORMATIVE COSTS

Simple spreadsheet models were developed for each type of hospital so that the MOH can easily produce an estimated normative cost using the number of beds, the bed occupancy rate and the number of outpatient services. We prepared one model for CPA 1 hospitals, one for CPA 2 hospitals and three models for CPA 3 hospitals (one with 100 to 150 beds, one with 151 to 200 beds, and one with 201 to 250 beds).

The costs are driven by the number of inpatient days and outpatient visits. To determine the number of inpatient days the number of official beds is multiplied by the bed occupancy rate. We used a bed occupancy rate of 85% in the model, although this can be changed by the user[12].

We developed and used normative unit costs for each main type of input: staff, drugs and medical supplies, and operating costs.

For staffing we used the norms shown in the CPA Guidelines. According to these guidelines, a CPA 1 hospital with 40 to 60 beds should have 47 to 65 staff, a CPA 2 hospital with 60 to100 beds should have 68 to 96 staff, and a CPA 3 hospital with 100 to 250 beds should have 155 to 212 staff. See Annexes 3, 4 and 5 for details.

These standards are somewhat different from the indicative ones shown in the MOH staffing standards report published in July 2005, which state that CPA 1 and CPA 2 hospitals with between 50 and 99 occupied beds should have a total of 53 staff [13]. That report does not provide a total staffing figure for a CPA 3 hospital with more than 150 beds and says that it should have the same staffing as a National Hospital which is 1 doctor (Medical Doctor or /Medical Assistant) for every 5 occupied beds, one nurse for every 2 occupied beds and one midwife for every 60 births in the hospital per year[14].

For staff who provide direct patient services (doctors, nurses, midwives and kinetic therapists, we converted the ranges into numbers of beds per staff person and entered them into the model so that a change in the number of beds will result in changes in the numbers of staff. We assumed that these figures cover both inpatient and outpatient services. Since this method produces fractions of staff the model rounds up the number for each category to the nearest whole number. For employees who do not provide direct patient services, such as laboratory technicians and maintenance workers, we used a fixed number based on the range shown in

[12] The rate of 85% was selected as optimal because this is reportedly the maximum rate of efficiency that can be achieved without compromising hospital-acquired infection rates. Lower rates are used in some countries. For example in the UK the Government's occupancy target is reportedly 82%, and some argue that over 85% contributes to high hospital-acquired infection rates and 65% is considered ideal from that perspective (Quality of Hospital Care Suffers Due to Overcrowding, Daily Mail June 24, 2008).

[13] Ministry of Health Staffing Standards for Health Centres, Referral Hospitals and National Hospitals, July 2005.

[14] These staff to patient ratios may be higher than in some other countries. South Africa, for example, has a standard of 1 doctor for 15 occupied beds and 1 Registered Nurse for 8 occupied beds, and in the USA some states have standards of 1 nurse for 6 patients on day duty and 1 for 10 patients on night duty. These standards are for registered doctors and registered nurses and probably do not include medical assistants and may not include primary nurses. They also only appear to cover inpatient services. Nevertheless, the Cambodia standards appear to require more doctors and nurses that those of some other countries.

the Guidelines for each hospital. We also entered dental staff as a fixed number on the assumption that these are only outpatient services (this could be set to vary with the number of dental services if a standard ratio can be established).

For the cost of staff we used averages of the actual remuneration levels for 2007 at the sampled hospitals. Because these hospitals are operating under contracting programs the remuneration levels are higher than at non-contracting hospitals and are more representative of levels that need to be paid to have motivated staff. The figures include remuneration from all sources identified in the hospital financial reports. These comprised Government salary, overtime and mission payments; shares of user fee, health insurance and health equity fund revenue; delivery incentives; and performance incentives paid under the contracting programs. The performance incentives represented between 10% and 20% of the total remuneration at the sample of hospitals. We produced a combined average for doctors and medical assistants, for secondary and primary nurses, and for secondary and primary midwives. We used the same remuneration levels for the different categories of administrative staff and also for general support staff (maintenance technicians, cleaners, launderers, kitchen workers and drivers).

For drugs and medical supplies we used the actual average cost in 2007 across the sampled hospitals including the additional drugs needed as estimated by the hospital directors. These were converted to average cost per inpatient bed day and per outpatient visit, and a combined cost per inpatient day equivalent. One would expect that the drug cost per IDE would rise with the level of hospital, offset to some degree by some economies of scale. Since this was not the case at the sampled hospitals we decided to use the average across the 4 hospitals. In any event, with such a small sample it is probable that the figures do not represent reasonable norms and further research should be carried out before the figures are used for anything other than rough estimates.

The figure for the operating cost for the CPA 1 hospital is an average of the costs at Ang Roka and Prey Chhor hospitals for 2007. These costs are the actual costs for 2007 plus a figure for additional needs estimated by the hospital directors. We treated them as fixed costs irrespective of the number of beds, which may be an over-estimate for the smaller hospitals since both Ang Roka and Prey Chhor hospitals are at the top end of the range for a CPA 1 hospital (Prey Chhor hospital actually 10 beds more than the top end of the range).

The figure for the operating cost for the CPA 2 hospital is the actual cost for 2007 at Kirivong Hospital plus a figure for additional needs estimated by the hospital directors. This may also be an over-estimate for any smaller CPA 2 hospitals since Kirivong Hospital is at the top of the range for a CPA 2 hospital, with 80 beds.

The figure for the operating costs for the three levels of CPA 3 hospitals is based on the actual cost for 2007 at Kampong Cham Hospital, again plus a figure for additional needs estimated by the hospital directors. Kampong Cham Hospital is bigger than the top end of the normative range, with 260 beds, so we estimated a proportion of the figure for the small and medium CPA 3 hospitals. This assumed that 50% of the Kampong Cham Hospital figure is fixed and the other 50% varies with the number of beds.

The results of using the models for an example of each level of hospital are shown in Table 11. These are examples of costs based on particular numbers of beds and outpatient services entered into the model. The examples of the models showing the detailed costs are shown in Annexes 7, 8, 9, 10 and 11.

Based on approximate normative staffing levels and standard costs for remuneration, drugs and operating costs, a 60-bed CPA 1 hospital with an 85% BOR and 5,000 outpatient services per

year should have around 60 staff and should cost around $260,000 per year. An 80-bed CPA 2 hospital with 8,000 outpatient services should have around 89 staff and should cost around $375,000. A CPA 3 hospital with 100 beds should have around 118 staff and should cost around $540,000, one with 175 beds should have around 185 staff and should cost around $840,000, and one with 250 beds should have around 255 staff and should cost around $1,150,000.

Table 11: Normative costs for hospitals (US$)

Summary of standard costs	**US$**				
	CPA 1 (40-60 beds)	**CPA 2 (60-100 beds)**	**CPA 3 small (100-150 beds)**	**CPA 3 medium (151-200 beds)**	**CPA 3 large (201-250 beds)**
ASSUMPTIONS					
Beds	60	80	100	175	250
BOR	85%	85%	85%	85%	85%
Occupied beds	51	68	85	149	213
Annual inpatient days	18,615	24,820	31,025	54,294	77,563
ALOS	4.6	5.5	7.3	7.3	7.3
Discharges and deaths	4,047	4,513	4,250	7,438	10,625
Outpatient services	5,000	8,000	-	-	-
Inpatient day equivalents (IDEs)	19,879	26,946	31,025	54,294	77,563
STAFF AND COSTS					
Staff numbers	*60*	*89*	*118*	*185*	*255*
Staff cost	102,378	151,594	208,737	333,771	463,121
Drugs and medical supplies	124,295	167,975	193,105	337,934	482,763
Operating costs	35,458	56,526	141,980	171,559	201,138
Total cost	**262,131**	**376,095**	**543,822**	**843,264**	**1,147,022**
Staff cost per IDE	5.15	5.63	6.73	6.15	5.97
Drugs etc per IDE	6.25	6.23	6.22	6.22	6.22
Operating costs per IDE	1.78	2.10	4.58	3.16	2.59
Total cost per IDE	**13.19**	**13.96**	**17.53**	**15.53**	**14.79**

The modeled examples produce cost per capita figures. For example, the CPA 2 hospital example would cost $1.88 per capita if it serves a catchment population of 200,000 people (Annex 8). However, it is important to note that these are not normative costs since we do not have norms for the numbers of beds per 1,000 population.

The cost per IDE for these hospitals would be $13.19 for the CPA 1 hospital, $13.96 for the CPA 2 hospital, $17.53 for the small CPA 3 hospital, $15.53 for the medium CPA 3 hospital and $14.79 for the large CPA 3 hospital. The cost per IDE for the CPA 3 hospitals is less as the number of beds increase since part of the operating costs are fixed and some of the staff do not increase proportionally with the number of occupied beds.

If a hospital runs at lower capacity, then fewer doctors, nurses and midwives and drugs are needed, but the numbers of support staff and operating costs are not much affected. If the above example of a CPA 1 hospital operates at 60% inpatient capacity instead of 85%, the

number of staff would fall to 49 and the total cost would go down to $207,731 but the cost per IDE would go up to $14.44 (because the fixed staff and operating costs are spread over fewer IDEs).

The costs are sensitive to the staffing ratios used. For example, for CPA 1 hospitals we used normative ratios of 1 MD/MA to 8 occupied beds, 1 nurse to 2.8 beds and 1 midwife to 7.5 beds (based on the CPA Guidelines). If we change the staffing ratios for the 60-bed CPA hospital in the above table to 1 MD/MA to 16 occupied beds, 1 nurse for 5.6 beds and 1 midwife for 15 beds, the total number of staff would be reduced from 60 to 45 and the budget from $260,830 to $234,292. However, this reduction is likely to affect quality of care. It should be noted that the reduction had limited effect on cost since the staffing numbers are fixed for most categories of staff.

The study of HSP 2 costs estimated that inpatient admissions would increase from 2.07 per 100 population in 2006 to 2.20 in 2007 and 2.99 in 2012 if the historical rate of growth continues, and to 2.26 in 2007 and 3.53 in 2012 if the rate of growth accelerates (Pearson[15]). In the cost section of HSP 2 it is assumed that these increases in demand can be met to some degree by making better use of existing hospital capacity.

This assumption seems reasonable since the BOR for all hospitals, excluding national hospitals, for 2007 was 68% and the ALOS was 7.4 days (both of which improved from 65% and 8.0 days in 2006). The hospitals can, therefore, treat 22% more inpatients before reaching the level of 85% and if the ALOS can be further lowered then even more can be treated. Since the ALOS at Ang Roka, Kirivong and Kampong Cham are 4.6, 5.5 and 7.3 respectively, it should be feasible to lower the overall average.

Further increases in demand would have to be addressed through investments in infrastructure as per the Health Coverage Plan.

[15] Costing of Health Strategic Plan (2008 - 2015). Mark Pearson. Health System Strengthening Cambodia Project, USAID. 2008.

9. COMPARISON OF NORMATIVE WITH ACTUAL COSTS

In 2007 Ang Roka Hospital had 26 staff and spent $175,231. As a 60-bed CPA 1 hospital, to provide the number of services that it did on 2007 it should have had 59 staff and a budget of around $258,000. The hospital director recognized the shortage of staff and identified a need for 14 additional persons, although according to the norm they needed 33 more. In terms of key staff, according to the norms, Ang Roka should have had 7 doctors (Medical Doctors and Medical Assistants), 18 nurses and 7 midwives. The hospital actually had 6 doctors, 12 nurses and 1 midwife, and was, therefore, severely under-staffed in these areas (see Annex 6 for a breakdown of the actual staff by hospital). The hospital only carried out 149 deliveries and spontaneous abortions, which may be partly because of the shortage of midwives. Also it had no dental staff, no pharmacist and no kinetic therapist. It should have a total of 16 employees engaged in non-medical roles such as administration and maintenance, but only had 4.

Prey Chor Hospital had 28 staff and spent $170,160. As a 70-bed CPA 1 hospital, to provide those numbers of services that it did in 2007 it should have had 54 staff and a budget of around $227,000. The hospital director recognized the staff shortage and estimated that they needed 17 more staff, although the norms indicate that they needed 26 more. However, if it operated at 85% and reduced its ALOS from 6.3 to 4.6 (the level at Ang Roka) it could have treated 4,721 inpatients (almost twice as many as it did treat) and provided 5,000 outpatient services with 65 staff and a budget of around $290,000. Based on the CPA Guidelines, Prey Chhor should have had about 6 doctors, 16 nurses and 6 midwives for the services that it provided in 2007. However, it only had 5 doctors, 10 nurses and 3 midwives, fewer than the norm all cases. It should have had16 employees in non-medical roles but only had 8. The low utilization rate (61% BOR) may be partly due to the low staffing level, but even with the low utilization rate the hospital appears to have been understaffed.

Kirivong Hospital had had 49 staff and spent $400,442. As an 80-bed CPA 2 hospital, for the number of services that it provided in 2007 it should have had 108 staff and a budget of around $476,000. Again, the hospital director recognized the shortage and estimated that they needed an additional 19 staff, although according to the norms they needed 59 more. However, if it operated at maximum capacity of 85% BOR it should have only treated 4,513 inpatients and provided 8,000 outpatient services with 89 staff and a budget of $374,337. Based on the CPA Guidelines, Kirivong should have had 15 doctors, 41 nurses and 13 midwives. In 2007 it actually had 7 doctors, 24 nurses and 5 midwives, and was thus seriously short of these key staff. It should have had 23 non-medical staff but only had 8.

Kampong Cham Hospital had 204 staff and spent $1,091,618. As a 260-bed CPA 3 hospital, to provide the numbers of services that it did in 2007 it should have had 314 staff and a budget of around $1,414,000[16]. However, if it operated at maximum capacity of 85% BOR it should have only treated 11,050 inpatients which would have needed 262 staff and a budget of around $1,183,000. The hospital should have had 70 doctors, 140 nurses and 38 midwives but only had 40 doctors, 102 nurses and 24 midwives. It should have had 39 non-medical staff but only had 28.

Using the norms, all four hospitals required many more staff and significant extra funding for the services that they provided in 2007, and as a result it is likely that the quality of care may have

[16] The hospital director estimated that they needed an extra 15 staff.

been less than optimal. If they had operated at the optimal BOR of 85%, Ang Roka, Prey Chhor and Kampong Cham hospitals would have needed more funds whereas Kirivong could have managed with less.

10. OTHER COSTING STUDIES

Several costing studies have been carried out in recent years. The studies with the most complete information on hospital costs were two carried by Fabricant and others in 2002 and 2003[17,18]. However, expenditures appear to have increased substantially over the 4/5 years since these studies and capacity and utilization appear to have also changed in some cases. As a result comparisons with the findings of this study are not very useful.

A more recent study of Pursat Provincial Hospital[19] showed that the hospital spent a total of $284,414 in 2004. The hospital, which has 202 beds, had 3,830 inpatient discharges and 4,093 outpatient consultations in that year. Of the total cost, 45% was spent on staff, 28% on drugs and 27% on operating costs. The cost came to $1.09 per capita. Using a cost weighting of 5 outpatient consultations to 1 inpatient day, the study estimated a cost of $1.79 per outpatient consultation, $8.97 per inpatient day and $71.74 per inpatient case (using an average ALOS of 8 days). The hospital had 117 staff. Although the hospital has 58 fewer beds than Kampong Cham, the total cost was much lower than the cost for Kampong Cham in 2007, and it is assumed that either expenditure has increased substantially over the 3 years or the allocation of funds to provincial hospitals differs greatly.

Two more recent studies used the data from the Fabricant studies described above. One study by Fabricant in 2006 used costs from his previous studies to help estimate the cost of increases utilization of health services by the poor[20]. Another study by WHO published in 2007 used 2001 estimates for district hospitals from the Fabricant studies of $0.86 per capita in non-contracting ODs and $1.38 in contracting-out ODs data and inflated them to 2007 prices of $1.00 and $1.60 respectively[21] [22].

The SRC final evaluation report estimated the average cost per contact in 2007 as $6.29 for Kirivong Hospital and $6.56 for Ang Roka Hospital. This is less than the figures of $10.67 and $8.98 used in this study, which may be because different weights for contacts were used in the two studies and/or because additional costs may have been identified in this study[23].

The actual costs in 2007 found in this study for Ang Roka and Kirivong were $8.98 and $10.67 per IDE. These costs are much higher than the average costs of $5.67 per IDE from 2006 used

[17] Cost Analysis of Essential Health Services in Cambodia. MOH/WHO Health Sector Reform Phase III Project. Final Report of Data Analysis. Steve Fabricant. WHO/USAID/POPTECH. 2002.

[18] Cost Analysis (Part 2) of Essential Health Services in Cambodia. MOH/WHO Health Sector Reform Phase III Project. Steve Fabricant, Sok Kanha, and Khout Thavary. Final Draft 11 December 2003.

[19] Hospital Financing Assessment Report, Chhorn Sao, HSSC/URC/Cambodia. February 2006.

[20] Estimating Costs of Increased Utilization of Health Services by the Poor in Cambodia. Steve Fabricant for WHO/Cambodia. Final Draft March 2006.

[21] Scaling Up for Better Health in Cambodia. WHO and Ministry of Health, Kingdom of Cambodia. WHO 2007.

[22] The figures in the Fabricant reports were mean per capita costs for 2 contracting out hospitals and for 4 non-contracting hospitals and the final figures were $1.39 and $0.88 respectively.

[23] Contracting of Health Services: Ang Rokar and Kirivong Operational Districts, Takeo Province, Cambodia – Final Evaluation Report. Sheryl Keller, Jean-Marc Thome and Jean-Yves Dekestier. April 2008. Swiss Red Cross.

in the second child survival study (which noted that the figures might not be very accurate)[24]. This is partly because total expenditure increased in 2007 and it may be that we were able to identify more expenditure for that year. The normative costs of $13.19 and $17.53 per IDE for a CPA 1 and a CPA 2 hospital are higher again, mainly since we used normative staffing levels. This means that the child survival costs were significantly under-estimated.

The average cost of $18.89 per admission used in the costing of hospital services under HSP 2 was based on 2005 costs for two hospitals and is also much less than the normative costs of $60.70 for a CPA1 hospital and $77.13 for a CPA 2 hospital. Again it seems that the HSP 2 costs may have been significantly underestimated (this possibility was noted in the HSP2 costing study).

[24] Scaling Up Child Survival Interventions in Cambodia: Service Delivery Costs. The BASICS Project/USAID. 25 February 2008. David Collins, Chan K. Chhuong and Kun Reth.

11. KEY SERVICES

Due to the difficulty of collecting comprehensive information on individual services and the lack of time available for the study, it was not possible to identify the cost of each type of service provided.

In the second child survival costing study, USAID/BASICS estimated the average cost of an inpatient day at a CPA1/CPA2 hospital as $5.67 including drugs and $2.91 excluding drugs. Based on these figures and a standard ALOS of 7 days, the average cost of a malaria admission was estimated at $20.38 excluding drugs. Similarly the average cost of a pneumonia admission was estimated at $14.96 (5 days) and that of a diarrhea admission was estimated at $5.82 (2 days). These figures were based on actual 2006 costs at Ang Roka Hospital and Kirivong Hospital.

In this study, the actual cost of an inpatient day in 2007 excluding drugs at the same hospitals was estimated at $3.59 at Ang Roka and $3.99 at Kirivong. Both costs are higher than the 2006 costs used in the child survival costing. The normative costs, excluding drugs, vary with the size of the hospital and range from $6.93 for a CPA 1 hospital to $11.31 at a small CPA 3 hospital. The average cost is $8.76. On this basis the cost of hospital treatment, excluding drugs, for child survival interventions should be $61.32 for a malaria admission, $43.80 for a pneumonia admission and $17.52 for a diarrhea admission. These figures are much higher than the cost estimates produced in the child survival costing study (as was noted above). It is possible that other estimates of the cost of hospitals services, such as for reproductive health, HIV/AIDS and TB have also been understated.

12. CONCLUSIONS AND RECOMMENDATIONS

The resources needed to provide the CPA at the hospitals varies significantly depending on the level of hospital (CPA 1, 2 or 3) and the number of occupied beds. Based on the norms and assuming a BOR of 85%, the number of staff needed to operate a hospital varies from 49 persons for a 40-bed CPA 1 hospital to 255 persons for a 250-bed CPA 3 hospital. The annual cost of the hospitals would range from around $200,000 for the 40-bed CPA 1 hospital to around $1.1 million for the 250-bed CPA 3 hospital.

These figures are sensitive to the staffing ratios used. For example, for CPA 1 hospitals we used normative ratios of 1 MD/MA to 8 occupied beds, 1 nurse to 2.8 beds and 1 midwife to 7.5 beds (based on the CPA Guidelines). Using those ratios a 60 bed CPA 1 hospital would need a total of 60 staff and a budget of around $260,000. If we change the staffing ratios to 1 MD/MA to 16 occupied beds, 1 nurse for 5.6 beds and 1 midwife for 15 beds, the total number of staff would be reduced to 45 and the budget to around $234,000. However, this reduction is likely to affect quality of care. It should be noted that the staffing numbers are fixed for certain categories of staff, such as laboratory technicians, where a minimum number is needed to run a hospital.

The cost per capita depends on the size of the catchment population, the level of hospital, and the number of occupied beds. For a 60-bed CPA 1 hospital serving a population of 100,000 people the per capita cost would be $2.62. For an 80-bed CPA 2 hospital serving a catchment population of 200,000 people the per capita cost would be $1.88. For a CPA 3 hospital serving a province of 2,000,000 people and acting as a second-level provincial referral hospital, the per capita cost would be $0.59 cents. This last figure would have to be added to the per capita cost of the various district hospitals in the province to arrive at a total hospital per capita cost for the province. Note that we did not have norms for numbers of beds per thousand population and these figures do not, therefore, represent normative per capita costs.

The normative cost per inpatient day equivalent (IDE) would range from $13.19 at a 60-bed CPA 1 hospital to $17.53 at a 100-bed CPA 3 hospital. The cost per IDE of a CPA 3 hospital would be less for larger hospitals due to economies of scale. At the same CPA 1 hospital, assuming an ALOS of 4.6 days this would translate to an average cost of $60.70 per admission. At the 100 bed CPA 3 hospital with an ALOS of 7.3 days the average cost per admission would be $127.96.

The HSP 2 targets could not be translated into specific hospital targets for all services. The HSP 2 costing assumed that increases in hospital services would be necessary but that these could be provided to some degree through greater and more efficient use of existing capacity. This seems reasonable since there is a significant gap between the average BOR of 68% for all CPA hospitals in 2007 and the optimal BOR of 85%, meaning that more inpatients can be treated without having to increase the numbers of beds. Lowering the average ALOS from the national average of 7.4 days in 2007 to the rates achieved in the sample of contracting hospital would allow even more inpatients to be treated.

However, the additional cost of bringing the resources of the existing hospitals up to the normative levels would be significant, especially for staffing. For example, Ang Roka Hospital, a 60-bed CPA 1 hospital in Takeo Province, had a BOR of 84% and an ALOS of 4.6 days in 2007 and was already operating at close to optimal capacity. However, it only had 26 staff and spent

$175,231 in that year, whereas according to the norms it should have had 59 staff and a budget of around $258,000.

As another example, Prey Chhor Hospital, a 70-bed CPA 1 hospital in Kampong Cham Province, had a BOR of 61% and an ALOS of 6.3 days in 2007. It had 28 staff and spent $170,160 in that year, whereas for the number of services that it provided it should have had 54 staff and a budget of around $227,000. However, if it operated at optimal capacity and reduced its ALOS to 4.6 days it would treat twice as many inpatients but would require 65 staff and a budget of around $290,000.

The funding for the sample of contracting hospitals used for this study came from a variety of sources. Between 67% and 83% of the funds came from the Government, most of which was in drugs and supplies. User fees, health equity funds and health insurance made up between 12% and 24% of total funding. Direct donor assistance made up between 5% and 9% of total funding. A portion of the Government funding and the health equity funds are also donor funded. Depending on the ability of the Government to finance the increased costs it is likely that a significant portion of the increased funds needed would have to come from user fees and insurance and from donors, at least in the short term.

Both the actual 2007 costs and the normative costs estimated in this study are significantly higher than the costs used in the second child survival costing study and in HSP 2, and may be higher than figures used in estimating the cost of the reproductive health, HIV/AIDS and TB strategic plans. The strategic plan costs need to be reviewed and, if necessary, adjusted.

The costing model can be used to estimate a budget for any referral hospital. However, it is important to note that these costs are rough estimates. The following recommendations are made regarding improving the quality of this information.

- For this study the staffing norms were developed from ranges shown in CPA Guidelines and drug and supply costs were based on actual amounts provided to the hospitals. They may not reflect accurately the needs of the hospitals and they do not take into account differences in patient mix. These figures should be reviewed by the MOH and an analysis and determination of standard clinical practices should also be carried out to develop more accurate staffing norms and standard drug and clinical supply needs.
- The figures used for staff remuneration were based on averages of actual payments at the sample of hospitals. These figures should be reviewed and, if necessary, adjusted.
- A more detailed analysis of the operating costs would also be advisable, since it is possible that some aspects, such as maintenance, are underfunded and that this may not have been fully taken into account by the hospital directors when they estimated the additional funds needed.

We also recommend that the HSP2 targets be translated into specific service delivery targets. This will assist the health centers and hospitals to set targets that will result in the achievement of HSP2 goals.

ANNEX 1: CPA SERVICES (COPIED FROM CPA GUIDELINES)

Clinical Services	CPA1	CPA2	CPA3	Observations
Emergency care	X	X	X	Different package
General medicine for adults	X	X	X	
Surgery		X	X	
Gynaeco-obstetrics	X	X	X	
Pediatrics	X	X	X	
Tuberculosis	X	X	X	
Referral consultation and Kinetic therapy	X	X	X	
Operation theatre and ICU		X	X	
Oral and Dentist	X	X	X	
Infectious diseases: TB, HIV/AIDS, Malaria	X	X	X	
Medical audit death	X	X	X	
Specialized services			X	eg. ENT, Ophialmology
Clinical support services				
Laboratory	X	X	X	
Blood bank			X	
Blood depot		X		
Pharmacy	X	X	X	
Imagery	X	X	X	
Administration and Finance				
Finance and accounting section	X	X	X	
Administration and Personnel	X	X	X	
Transportation, Ambulance, and security	X	X	X	
Maintenance of medical equipment	X	X	X	
Warehouse for equipment and materials	X	X	X	
Sanitation, waste management, and morgue	X	X	X	
Laundry and canteen	X	X	X	

ANNEX 2: INPATIENT STATISTICS BY WARD

	Ang Roka	Pre Chhor	Kirivong	Kampong Cha
Beds - Medicine	10	23	24	66
Beds - Surgery	4	7	16	80
Beds - Pediatric	8	8	16	25
Beds - Maternity	4	7	8	30
Beds - other	4	5	-	29
Beds - TB	30	20	16	30
Beds - Total	**60**	**70**	**80**	**260**
Discharges, referrals and deaths - Medicine	835	514	1,966	3,524
Discharges, referrals and deaths - Surgery	120	162	850	3,342
Discharges, referrals and deaths - Pediatric	2,298	949	2,508	3,914
Discharges, referrals and deaths - Maternity	134	212	1,114	2,314
Discharges, referrals and deaths - Others	567	618	-	575
Discharges, referrals and deaths - TB	77	37	64	314
Discharges, referrals and deaths - Total	**4,031**	**2,492**	**6,502**	**13,983**
Hospitalization Days - Medicine	3,485	4,215	10,402	28,275
Hospitalization Days - Surgery	358	816	5,871	31,329
Hospitalization Days - Pediatrics	8,196	5,099	13,075	15,928
Hospitalization Days - Maternity	185	888	4,647	12,907
Hospitalization Days - Other	1,765	3,069	-	4,435
Hospitalization Days - TB	4,392	1,509	1,444	8,875
Hospitalization Days - Total	**18,381**	**15,596**	**35,439**	**101,749**
ALOS - Medicine	4.2	8.2	5.3	8.0
ALOS - Surgery	3.0	5.0	6.9	9.4
ALOS - Pediatric	3.6	5.4	5.2	4.1
ALOS - Maternity	1.4	4.2	4.2	5.6
ALOS - Others	3.1	5.0		7.7
ALOS - TB	57.0	40.8	22.6	28.3
ALOS - all	**4.6**	**6.3**	**5.5**	**7.3**
BOR - Medicine	95%	50%	119%	117%
BOR - Surgery	25%	32%	101%	107%
BOR - Pediatric	281%	175%	224%	175%
BOR - Maternity	13%	35%	159%	118%
BOR - Other	121%	168%		42%
BOR - TB	40%	21%	25%	81%
BOR - All	**84%**	**61%**	**121%**	**107%**

ANNEX 3: CPA 1 STAFFING STANDARDS FROM CPA GUIDELINES

The following is described in English section of the CPA Guidelines as the staffing standards for a CPA 2 Hospital but the Khmer version says that it is for a CPA 2 hospital

3. CPA2 Referral Hosptial (40-60 beds)

At least there should be essential obstetric service with 5-10 beds

1	Medical Doctor/Medical Assistant	5-7
2	Dentist/dentistry nurse	2
3	Nurses and specialty nurses	15-22
4	Midwife	6-8
5	Pharmacist	1-2
6	Lab technician	3
7	Radiology technician	2
8	Kinetic Therapist	1-2
9	Technician on maintenance of equipment, material and facility	2-3
10	Cleaner	2-3
11	Launderer	1-2
12	Kitchen worker	1-2
13	Driver	1
14	Administration	2-5
15	Accountant	1
16	Information Technology	1-2
	Total	**47-65**

In case of need: workers or floating staff or contracting staff can be recruited.

ANNEX 4: CPA 2 STAFFING STANDARDS FROM CPA GUIDELINES

2. CPA2 Referral Hosptial (60-100 beds)

At least there should be emergency care service and surgery service

1	Medical Doctor/Medical Assistant	11-14 Minimum: 3 surgeons and 1 imagery specialist.
2	Dentist/dentistry nurse	2
3	Nurses and specialty nurses	22-32 (3 anesthesia specialist) 4 for equipment and material arrangement, 2 for mental health
4	Midwife	7-10
5	Pharmacist	2-3
6	Lab technician	3-5
7	Radiology technician	3
8	Kinetic Therapist	2-3
9	Technician on maintenance of equipment, material and facility	3-5
10	Cleaner	3-4
11	Launderer	2-3
12	Kitchen worker	2-3
13	Driver	1-2
14	Administration	3-4
15	Accountant	1
16	Information Technology	1-2
	Total	**68-96**

In case of need: workers or floating staff or contracting staff can be recruited.

ANNEX 5: CPA 3 STAFFING STANDARDS FROM CPA GUIDELINES

Appendix 9: Personnel Standard

1. CPA3 Referral Hosptial (100-250 beds)

1	Medical Doctor/Medical Assistant	23-35 Minimum: -6 surgeons, -1 Anesthesia specialist (CESAR), -1 Pediatric surgeon, -1 Ophthlamologist, -1 ENT specialist, -1 psychiatrist, and 2 imagery specialists.
2	Dentist/dentistry nurse	2-3 At least one dentist
3	Nurses and specialty nurses	78-103 (5 anesthesia technician (ISAR)) 6 for equipment and material arrangement, 3 for mental health
4	Midwife	15-20
5	Pharmacist	3-4
6	Lab technician	6-8
7	Radiology technician	3
8	Kinetic Therapist	3-4
9	Technician on maintenance of equipment, material and facility	5-7 At least there should be one electronic engineer
10	Cleaner	4-5
11	Launderer	3-4
12	Kitchen worker	3-4
13	Driver	1-2
14	Administration	4-6
15	Accountant	1-2
16	Information Technology	1-2
	Total	**155-212**

In case of need: workers or floating staff or contracting staff can be recruited.

ANNEX 6: ACTUAL STAFFING NUMBERS FOR 2007

	Ang Roka	Prey Chhor	Kirivong	Kampong Cham
Beds	60	70	80	260
Maximum beds				
STAFFING				
Medical Doctors / Medical Assistants	6	5	7	41
Dentist/Dentistry Nurses	-	1	1	2
Nurses	12	10	24	102
Midwives	1	3	5	24
Pharmacists	-	-	1	3
Lab technicians	3	1	3	3
Radiology technicians	-	-	-	1
Kinetic therapists (physiotherapists)	-	-	-	-
Total medical staff	**22**	**20**	**41**	**176**
Maintenance Technicians				
Cleaners				
launderers				
Kitchen Workers				
Drivers				
Total general workers	**4**	**7**	**8**	**20**
Administration				
Accountants				
Information Technology				
Total aministration staff	**0**	**1**	**0**	**8**
Total	**26**	**28**	**49**	**204**

ANNEX 7: COST MODEL EXAMPLE FOR CPA 1 HOSPITAL (US$)

Standard Cost Model		**CPA 1 Hospital**		
Range of beds		40 to 60		
UTILIZATION ASSUMPTIONS				
Catchment population		133,056		
Number of beds		60		
BOR		85%		
Occupied beds		51		
Annual inpatient days		18,615		
ALOS		4.6		
Admissions / Discharges		4,047		
Outpatient services		5,000		
Admissions per 100 population		3.04		
STAFFING	**Norms for beds per staff**	**Numbers**	**Annual pay**	**Total cost**
Medical Doctors / Medical Assistants	8.0	7	2,722	19,056
Dentist/Dentistry Nurses	na	2	1,932	3,865
Nurses	2.8	19	1,602	30,445
Midwives	7.5	7	1,750	12,253
Pharmacists	na	2	2,611	5,222
Lab technicians	na	3	1,679	5,038
Radiology technicians	na	2	2,029	4,059
Kinetic therapists (physiotherapists)	49.0	2	1,763	3,526
Maintenance Technicians	na	2	884	1,768
Cleaners	na	2	884	1,768
launderers	na	2	884	1,768
Kitchen Workers	na	2	884	1,768
Drivers	na	1	884	884
Administration	na	4	1,565	6,262
Accountants	na	1	1,565	1,565
Information Technology	na	2	1,565	3,131
Total		**60**	-	**102,378**
Drug and suppplies cost per inpatient day		18,615	6.22	115,863
Drug and supplies cost per outpatient service		5,000	1.69	8,432
Total drugs and supplies				**124,295**
Operating costs				**35,458**
Total				**262,131**
Cost per capita				1.97
Cost per inpatient bed day				13.20
Cost per inpatient admission				60.70

The shaded figures are ones that are entered by the user.

ANNEX 8: COST MODEL EXAMPLE FOR CPA 2 HOSPITAL (US$)

Standard Cost Model		**CPA 2 Hospital**		
Range of beds		60 to 100		
UTILIZATION ASSUMPTIONS				
Catchment population		200,000		
Number of beds		80		
BOR		85%		
Occupied beds		68		
Annual inpatient days		24,820		
ALOS		5.5		
Admissions / Discharges		4,513		
Outpatient services		8,000		
Admissions per 100 population		2.26		
STAFFING	**Norms for beds per staff**	**Numbers**	**Annual pay**	**Total cost**
Medical Doctors / Medical Assistants	6.5	11	2,722	29,945
Dentist/Dentistry Nurses	na	3	1,932	5,797
Nurses	2.4	29	1,602	46,469
Midwives	7.5	10	1,750	17,504
Pharmacists	na	4	2,611	10,444
Lab technicians	na	4	1,679	6,717
Radiology technicians	na	3	2,029	6,088
Kinetic therapists (physiotherapists)	49.0	2	1,763	3,526
Maintenance Technicians	na	4	884	3,537
Cleaners	na	4	884	3,537
launderers	na	3	884	2,653
Kitchen Workers	na	3	884	2,653
Drivers	na	2	884	1,768
Administration	na	4	1,565	6,262
Accountants	na	1	1,565	1,565
Information Technology	na	2	1,565	3,131
Total		**89**	-	**151,594**
Drug and suppplies cost per inpatient day		24,820	6.22	154,484
Drug and supplies cost per outpatient service		8,000	1.69	13,491
Total drugs and supplies				**167,975**
Operating costs				**56,526**
Total				**376,095**
Cost per capita				1.88
Cost per inpatient bed day				14.02
Cost per inpatient admission				77.13

The shaded figures are ones that are entered by the user.

ANNEX 9: COST MODEL EXAMPLE FOR SMALL CPA 3 HOSPITAL

Standard Cost Model		**Small CPA 3 Hospital**		
Range of beds		100 to 150 beds		
UTILIZATION ASSUMPTIONS				
Catchment population		1,600,000		
Number of beds		100		
BOR		85%		
Occupied beds		85		
Annual inpatient days		31,025		
ALOS		7.3		
Admissions / Discharges		4,250		
Outpatient services		-		
Admissions per 100 population		0.27		
STAFFING	**Norms for beds per staff**	**Numbers**	**Annual pay**	**Total cost**
Medical Doctors / Medical Assistants	4.0	22	2,722	59,890
Dentist/Dentistry Nurses	na	2	1,932	3,865
Nurses	2.0	43	1,602	68,902
Midwives	7.5	12	1,750	21,004
Pharmacists	na	3	2,611	7,833
Lab technicians	na	6	1,679	10,075
Radiology technicians	na	3	2,029	6,088
Kinetic therapists (physiotherapists)	49.0	2	1,763	3,526
Maintenance Technicians	na	5	884	4,421
Cleaners	na	4	884	3,537
launderers	na	3	884	2,653
Kitchen Workers	na	3	884	2,653
Drivers	na	2	884	1,768
Administration	na	4	1,565	6,262
Accountants	na	2	1,565	3,131
Information Technology	na	2	1,565	3,131
Total		**118**	-	208,737
Drug and suppplies cost per inpatient day		31,025	6.22	193,105
Drug and supplies cost per outpatient service				-
Total drugs and supplies				193,105
Operating costs				141,980
Total				543,822
Cost per capita				0.34
Cost per inpatient bed day				17.53
Cost per inpatient admission				127.96

The shaded figures are ones that are entered by the user.

ANNEX 10: COST MODEL EXAMPLE FOR MEDIUM CPA 3 HOSPITAL

Standard Cost Model		**Medium CPA 3 Hospital**		
Range of beds		151 to 200 beds		
UTILIZATION ASSUMPTIONS				
Catchment population		1,600,000		
Number of beds		175		
BOR		85%		
Occupied beds		148.75		
Annual inpatient days		54,294		
ALOS		7.3		
Admissions / Discharges		7,438		
Outpatient services				
Admissions per 100 population		0.46		
STAFFING	**Norms for beds per staff**	**Numbers**	**Annual pay**	**Total cost**
Medical Doctors / Medical Assistants	4.0	38	2,722	103,446
Dentist/Dentistry Nurses	na	3	1,932	5,797
Nurses	2.0	75	1,602	120,177
Midwives	7.5	20	1,750	35,007
Pharmacists	na	4	2,611	10,444
Lab technicians	na	7	1,679	11,755
Radiology technicians	na	4	2,029	8,117
Kinetic therapists (physiotherapists)	49.0	4	1,763	7,051
Maintenance Technicians	na	6	884	5,305
Cleaners	na	5	884	4,421
launderers	na	4	884	3,537
Kitchen Workers	na	4	884	3,537
Drivers	na	3	884	2,653
Administration	na	4	1,565	6,262
Accountants	na	2	1,565	3,131
Information Technology	na	2	1,565	3,131
Total		**185**		**333,771**
Drug and suppplies cost per inpatient day		54,294	6.22	337,934
Drug and supplies cost per outpatient service				-
Total drugs and supplies				**337,934**
Operating costs		Increase		171,559
Total				**843,264**
Cost per capita				0.53
Cost per inpatient bed day				15.53
Cost per inpatient admission				113.38

The shaded figures are ones that are entered by the user.

ANNEX 11: COST MODEL EXAMPLE FOR LARGE CPA 3 HOSPITAL

Standard Cost Model		**Large CPA 3 Hospital**		
Range of beds		201 to 250 beds		
UTILIZATION ASSUMPTIONS				
Catchment population		2,000,000		
Number of beds		250		
BOR		85%		
Occupied beds		212.5		
Annual inpatient days		77,563		
ALOS		7.3		
Admissions / Discharges		10,625		
Outpatient services				
Admissions per 100 population		0.53		
STAFFING	**Norms for beds per staff**	**Numbers**	**Annual pay**	**Total cost**
Medical Doctors / Medical Assistants	4.0	54	2,722	147,003
Dentist/Dentistry Nurses	na	3	1,932	5,797
Nurses	2.0	107	1,602	171,453
Midwives	7.5	29	1,750	50,761
Pharmacists	na	5	2,611	13,055
Lab technicians	na	8	1,679	13,434
Radiology technicians	na	5	2,029	10,146
Kinetic therapists (physiotherapists)	49.0	5	1,763	8,814
Maintenance Technicians	na	7	884	6,189
Cleaners	na	6	884	5,305
launderers	na	5	884	4,421
Kitchen Workers	na	5	884	4,421
Drivers	na	4	884	3,537
Administration	na	6	1,565	9,393
Accountants	na	4	1,565	6,262
Information Technology	na	2	1,565	3,131
Total		**255**		**463,121**
Drug and suppplies cost per inpatient day		77,563	6.22	482,763
Drug and supplies cost per outpatient service				-
Total drugs and supplies				**482,763**
Operating costs		Increase		**201,138**
Total				**1,147,022**
Cost per capita				0.57
Cost per inpatient bed day				14.79
Cost per inpatient admission				107.96

The shaded figures are ones that are entered by the user.

ANNEX 12: PEOPLE CONSULTED

His Excellency, Prof. Eng Huot, Secretary of State for Health, MOH
Professor Sann Chan Soeung, Deputy Director General for Health, NIP Program Manager, MOH
Dr. Lo Veasnakiry, Director of the Department of Planning and Health Information, MOH
Dr. Michael Bernhart, Chief of Party, URC
Dr. Heng Vuthy, QI/Hospital Program ManagerURC
Dr. Frances Dailey, Technical Advisor, URC
Mr. Tapley Jordanwood, Health Financing Program Manager, URC
Dr. Niklas Danielsson, Child and Adolescent Health Medical Officer, WHO
Dr. Sok Srun, Deputy Director, Department of Hospital Services, MOH
Dr. Sun Nasy, Deputy Director, RACHA
Mr. Fred Griffiths, Advisor, MOH
Ms. Maryam Bigdeli, Health Economist, WHO
Dr. Thach Ly Khann, Provincial Coordinator RACHA
Dr. Him Phannary, Senior Public Health Advisor, BTC
Dr. Chan Sorya, Provincial Coordinator, UNICEF
Ms. Luize Guimaraes Scherer Navarro, Chargee de Projets AFD
Ms. Hilde Schalenbourg, Finance and Admin Delegate, SRC
Mr. Sam Sam Oeun, Technical Advisor Finance, SRC
Dr. Bun Samnang, DPHI, MOH
Dr. Ros Chhun Eang, DPHI, MOH
Dr. Rasoka Thor, Project Officer, UNICEF
Ms. Siobhan McClelland, OPML
Mr. Mike Naylor, Principal Consultant, Health, Oxford Policy Management
Mr. Ravindra Bhupathy, OPML
Mr Roger Hay, OPML
Dr. Ly Nareth, World Bank
Dr. Toomas Palu, Lead Health Specialist, World Bank
Dr. Sok Kanha, Deputy Director, DPHI, MOH
Ms. Katherine Crawford, Director Office of Public Health and Education, USAID
Dr. Sek Sopheanarith, Development Assistance Specialist, OPHE, USAID
Mr. Jonathan Ross, Vice Director, OPHE, USAID
Dr. Heng Thy, Ang Roka Hospital Director
Mr. Prak Buntheoun, Ang Roka OD director
Dr. Mey Sambo, Kirivong Hospital Director
Dr. Meas Chea, Kampong Cham Hospital Director

MOH costing task team

Dr. Lim Yi	National Center for HIV/AIDS, Dermatology and STDs
Dr. Peng Vanny	University Research Co., LLC-Cambodia
Dr. Lim Nary	Reproductive Health and Child Health Alliance
Dr. Khoy Dy	Reproductive Health and Child Health Alliance
Dr. Heng Limtry	National Center for Health Promotion
Dr. Vong Sathiarany	National Center for Maternal and Child Health – PMTCT Programme
Dr. Tung Rathavy	National Reproductive Health Programme
Dr. Sun Sammang	Department of Planning and Health Information
Dr. Var Chivorn	Reproductive Health Association of Cambodia
Mr. Ork Vichit	National Immunization Programme
Dr. Khuon Eng Mony	Preventive Medicine Department
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Dr. Ou Kevanna	National Nutrition Programme
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Dr. Lo Veasnakiry	Department of Planning and Health Information
Mr. Prateek Gupta	Basic Support for Institutionalizing Child Survival

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