COSTING LIBERIA'S BASIC PACKAGE OF HEALTH SERVICES
COUNTY HOSPITAL LEVEL

Rebuilding Basic Health Services Project (RBHS)

Horton Building, Horton Avenue, Monrovia, Liberia

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Executive Summary

The Liberian Ministry of Health and Social Welfare (MOHSW) has developed a Basic Package of Health Services (BPHS) as a cornerstone of its National Health Plan. The purpose of the BPHS is to: 1) describe a standardized package of services that that will be implemented at each level of the Liberian health system; and 2) in accordance with the stated policy of decentralization, to promote a (re)distribution of health services in a way that ensures that there will be universal access to essential health services throughout Liberia.[1]

The BPHS is being costed at each level of service delivery in a series of phased costing exercises. The first phase was carried out in early 2009 and covered the clinic and health center level. This report covers the costing of the county hospital level and a costing of community level services is to be planned.

According to the BPHS, county hospitals provide both primary and secondary care. These hospitals are open 24 hours, and the staff is usually organized in two shifts in order to provide appropriate medical, midwifery and nursing cover at all times. This makes it possible for more severe medical and pediatric cases to be cared for and for basic emergency obstetric care (BEOC) to be provided. The county hospital provides primary care to the people living close by, secondary medical care and BEOC to a similar size of population as a health centre, and general surgical and surgical obstetric care to the whole county (an average population of about 200,000). It is supposed to have an operating theatre, a more extensive laboratory with blood transfusion services, a basic X-Ray machine and small ultrasound machine. It should have more than 50 beds, with a permanent capacity for intensive care. The hospital should be staffed with doctors and should have an ambulance and a 4-wheel drive vehicle.

It should be noted that the BPHS does not set out need norms for county hospitals (usually expressed in terms of beds per population). As stated in Section 1 of this report we assumed that a county hospital provides inpatient services to an average population of 200,000 persons but the BPHS does not state how many beds such a hospital should have. The average figures for admissions, beds and costs per capita are therefore not normative in terms of the need for inpatient services.

Costing the BPHS at the county hospital level required two main steps: first, taking a sample of actual facilities to retrieve their cost and utilization data; and second, creating norm-driven cost models for hospitals.

The normative models and cost estimates developed are intended to serve as a basis for preparing standard budgets for provision of BPHS services at hospitals. The cost estimates can then be used for planning and budgeting at the national level to achieve targets set out by the MOHSW in the National Health Plan. Some key results from the costing are as follows.

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[1] The basic package of Health and Social Welfare Services. Republic of Liberia. Ministry of Health and Social Welfare. Monrovia, Liberia.

The resources needed to provide services at different sized hospitals vary depending on the number of occupied beds and length of inpatient admissions. At the BPHS staffing levels, an 80-bed hospital at 85% Bed Occupancy Rate (BOR) and 5-day Average Length of Stay (ALOS) would cost a total of $404,291 per year, which comes to an average of $14.09 per Inpatient Day Equivalent (IDE). A 120-bed hospital would cost a total of $779,794 per year, which comes to an average of $18.11 per IDE.

Increasing the staffing from the BPHS staffing norm of 68 beds and 102 beds per physician (at <100 and >100 sized hospitals) to a norm of 22 beds per physician would change the total annual costs at 80-bed and 120-bed hospitals to $467,667 and $856,706, respectively. The annual average per capita costs would change from $2.02 to $2.34 at the 80-bed hospital, and from $2.60 to $2.86 at the 120-bed hospital. 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 total actual annual costs at the hospitals sampled for 2008/09 were as follows: $312,882 total cost at Curran Hospital; $1,679,689 total cost at Phebe Hospital; and $453,177 total cost at Tellewoyan Hospital. The costs per IDE at the three hospitals were, respectively: $21.96, $38.51, and $31.91, with an average of $30.79. The costs per capita at the hospitals were, respectively: $3.13, $3.36, and $1.64, with an average of $2.71. There was not sufficient cost and utilization information gathered at Liberia Government Hospital in Tubmanburg to be included in this analysis. There was also not sufficient cost information gathered at Redemption to be included in the cost analysis.

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

- The MOHSW should establish catchment populations for each facility. This data was not readily available at the MOHSW, and had to be roughly estimated by hospital administrators. In addition, normative catchment populations for the hospitals at each size and level should be determined by the MOHSW.
- The MOHSW should review staffing norms for different sized hospitals at each level of care (primary, secondary, tertiary). For this study, staffing was based on norms provided in an older version of the BPHS. The BPHS norms were compared with Ugandan staffing norms determined in another study. The BPHS norms may not reflect accurately the needs of the hospitals and they do not take into account differences in patient mix.
- The figures used for staff remuneration were based on the BPHS salary structure from 2007; these figures should be reviewed and updated as necessary. In addition, several staff categories listed in the BPHS staffing norms are not found in the salary structure.
- 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.
- Hospitals should be encouraged to maintain detailed records of expenditure, allowing for the accurate allocation of staff, drugs across the hospitals wards and between inpatient

and outpatient departments. Detailed operating cost records should also be kept.

- The MOHSW should continue rolling out the HMIS to hospitals, and ensure data are being collected correctly. Hospitals should additionally be encouraged to regularly maintain utilization records and statistics; in particular, total hospitalization days in order to calculate bed occupancy rate and average length of stay. These statistics should be monitored regularly to ensure hospitals are running efficiently and at a high level of quality.

A high level of detailed cost and utilization records will allow for better modeling of these costs. The budgets and plans based on the hospital cost models will therefore more accurately predict the resources required to provide different levels and numbers of services. The sample size used in this report is small, and we recommend increasing the number of county hospitals in future analyses to ensure greater accuracy.

Introduction

Liberia's National Health Plan 2007-2011 (NHP) provides a summary of the situation in the country at the time that it was written and the following sections of it are relevant as an introduction to this report.

It noted that Liberia was emerging from more than 14 years of destructive war and a 'culture' of violence. The elections of 2005 ushered in an era of new leadership and optimism that have already resulted in significant improvements in the health sector.

At the time of writing the NHP, the population was estimated at 3.2 million with a growth rate of 2.4%. Land area comprised 111,370 square km and population density was estimated at around 30 per square km, but very uneven, with four counties containing 70% of the total population.

Massive population displacement in the rural areas during the war led to artificially accelerated urbanization, resulting in severe overcrowding in towns and cities. The literacy rate was less than 40%. And three fourths of the population lived below the poverty line on less than US$1 a day. The economy, however, was making a modest recovery, and there has been a gradual improvement in security in rural areas.

Liberia's health services were severely disrupted by years of conflict and looting. While revitalization of the health services has begun, the NHP noted that it was still far from satisfactory. The following table summarizes the health status of Liberia, based on two different sources - the NHP and the 2007 DHS. Whereas the DHS surveys occurred over 2006/2007, the National Health Plan quotes a variety of sources for the health indicators, some of which date back to 2000. As a result of the differing times at which the data were collected, as well as the differing methodologies used, some of the indicators vary widely.

Table 1: Comparison of Liberia's health indicators, based on National Health Plan and Demographic Health Survey

Indicator	2007 NHP[2]	2007 DHS[3]
Infant Mortality Rate (per 1,000)	157[4]	72
Under-Five / Child Mortality Rate (per 1,000)	235[5]	111
Maternal Mortality Ratio (per 100,000)	580[6]	994
HIV prevalence (%)	5.2[7]	1.5
Exclusive breast-feeding of children < 6 months (%)	35[8]	29
Moderate underweight rates of children < 5 years (%)	27[9]	39
Severe underweight rates of children <5 years (%)	7[10]	8
Access to safe water (%)	24[11]	65
Access to sanitation (%)	26[12]	10

The MOHSW Rapid Assessment (2007)[13] identified 354 functional health facilities, including 286 clinics, 50 health centres, and 18 hospitals. An additional 200 health facilities were identified as nonfunctional. Access to health services was estimated to be 41%. The health workforce was estimated at approximately 4,000 full-time and 1,000 part time staff. This included 168 physicians, 273 physician assistants, 453 registered nurses, and more than 1,000 nurse aides and other health professionals.

The NHP described the health care system as fragmented, uneven, and heavily dependent on vertical programs and NGOs still operating in a humanitarian mode. However, it noted that the vertical programs resulted in some significant achievements, e.g., 35% of health facilities received some rehabilitation, and EPI coverage increased to 87%.

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[2] Republic of Liberia National Health Plan, 2007 – 2011. Ministry of Health and Social Welfare, Monrovia, Liberia.

[3] Liberia Institute of Statistics and Geo-Information Services (LISGIS) [Liberia], Ministry of Health and Social Welfare [Liberia], National AIDS Control Program [Liberia], and Macro International Inc. 2008. *Liberia Demographic and Health Survey 2007.* Monrovia, Liberia: Liberia Institute of Statistics and Geo-Information Services (LISGIS) and Macro International Inc.

[4] UNICEF: The Official Summary of The State of the World's Children 2006; World Development Indicators database, April 2006

[5] Ibid.

[6] According to the NHP, this figure was estimated by the UNFPA in 2005.

[7] According to the NHP, HIV prevalence rate estimates vary widely, but the Interim Poverty Reduction Strategy (iPRS) suggests a figure of 5.2%.

[8] UNICEF, 2006.

[9] Liberian National Micronutrients Survey, 2000.

[10] Ibid.

[11] UNDP, 2006.

[12] UNICEF, 2006.

[13] Republic of Liberia, National health policy / National health plan, 2007-2011. Ministry of Health & Social Welfare. Monrovia, Liberia.

The NHP noted that the challenges for rebuilding the health system are many and diverse. The immediate challenge was described as ***expanding access to basic health care of acceptable quality***, by:

- Ensuring the availability of funds at county level to support the continuous delivery of basic services;
- Improving the availability of essential medicines and other critical health commodities;
- Rehabilitating health facilities in under-served areas;
- Upgrading the skills of health workers and redeploying them to areas where they are most needed;
- Boosting management capacity at all levels to support the delivery of services. The first step in this direction is improving the information base and monitoring and evaluation capacity.
- Improving availability of safe water and sanitary facilities.

The NHP also described the many long-term challenges, which included:

- Ensuring the availability of adequate resources to sustain the investments called for by reconstruction, as well as the increased recurrent expenditure induced by it;
- Restructuring resource allocation patterns, so that underserved communities benefit adequately from health sector recovery;
- Strengthening the supply chain and rationalizing pharmaceutical management to ensure the availability of affordable, safe, effective essential drugs and other critical commodities;
- Revamping the health care network, through targeted investments in health care and support facilities, in view of increasing access to primary and referral health services;
- Establishing effective management systems capable of operating a modern health sector and evolving as the context and health needs of the Liberian population change over time;
- Introducing effective regulatory provisions and mechanisms to ensure adhesion to norms, fair and productive competition, and quality health services.

The MOHSW has defined a Basic Package of Health Services (BPHS), which is described as the cornerstone of the national health plan. The BPHS defines the services that the Ministry of Health and Social Welfare (MOHSW) assures will be available to each and every Liberian. The BPHS standardizes prevention and treatment services throughout the health system to ensure that all individuals, wealthy or poor, living in urban or in rural areas, receive the same package of care.

The NHP describes the BPHS as a "minimum package" to be made available as an integrated whole, rather than an assortment of vertical and parallel programs. Additional services not currently included in the BPHS will, once approved by the MOHSW, be added to, but not substituted for, those already included in the BPHS. A fully functional health facility must be able to offer the complete BPHS to the entire catchment population.

The BPHS is intended to provide a basis for the preparation of operational plans, and thus also for budgets.

Objectives of the costing

Thus far, two studies have been undertaken to model the costs of Liberia's BPHS—one at the health center and clinic level, and a second at the county hospital level. A draft report on the initial costing phase at the health center and clinic level is awaiting validation by the MOHSW.[14] The second costing phase, at the hospital level, is described in this document and will also undergo a validation by the MOHSW. A third phase is being planned to cost the BPHS at the community level.

The models and cost estimates developed are intended to serve as a basis for preparing standard budgets for provision of BPHS services at each level of healthcare. The cost estimates can then be used for planning and budgeting at the national level to achieve targets set out by the MOHSW in the National Health Plan.

The main objective was to prepare a standard cost model of the package of services that will provide estimates of the resources required to implement the BPHS at varying hospital sizes. The information in this report may also be used to compare the current costs and utilization across the hospitals sampled.

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[14] Collins, David and Jarrah, Zina. Costing the basic package of health services at clinics and health centres in Liberia. 26 August 2009.

1.   BPHS structure

Types of service

The BPHS covers the following services: Maternal and Newborn Health, Child Health, Reproductive and Adolescent Health, Communicable Disease Control, Mental Health and Emergency Care. A summary of the services can be found in Annex 1.

At present, the BPHS includes only the highest priority services that can be implemented given Liberia's current resources and constraints. As a result, certain services that are often included under basic primary health care may not be included in the current version of the BPHS. Control of Non-Communicable Diseases, especially diabetes and hypertension, will be added to the BPHS as soon as they have been assessed and resources become available to provide the services.

Levels of care
According to the BPHS Guidelines, the BPHS involves an integrated provision of primary and secondary care. Primary care, including both outpatient curative and preventive care as well as outreach services, is provided at all health facilities for their primary catchment area. This applies equally to hospitals, health centres and clinics. Secondary care is provided at health centres and hospitals.

The four levels of care of the BPHS can be summarized as community, clinic, health centre and county hospital. Details relevant to this study are as follows.

County hospitals
County hospitals provide both primary and secondary care. These hospitals are open 24 hours, and the staff is usually organized in two shifts in order to provide appropriate medical, midwifery and nursing cover at all times. This makes it possible for more severe medical and pediatric cases to be cared for and for basic emergency obstetric care (BEOC) to be provided. The county hospital provides primary care to the people living close by, secondary medical care and BEOC to a similar size of population as a health centre, and general surgical and surgical obstetric care to the whole county (an average population of about 200,000). It is supposed to have an operating theatre, a more extensive laboratory with blood transfusion services, a basic X-Ray machine and small ultrasound machine. It should have more than 50 beds, with a permanent capacity for intensive care. The hospital should be staffed with doctors and should have an ambulance and a 4-wheel drive vehicle.

It should be noted that the BPHS does not set out need norms for county hospitals (usually expressed in terms of beds per population). We assumed that a county hospital provides inpatient services to an average population of 200,000 persons but the BPHS does not state how many beds such a hospital should have. The average figures for admissions, beds and costs per capita are therefore not normative in terms of the need for inpatient services.

Catchment populations
The effective catchment area for primary level care is thought to be an area with a diameter of about ten kilometers round the facility. According to the BPHS, a clinic should serve between 3,500 and 12,000 people and a HC between 25,000 and 40,000; also, there should be between 4 and 5 clinics to a HC. If we take the mid-points between the two sets of figures, we can estimate an average catchment population of 32,000 for a health centre and 8,000 for a clinic. This means that there would be 3 clinics covering 8,000 people each and the primary care part of the health centre would cover another 8,000 people. This comes to a ratio of 3 clinics to a health centre, which is slightly less than the ratio stated in the BPHS, unless it is assumed that the primary care part of the health centre is also counted as a clinic.

Using the same logic, a county hospital should provide primary services to a population of 8,000, secondary services to a population of 32,000 and higher level secondary services to a population of 200,000.

2.   Methodology

Costing the BPHS at the hospital level was conducted in two steps. The first step was to gather information on the actual costs of a small sample of hospitals and to estimate the costs of any additional resources needed by those hospitals. The second step was to develop normative cost models using both norms from the BPHS and the information gathered from the sample of hospitals.

a. Sample of Actual Hospitals

Selection of Facilities

Due to the limited time available for the study, and difficulty accessing all parts of the country, a sample of five hospitals was selected. The hospitals were selected based on their relatively good performance in an accreditation study carried out previously[15], as well as their accessibility in terms of distance and navigability of roads (the study was done during the rainy season). In addition, we asked the MOHSW and members of the RBHS team to recommend well-run hospitals[16]. Cost and utilization data from 2008 and 2009 were collected.

The sample comprised five hospitals in four different counties: Redemption Hospital in Montserrado, Phebe Hospital in Bong, Liberia Government Hospital – Tubmanburg in Bomi, and Tellewoyan Memorial Hospital and Curran Lutheran Hospital in Lofa. The overall accreditation scores for each hospital were assessed, with particular attention paid to the score for Medical Records. All of the selected hospitals scored high overall and in relation to their medical records. Phebe Hospital, for example, topped the list at a 94% overall accreditation score and 100% score for Medical Records.

The sources of revenue for the five sampled hospitals are different, with varying levels of support from the Government of Liberia. Both Phebe and Curran Hospitals are managed by, and receive the majority of their support from, faith-based organizations, in addition to revenue from fees for service. Redemption Hospital and Liberia Government Hospital in Tubmanburg are managed by the MOHSW and supported by the GoL; and Tellewoyan Memorial Hospital is managed by the International Medical Corps (IMC) and funded by the Swiss Agency for Development and Cooperation (SDC).

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

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[15] January 2009 BPHS Accreditation: Preliminary Results Report. Released March 23, 2009. Ministry of Health and Social Welfare, Republic of Liberia.

[16] When the aim is to estimate what hospitals should cost (rather than what they actually cost) it is best to use well-run hospitals for data collection rather than poorly-run ones, since it is more likely that well-run hospitals are adequately resourced.

- Catchment populations, bed numbers, ward information, and numbers of services were obtained from the individual hospitals.
- Income and expenditure data were obtained from routine reports prepared by the hospitals. In addition, hospital administrators estimated the cost of additional resources that their hospitals needed. In the case of Tellewoyan Hospital, additional income and expenditure data were collected at the IMC headquarters in Monrovia.
- Details of staffing, including numbers and types of staff, assignments and pay, were taken from payroll and staffing reports.
- Staffing structures for categories outlined in the BPHS were obtained from the MOHSW for the three different Zones in Liberia.
- Additional utilization data were obtained from the HMIS department at the MOHSW.
- Additional drug costs were obtained from the National Drug Service (NDS).

Not all hospitals were able to provide the full range of information required to do a complete costing. Any assumptions made in the absence of required data have been noted in the text.

Through the course of the data collection process, it became apparent that one of the hospitals, Liberia Government Hospital in Tubmanburg, was unable to provide significant amounts of the required data. This was mainly due to the fact that the hospital had previously been administered by the Pakistani UN Battalion, which completed its withdrawal from the hospital as late as June 2009. Much of the required utilization and expenditure information from 2008 was therefore not available to the current hospital administrator. As a result, this report does not include figures from Liberia Government Hospital in Tubmanburg.

In addition, we were unable to obtain one of the main cost inputs for Redemption Hospital – salary costs. This facility has been removed from the hospital cost comparisons.

Data Collection from Actual Facilities

Utilization statistics from each hospital were collected, including outpatient consultations, inpatient admissions or discharges and deaths, and hospitalization days. The HMIS was rolled out to hospitals beginning in 2009, so all 2008 data had to be collected from the individual hospitals.

Both Redemption and Tellewoyan Hospital provided records based on their 2009 Fiscal Year (ending June 2009). In these cases, the utilization data for 2008/09 were collected to be in alignment with the expenditure data. Both Phebe and Curran Lutheran Hospital provided utilization and expenditure data for calendar year 2008.

Statistics on hospitalization days, or inpatient days of care, were not easily accessible at most hospitals. Only Tellewoyan Hospital kept summary figures of hospitalization days on a monthly and annual basis. The remaining hospitals had hospitalization days in their ward registers but did not compile these records monthly. Hospitalization days are a key statistic, which are required to calculated Average Length of Stay (ALOS) and Bed Occupancy Rate (BOR), both of which are commonly used statistics to compare hospitals and evaluate their efficiency.

The original intention was to allocate the costs of 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. Also, hospitals did not all keep information on the cost of drugs and medical supplies issued to each department. As a result, all inpatient departments are grouped together in this costing report.

Furthermore, cost data were not always available broken down by inpatient and outpatient department. For example, operating costs such as generator fuel costs were generally given for the hospital overall. Drug costs were also not readily available by inpatient and outpatient department. To give an approximation of the resources required, a standard Inpatient Day Equivalent (IDE) ratio was calculated (see Methodology, Section C, below).

Costs that did not apply to providing services at the hospitals were not included. For example, if the hospital had an affiliated pre-service training school, these costs were not included. Operating costs were mainly recurrent costs, with a significant portion of the cost going to vehicle and generator fuel.

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. To adjust for this discrepancy, hospital administrators were asked to estimate the additional needed resources for 2008. These additional cost estimates were either given verbally or in the form of the resources budgeted for the same time period.

b. Normative Cost Models

After collecting actual data from the hospitals, the second step was to develop a simple model for each type of hospital, which was done using spreadsheets.

The final version of the BPHS does not include plans for different sizes of hospitals; however, a previous draft of the BPHS provided a suggested staffing list for hospitals with less than 100 beds and hospitals with more than 100 beds (See Annex 4). This report, therefore, provides normative cost estimates for these two hospital sizes. For purposes of the model, the hospitals are assumed to have 80 and 120 beds, respectively, and catchment population sizes of 200,000 and 300,000. These assumptions can easily be changed by the user; thus, if the MOHSW creates guidelines for different sizes of county hospitals, these can be input into the model.

It should be noted that the BPHS does not set out need norms for county hospitals (usually expressed in terms of beds per population). As stated in Section 1 of this report we assumed that a county hospital provides inpatient services to an average population of 200,000 persons but the BPHS does not state how many beds such a hospital should have. The average figures for admissions, beds and costs per capita are therefore not normative in terms of the need for

inpatient services.

The cost model relies on BOR and ALOS norms to calculate utilization projections. These figures are used to calculate the number of occupied beds, total inpatient admissions, outpatient services, and inpatient day equivalents. The number of inpatient days is a function of the number of official beds at the hospital multiplied by the BOR. The number of outpatient services is based on the average ratio of inpatient to outpatient services at the four hospitals sampled.

Costs are broken down by three inputs – staff, drugs and medical supplies, and operating costs. The cost estimates are driven by several variables. The numbers of staff can be input manually or can be based on a normative bed-to-staff ratio. These staff figures are then multiplied by the BPHS standard salaries (See Annex 6). The costs of drugs are driven by the numbers of services, which are defined as the number of inpatient days and the number of outpatient visits.

An average cost per inpatient admission and outpatient visit for drugs and medical supplies was estimated using the needed cost figures for each hospital in the sample. The average cost was then multiplied by the normative number of inpatient and outpatient services calculated by the model.

The normative operating costs were derived from the sample of hospitals using the additional resource requirements given by the hospital administrators. The hospitals were split into two groups based on number of beds (<100 and >100 beds). Needed operating costs for each group were then averaged, and operating costs per bed were calculated. The standard model assumes that 50% of operating costs are fixed, and 50% variable by bed number. These figures were applied to the normative number of hospital beds to approximate operating costs.

It is important to note that the norms used in these models should be reviewed by the MOHSW. In particular, staffing norms should be provided (such as the ratio of physicians to bed numbers). For this report, a standard bed occupancy rate and average length of stay were used, but changing these statistics can result in very different levels of efficiency and service provision. The models easily allow for changes to the norms.

c. Calculation of Hospital Statistics

The following key statistics are referred to throughout this report. The calculations and assumptions for each statistic are described in the following section.

Hospitalization Days (Inpatient Days of Care)

Hospitalization days are the sum of each daily inpatient census for the year. Hospitals should add the daily census for the 365 days in the year. Other synonymous terms include "total inpatient service days," "occupied bed days," or "census patient days of care."[17]

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[17] Pennsylvania Department of Health. Health Statistics – Tools of the Trade. Viewed 10 December 2009 at: http://www.health.state.pa.us/hpa/stats/techassist/occrates.htm

Beds Days Available

Bed days available are the maximum number of inpatient days of care that would have been provided if all beds were filled during the year. Bed days available are calculated by multiplying the number of beds by 365. If the bed number has fluctuated during the year, the calculation for bed days must reflect this. For example, if the hospital starts the year with 50 beds, but increases to 55 beds after 300 days, the calculation would be as follows:

50 beds x 300 days + 55 beds x 65 days = 18,575 bed days available

Average Length of Stay (ALOS)

The average length of stay in hospitals is a statistical calculation often used for health planning purposes. ALOS is calculated by dividing the total inpatient days of care, or hospitalization days, by the total number of admissions or discharges. We calculated ALOS as follows:

(Total Hospitalization Days / Total Admissions) = Average Length of Stay (in days)

For the standard model calculations, an ALOS of 5.0 days was used.[18]

Bed Occupancy Rate (BOR)

The bed occupancy rate is a calculation used to show the actual utilization of the hospital for a given time period. To calculate BOR, hospitals need to keep records of total inpatient days of care and bed days available. We calculated BOR as follows:

(Inpatient Days of Care / Bed Days Available) x 100

BOR can be calculated by ward, or the hospital as a whole. For this study, detailed statistics were not available by ward, so all BOR calculations are for the entire hospital. For the standard model calculations, this study assumes an optimal BOR of 85%.[19]

Inpatient Day Equivalents (IDE)

The inpatient day equivalent is a ratio between resources required to provide an outpatient service and an inpatient day of care. A quick ratio of 3:1 is sometimes used where it is not feasible due to lack of time or data to calculate the actual cost of inpatient or outpatient services. In this study, the IDE was calculated using two different sources for the three different cost

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[18] 5 days is an average of the ALOS provided by two hospitals in the sample, Tellewoyan and Redemption.

[19] 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).

inputs (staff, drugs and medical supplies, and operating costs). Adam and Evans propose a model for the econometric estimation of country-specific hospital costs at the primary, secondary, and tertiary levels.[20] The WHO-CHOICE tool uses this model to estimate Liberia-specific costs per hospital stay and per outpatient visit by hospital level.[21] At the primary hospital level (assumed to be the level of county hospitals in Liberia), the estimates are $25.78 per bed day and $7.64 per outpatient visit. These cost calculations cover staff and operating costs, but not drugs.

We used the actual drug and medical supply costs provided by Phebe Hospital to create a ratio between drug costs per bed day and per outpatient visit (of the four hospitals, only Phebe had the costs split between the two departments). We calculated drug costs of $25.56 per bed day and $3.48 per outpatient visit.

The staff and operating costs were added to the drugs costs to come up with a total cost per bed day ($51.34) and per outpatient visit ($11.11). We then divided the two to get the ratio of cost of one inpatient day of care to one outpatient visit: 4.62.

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[20] Econometric estimation of country-specific hospital costs, Taghreed Adam, David B Evans and Christopher JL Murray, Published: 26 February 2003 Cost Effectiveness and Resource Allocation 2003, 1:3.

[21] WHO-CHOICE. Choosing Interventions that are Cost-Effective. Viewed 10 December 2009 at: http://www.who.int/choice/country/lbr/cost/en/index.html

3. Actual Hospital Utilization and Costs

a. Utilization Comparisons

Table 1 shows the basic information for the four hospitals sampled. As indicated in the methodology section, Liberia Government Hospital in Tubmanburg was unable to provide sufficient information to be included in the comparison.

Table 1. Basic Information for Hospitals Sampled

Hospital Name	Curran Hospital	Phebe Hospital	Redemption Hospital	Tellewoyan Hospital
County	Lofa	Bong	Montserrado	Lofa
Period of Analysis (1)	2008	2008	2008/09	2008/09
Catchment Population (2)	100,000	500,000	N/A	276,863
Total Number of Beds (3)	83	207	113	73
Total Number of Staff (4)	80	265	N/A	139

(1) Period of Analysis was the calendar year 2008 for Curran and Phebe Hospitals; and the 2008/09 Fiscal Year (ending June 2009) for Redemption and Tellewoyan Hospitals.
(2) Catchment Populations as estimated by Hospital Administrators. No accurate estimate of catchment population for Redemption Hospital currently available.
(3) Total number of beds provided by Hospital Administrators.
(4) Total number of medical, technical, and support staff (for more detail, see Table 4, and Annex 3). No staff information for Redemption Hospital currently available.

Table 2 shows the actual utilization figures for the four hospitals sampled, based on utilization records collected from the individual facilities. Three of the four hospitals have both inpatient and outpatient departments (OPDs); Tellewoyan Hospital in Voinjama only provides inpatient services. Whereas Phebe Hospital provided the highest total number of outpatient services (18,103), Curran hospital had the highest outpatient services per capita (0.14). The catchment population estimates were very broad, so it is important to note that the per capita figures are rough approximations. No catchment population estimate is currently available for Redemption Hospital.

Table 2. Hospital Utilization Figures for 2008/09

	ACTUAL - 2008/09			
	Curran Hospital 2008	**Phebe Hospital 2008**	**Redemption Hospital 2008/09**	**Tellewoyan Hospital 2008/09**
Total Outpatient Visits (1)	13,946	18,103	16,769	-
Total Outpatient Visits per Capita	0.14	0.04	N/A	-
Total Inpatient Admissions (2)	2,245	7,940	7,134	3,955
Surgical Ward Admissions	295	2,988	1,486	844
OB/GYN Ward Admissions	664	1,735	4,215	1,080
Pediatric Ward Admissions	558	3,217	694	1,074
Medical Ward Admissions	728	-	739	941
Other Admissions	-	-	-	16
Total Inpatient Admissions per Capita	0.02	0.02	N/A	0.01
Total Hospitalization Days (3)	11,226	39,700	49,938	14,201
Total Inpatient Day Equivalents (IDE) (4)	14,245	43,619	53,568	14,201
Average Length of Stay (ALOS) (5)	5.0	5.0	7.0	3.6
Bed Occupancy Rate (BOR) (6)	37%	53%	98%	53%
Total Lab tests	13,148	72,355	N/A	31,208
Total Radiography	-	-	-	537

(1) Note that Tellewoyan Hospital has no Outpatient Department.
(2) Total outpatient admissions should be equal to the total number of transfers, discharges and deaths (not always recorded). Note that Phebe Hospital has a single figure for Medico-Surgical Ward Admissions.
(3) Total hospitalization days were only recorded at Tellewoyan Hospital. For the remaining hospitals, this figure was calculated by multiplying the ALOS by the Total Inpatient Admissions.
(4) Calculation of Inpatient Day Equivalents described in detail in Methodology section.
(5) ALOS was provided only by Redemption and Tellewoyan Hospitals. A standard ALOS of 5.0 days was input, and the ALOS was then used to calculate hospitalization days.
(6) BOR for Curran and Phebe Hospitals calculated using 5-day ALOS assumption, since this was not available.

The total inpatient admissions were again highest in Phebe Hospital, although both Phebe and Curran hospitals had 0.02 inpatient admissions per capita. Interestingly, the percentage of total admissions by ward varied across the four hospitals. At Curran Hospital, the greatest number of inpatient admissions were at the medical ward (32%); at Phebe, 42% of inpatients were admitted to the pediatric ward; at Redemption, 59% were admitted to the OB/GYN ward; and at Tellewoyan, the pediatric and OB/GYN ward each had 27% of the total inpatient cases. The variations in service mix are due to many different factors, which include health-seeking behavior in the catchment populations, user fees, and availability of community or health center level services. Figure 1 shows a graph of the inpatient admissions by ward for each hospital.

Figure 1. Number of Inpatient Admissions by Ward for Hospitals Sampled
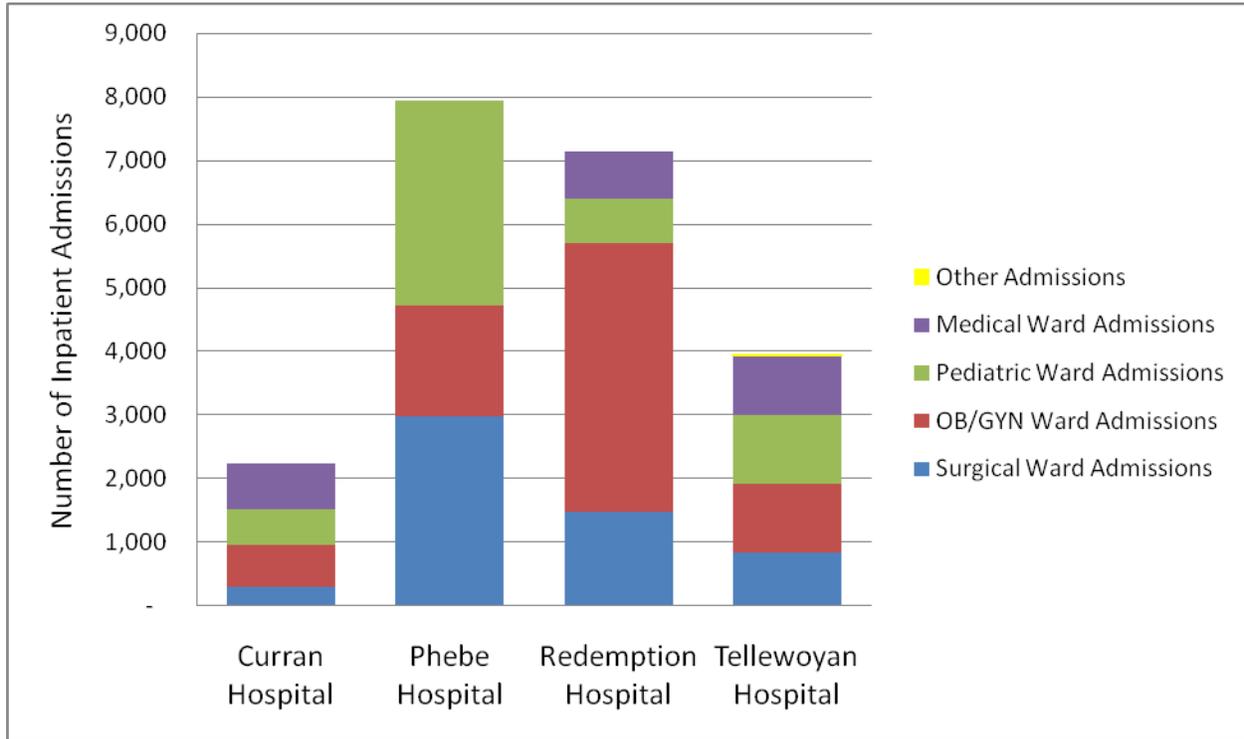
Total hospitalization days are a function of the number of inpatient admissions and the length of each inpatient visit. As mentioned in the methodology section, only Tellewoyan Hospital provided records of hospitalization days by month and year, in addition to BOR and ALOS. Redemption Hospital did not provide hospitalization days but did estimate ALOS as 7 days and BOR at 98%. For Phebe and Curran Hospitals, a plug figure for ALOS was input as 5 days[22], which resulted in BORs calculated as 53% and 37%, respectively. BOR is often used as an indicator of hospital efficiency, with 85% commonly held as an ideal occupancy rate. High BORs suggest too many patients, which often results in inferior quality; whereas low BORs suggest inefficient usage of resources. Similarly, ALOS can be used as a measure of quality and efficiency.

Bearing in mind that the actual ALOS for Curran and Phebe Hospitals were not given, the BORs calculated suggest that three of the four hospitals are significantly underused. Redemption Hospital, at a BOR of 98%, seems to be admitting more patients than the facility can treat at a high level of quality – not surprising for a facility in a densely-populated urban area. Curran Hospital had a low BOR of 37% (based on the 5-day ALOS input by the author), which suggests the facility could take in a significantly higher number of patients. Tellewoyan and Phebe

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[22] The ALOS 5-day plug figure was based on the average between Redemption Hospital's ALOS of 7 days and Tellewoyan Hospital's ALOS of 3.5. The plug figure was used to provide some context for comparison, since many calculations are based on ALOS and there would otherwise be no way to analyze Curran and Phebe Hospitals.

Hospitals had a BOR of around 53%, which also suggests more patients could be admitted. Hospitals should keep track of BOR over time to ensure that an appropriate number of patients are being treated, and at a high level of quality.

Using the IDE calculation described in the Methodology section, Redemption had the greatest number of inpatient day equivalents (53,568), and Curran the least (14,245) (excluding Tellewoyan, which has no outpatient department).

Total numbers of lab tests were provided at all facilities except Redemption Hospital, and of the four facilities, only Tellewoyan had a Radiology department that was providing X-Ray services during the period for which data were collected.

b. Cost Comparisons

As discussed in the methodology section, the actual expenditures provided by the hospitals were not necessarily a reflection of the complete resources needed. Lower costs, therefore, may be a reflection of lower quality and do not necessarily suggest greater efficiency. The costs were broken down by three main inputs: staff, drugs, and operating costs.

Both the actual and needed costs for the four hospitals sampled are shown in Table 3.

Table 3. Total Actual and Needed Costs, 2008/09 (US$)

	ACTUAL			NEEDED		
	Curran Hospital	Phebe Hospital	Tellewoyan Hospital	Curran Hospital	Phebe Hospital	Tellewoyan Hospital
Year	2008	2008	2008/09	2008	2008	2008/09
Number of Beds	83	207	73	83	207	73
Staff	100,568	521,890	146,179	173,028	609,714	228,108
Drugs and clinical supplies (1)	47,188	375,666	170,000	70,445	461,622	170,000
Operating costs	165,125	782,133	136,998	211,988	923,487	217,637
Total Cost	312,882	1,679,689	453,177	455,462	1,994,823	615,745
Fuel / Gasoline Costs (2)	51,380	N/A	56,283	93,725	546,822	78,120

(1) Drugs figure used for Tellewoyan Hospital is needed, not actual costs. This is due to the fact that actual drug costs for 08/09 were extremely low due to previously existing drug stock.
(2) Fuel/gasoline costs included within Operating Cost figure.

Actual expenditure varied significantly across the sampled hospitals. Staff costs were lowest at Curran Hospital ($100,568), and highest at Phebe Hospital ($521,890). Staff cost data for Redemption Hospital has not yet been provided. Table 4 shows the breakdown of staff in more detail for each hospital, in addition to the total IDE per staff. This can be read as the number of inpatient days of care for each type of staff; for example, at Tellewoyan Hospital, there were 2,367 inpatient days of care for each physician. Using the ALOS of 3.6 days at Tellewoyan, this means an average of 657 patients seen by a physician in the year. The complete list of staff at

each facility can be found in Annex 3.

Table 4. Detailed Staff Statistics by Hospital

	Curran Hospital	Phebe Hospital	Tellewoyan Hospital
Total Staff	80	265	139
Total number of Inpatient Day Equivalents (IDE)	14,245	43,619	14,201
Total IDE per Staff	178	165	102
Doctor, Physician, Physician's Assistant	2	9	6
IDE per Doctor	7,122	4,847	2,367
Nurse, Midwife	34	116	38
IDE per Nurse	419	376	374
Pharmacy	3	13	8
IDE per Pharmacy staff	4,748	3,355	1,775
Laboratory	4	15	4
IDE per Laboratory staff	3,561	2,908	3,550
Admin/Finance	8	19	7
IDE per Admin/Finance staff	1,781	2,296	2,029
Other Medical/Tech Staff	6	7	11
IDE per Other staff	2,374	6,231	1,291
Maintenance / Support	23	86	65
IDE per Maintenance/Support staff	619	507	218

Drug costs also varied across the hospitals. Phebe Hospital spent the most on drugs ($375,666), and Curran the least ($47,188). Drug costs at Tellewoyan Hospital were unusually low in 2008/09 ($6,778) due to a very large pre-existing stock of drugs at the hospital, which opened under IMC administration in May 2008. To enable comparison with the other hospitals, the needed drugs figure of $170,000 was used instead.

Operating costs consumed the most resources at both Phebe and Curran Hospitals. Only the operating costs related to direct service delivery were included.[23] One of the biggest cost drivers within the operating costs was the gasoline and fuel for generators and vehicles (broken out separately in Table 3). On average, fuel costs took up around 30-40% of total operating costs for the hospitals. Figure 2 shows the percentage break-down of cost inputs for the three hospitals. The percentage of total cost that went to staff salaries was similar across the sample – 31 to 32%. Drug costs varied, with significantly smaller percentages at Curran and Phebe Hospitals. Anecdotal evidence from the hospital administrators suggest that these two hospitals did not always have sufficient drugs, and often sent patients home with prescriptions to buy at a pharmacy instead of providing the drugs directly.

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[23] Note that costs of community health programs and nursing schools were excluded. Also, costs associated for the chaplaincy were not included (salary and operating costs) for Phebe and Curran Hospitals.

Figure 2. Percentage breakdown of total costs by input, 2008/09 (US$)
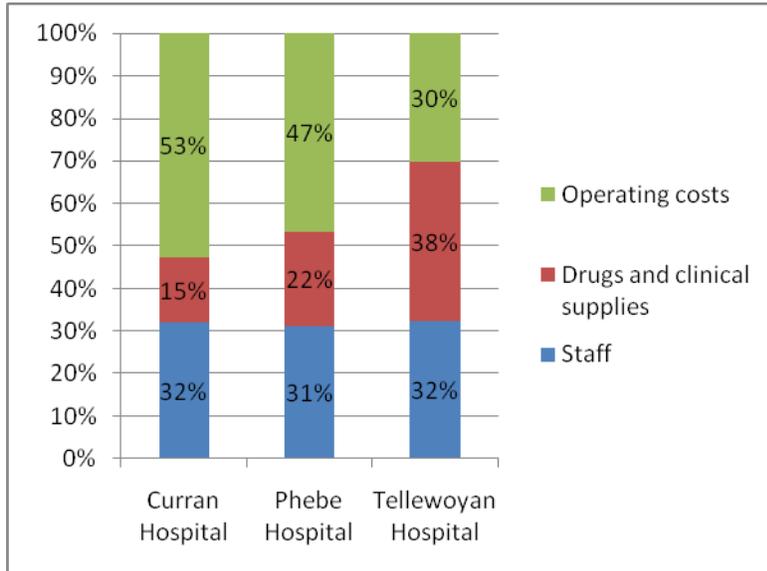
In addition to actual costs, Table 3 shows the needed costs to run the three facilities, as provided by the hospital administrators. In the case of Curran and Phebe Hospitals, the needed resources were provided as verbal estimates; whereas for Tellewoyan Hospital, the needed resources are based on budgets for the same time period.

The additional resource estimates suggest that all three hospitals require more resources across the three inputs – staff, drugs, and operating costs. The additional resources required for each hospital are as follows: $142,580 or 46% increase for Curran; $315,133.83 or 19% increase for Phebe; $162,568 or 36% increase for Tellewoyan. (As noted earlier, the needed drugs figure was used for Tellewoyan Hospital as an actual).

Dividing the total actual costs by the catchment populations for each hospital shows the per capita costs, as displayed in Table 5. The per capita cost figures can better gauge equity since the same levels of health resources should be provided for everyone in the population. However, it should be noted that the catchment populations for these hospitals are broad estimates, and the hospitals may be providing different levels of services. The BPHS does not currently specify that there are different sizes of county hospitals in terms of bed number or levels in terms of types of services.

Table 5. Actual and Needed Costs per Capita, 2008/09 (US$)

	ACTUAL			NEEDED		
	Curran Hospital	Phebe Hospital	Tellewoyan Hospital	Curran Hospital	Phebe Hospital	Tellewoyan Hospital
Catchment Population	100,000	500,000	276,863	100,000	500,000	276,863
Staff per Capita	1.01	1.04	0.53	1.73	1.22	0.82
Drugs, supplies per Capita	0.47	0.75	0.61	0.70	0.92	0.61
Operating costs per Capita	1.65	1.56	0.49	2.12	1.85	0.79
Total Cost per Capita	3.13	3.36	1.64	4.55	3.99	2.22

The actual costs per capita suggest that Curran and Phebe Hospitals are spending a similar amount per person ($3.13 and $3.36 per capita), while Tellewoyan had a lower expenditure per capita ($1.64). The needed costs per capita show a similar pattern, with Tellewoyan at the lowest at $2.22 per capita, Phebe at $3.99 per capita, and Curran the highest at $4.55 per capita. The major increase in cost per capita for Phebe is due to rising operating costs.

In addition to comparing per capita costs, another important way to compare costs is to calculate how much is spent on average on each service. This is generally a reflection of how much funding is provided to a hospital. Too little funding affects the ability to provide good quality services, whereas too much funding may indicate a waste of resources. In this case, since these are just comparisons the figures merely indicate that one hospital is relatively better or worse funded than another.

Cost per service is calculated as the average cost per inpatient bed day or per discharge (Table 6). Since hospitals provide both outpatient and inpatient services, a ratio of outpatient costs to inpatient costs is used to produce a cost per inpatient day equivalent (IDE). (See Methodology section for IDE calculation).

The cost per service varies with the total cost and with the total number of IDEs. It should also vary with the mix of services. For example, a hospital that has more surgical services is likely to have a higher cost than one that has less. We were not able to take service mix into account for this study since, for the hospitals sampled, expenditure data were not kept at this level of detail.

In line with the previous findings, Phebe Hospital had the highest actual costs per IDE at $38.51. Tellewoyan and Curran Hospital provided similar numbers of services, but the costs per IDE varied from $31.91 and $21.96, respectively. Curran and Phebe had operating costs per IDE as the highest inputs ($11.59 and $17.93), whereas for Tellewoyan hospital the highest input per IDE was drugs ($11.97).

Table 6 also shows a comparison of actual costs per IDE with needed costs.[24]

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[24] The needed costs per IDE are used as part of the calculations for standard costs in Section 4: Normative Models. The average needed drug cost per IDE was $9.17.

Table 6. Actual and Needed Costs per Inpatient Day Equivalent, 2008/09 (US$)

	ACTUAL			NEEDED		
	Curran Hospital	Phebe Hospital	Tellewoyan Hospital	Curran Hospital	Phebe Hospital	Tellewoyan Hospital
Total Inpatient Day Equivalent	14,245	43,619	14,201	14,245	43,619	14,201
Staff costs per IDE	7.06	11.96	10.29	12.15	13.98	16.06
Drugs, supply costs per IDE	3.31	8.61	11.97	4.95	10.58	11.97
Operating costs per IDE	11.59	17.93	9.65	14.88	21.17	15.33
Total Cost per IDE	21.96	38.51	31.91	31.97	45.73	43.36

Table 7 shows the actual and needed costs per admission across the hospitals. Due to the lack of information about hospitalization days for Curran and Phebe Hospitals, a plug-in figure of 5 days was used for ALOS.[25]

Phebe Hospital had the highest cost per admission at $192.54, and Curran the lowest at $109.82. These figures will change if an accurate ALOS for these hospitals is input. Similar to the total costs, the total cost per admission would need to increase 46%, 19% and 36% to achieve the needed costs for Curran, Phebe, and Tellewoyan, respectively.

Table 7. Actual and Needed Costs per Admission, 2008/09 (US$)

	ACTUAL			NEEDED		
	Curran Hospital	Phebe Hospital	Tellewoyan Hospital	Curran Hospital	Phebe Hospital	Tellewoyan Hospital
Total Inpatient Admissions	2,245	7,940	3,955	2,245	7,940	3,955
Average Length of Stay	5.0	5.0	3.6	5.0	5.0	3.6
Staff costs per Admission	35.30	59.82	36.96	60.73	69.89	57.68
Drugs and clinical supply costs	16.56	43.06	42.98	24.73	52.92	42.98
Operating costs per Admission	57.96	89.66	34.64	74.41	105.86	55.03
Total Cost per Admission	109.82	192.54	114.58	159.87	228.67	155.69

Table 8 shows the actual costs per outpatient service, which are calculated using the IDE ratio, so the relationship among these costs is the same as the relationship among the inpatient costs.[26] Tellewoyan Hospital has no outpatient department, so a comparison of Phebe and Curran hospitals shows almost double the cost per outpatient visit at Phebe ($8.34) than at Curran ($4.75).

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[25] Cost per admission was calculated by multiplying ALOS by the cost per IDE. For example, 5 days ALOS x $7.06 staff cost per IDE for Curran Hospital to get a staff cost per admission of $35.30.

[26] Cost per outpatient visit was calculated by multiplying the cost per IDE by ratio of outpatient visit costs to inpatient bed day costs. For example, $7.06 staff cost per IDE for Curran Hospital x (1/4.62). Calculation of 4.62 IDE is described in detail in Methodology section.

Table 8 also shows a comparison of actual and needed costs per outpatient visit.[27]

Table 8. Actual and Needed Costs per Outpatient Visit, 2008/09 (US$)

	ACTUAL			NEEDED		
	Curran Hospital	Phebe Hospital	Tellewoyan Hospital	Curran Hospital	Phebe Hospital	Tellewoyan Hospital
Total Outpatient Visits	13,946	18,103	-	13,946	18,103	-
Staff costs per Visit	1.53	2.59	-	2.63	3.03	-
Drug, supply costs per Visit	0.72	1.86	-	1.07	2.29	-
Operating costs per Visit	2.51	3.88	-	3.22	4.58	-
Total Cost per Outpatient Visit	4.75	8.34	-	6.92	9.90	-

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[27] The needed costs per outpatient visit are used as part of the calculations for standard costs in Section 4: Normative Models. The average needed drug cost per outpatient visit was $1.68.

4.   Normative Models

a. Projected Utilization and Costs

To project utilization and cost figures based on norms, simple spreadsheet models were developed for the two hospital sizes described in the BPHS (less than 100 beds and greater than 100 beds). The models assume that the two hospitals have 80 and 120 beds, although these figures can be changed, or additional size models added, at the request of the MOHSW. The accompanying catchment populations for these hospitals were input into the model as 200,000 and 300,000, respectively. In addition, if different levels of hospital are identified, these hospital levels can also be modeled.

Cost inputs for the normative models are separated into staff, drugs, and operating costs. These costs are driven by the number of inpatient days and outpatient visits. The model requires the user to input catchment population size, total number of beds, bed occupancy rate (BOR), and average length of stay (ALOS).[28] From these inputs, the model calculates the number of occupied beds, hospitalization days, inpatient admissions, and outpatient visits, as follows:

- Occupied beds are the number of beds multiplied by BOR.
- Hospitalization days are calculated by multiplying occupied beds by 365.[29]
- Inpatient admissions are calculated by dividing hospitalization days by the ALOS.
- Outpatient visits are calculated using a ratio of inpatient admissions to outpatient visits from the three hospitals sampled.[30]

We assumed norms of 85% for the BOR and 5 days for the ALOS to calculate the number of admissions and hospitalization days.[31] These can be adjusted by the user. The model uses normative unit costs for each main type of input: staff, drugs and medical supplies, and operating costs.

For staffing, the BPHS norms for hospitals with <100 beds and >100 beds were used (See Annex 4). According to the BPHS guidelines, a hospital with less than 100 beds should have a total of 93 staff, and a hospital with greater than 100 beds a total of 150 staff. These staffing norms are

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[28] Currently, the population does not drive the number of beds or outpatient services in the model. Catchment population is only used for calculations of per capita costs.

[29] For example, the standard 80-bed hospital, at an occupancy rate of 85%, will have 68 occupied beds. 68 x 365 days = 24,820 occupied bed days.

[30] The ratio of outpatient visits to number of inpatient admissions was 3.61 across the sample.

[31] The BOR of 85% was selected as optimal because it is reportedly the maximum rate of efficiency that can be achieved in a hospital without compromising hospital-acquired infection rates. The ALOS of 5 days was calculated based on the average of the two actual ALOS provided by the hospitals. Both BOR and ALOS can be adjusted easily in the model by the user.

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listed in an older draft of the BPHS; the current version does not include any staffing norms for hospitals. Thus, it is imperative the MOHSW review these norms, and update them as necessary. Staffing norms are often provided as a ratio of staff to occupied hospital beds.

The models allow the user to change the numbers of occupied beds per staff, with the assumption that these changes affect both inpatient and outpatient services equally. These norms are required for staff that provide direct patient services, such as physicians and nurses. 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, a fixed number is used based on the figures in the BPHS.

Staff costs were based on BPHS salary structures for the three different Zones in Liberia (See Annex 5). The staff salaries were averaged, and this average figure for each category is multiplied by the number of staff calculated by the model. In addition to reviewing the staffing norms, the MOHSW should also review the staff salary structure.

To calculate normative drug costs, the average figures for the 2008 needed costs were used. Normative drug costs were split between outpatient visits and inpatient admissions. For outpatient visit drug costs, we multiplied the average needed drug cost per outpatient visit ($1.68) by number of outpatient visits. Since Tellewoyan has no outpatient department, this drug cost was an average of Curran and Phebe Hospitals. For inpatient admission drug costs, we multiplied the average needed drug cost per IDE ($9.17) by the number of admissions. The normative drug cost per IDE is, therefore, the same for all standard hospital models.

In calculating operating costs, the model assumes that 50% of these expenses are fixed, and 50% vary by the number of beds – for example, larger hospitals with more beds would require more generator fuel to run. Normative operating costs were based on the actual needed hospital costs. The hospitals were split into two groups based on number of beds (<100 and >100 beds). Needed operating costs for each group were then averaged, and operating costs per bed were calculated. These figures were applied to the normative number of hospital beds to approximate operating costs.

As with the drug costs, it is important to keep in mind that these calculations are rough estimates. With such a small sample of hospitals, it is probable that these figures do not represent reasonable norms. It is important to note that further research should be carried out before the figures are used for anything other than rough estimates. In addition, the ratios seen in this hospital sample differ from usual ratios seen in other studies of 60% staff, 30% drugs, and 10% operating costs.[32]

Table 9 summarizes the projected utilization and costs for the two hospitals described in the BPHS (<100 and >100 beds). 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 6, 7, 8, and 9.

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[32] Reference?

To demonstrate the effect of changing staffing norms, we used two different staffing scenarios for each hospital size. In the first, staffing norms based on the BPHS list are used (the <100-bed staffing for the 80-bed hospital and the >100-bed staffing for the 120-bed hospital, in Annex 4). The BPHS does not include staff-per-bed ratios, but instead lists the number of staff for each hospital size. We assume that the staffing norms are for an 80-bed hospital at 85% BOR. For example, the BPHS lists 10 Registered Nurses as the standard for a hospital with less than 100 beds. Assuming the standard hospital is 80 beds and 85% occupancy rate results in 68 occupied beds. Dividing 68 occupied beds by 10 Registered Nurses results in a ratio of 6.8 RNs per occupied bed (or inpatient). The details of the models using this scenario are in Annex 6 (for <100 bed hospital size) and Annex 8 (for >100 bed hospital size).

In the second scenario, staffing norms based on another study are used to drive the number of staff. Using a study in Uganda that developed staffing ratios for doctors, nurses, and midwives per inpatient, we changed the staffing norms for these three cadres in the model.[33] For example, in the smaller sized hospital, whereas the BPHS staffing norm would be 68 occupied beds to each physician, we used the Ugandan staffing norm of 21.9 occupied beds per physician. The purpose of this second scenario is to demonstrate the importance of reviewing the staffing norms and creating Liberia-specific staff-to-patient ratios for each hospital size. The details of the models using this scenario are in Annex 7 (for <100 bed hospital size) and Annex 9 (for >100 bed hospital size).

The 80-bed hospital would require a total of 99 staff using BPHS staffing norms and 123 staff using the Ugandan study staffing norms. The 120-bed hospital would require a total of 155 and 184 staff, respectively. Numbers of inpatient admissions and outpatient visits have not been changed for the two staffing scenarios, so the costs of drugs and operating costs remain the same.

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[33] *Namaganda, Grace. "Determining Staffing Levels and Mix of UCMB Affiliated Hospitals."* Health Policy and Development Journal, Vol. 2, No. 3, December, 2004, pp.236-242

Table 9. Projected Utilization and Costs for Hospitals, (US$)

	Hospital 1 BPHS Staffing 80 beds	Hospital 1 Staffing Norms 80 beds	Hospital 2 BPHS Staffing 120 beds	Hospital 2 Staffing Norms 120 beds
ASSUMPTIONS				
Catchment Population (1)	200,000	200,000	300,000	300,000
Total Number of Beds (2)	80	80	120	120
Occupied Beds	68	68	102	102
Total Outpatient Visits	17,940	17,940	26,910	26,910
Total Inpatient Admissions	4,964	4,964	7,446	7,446
Total Hospitalization Days	24,820	24,820	37,230	37,230
Total Inpatient Day Equivalents (IDE)	28,703	28,703	43,055	43,055
Average Length of Stay (ALOS)	5.0	5.0	5.0	5.0
Bed Occupancy Rate (BOR)	85%	85%	85%	85%
STAFF AND COSTS				
Total number of staff	99	123	155	184
Staff cost	$ 152,776	$ 216,152	$ 243,020	$ 319,932
Drugs and medical supplies	$ 75,653	$ 75,653	$ 113,480	$ 113,480
Operating costs	$ 175,861	$ 175,861	$ 423,294	$ 423,294
Total cost	$ 404,291	$ 467,667	$ 779,794	$ 856,706
Staff cost per IDE	$ 5.32	$ 7.53	$ 5.64	$ 7.43
Drugs etc per IDE	$ 2.64	$ 2.64	$ 2.64	$ 2.64
Operating costs per IDE	$ 6.13	$ 6.13	$ 9.83	$ 9.83
Total cost per IDE	$ 14.09	$ 16.29	$ 18.11	$ 19.90
Staff cost per capita	$ 0.76	$ 1.08	$ 0.81	$ 1.07
Drugs etc per capita	$ 0.38	$ 0.38	$ 0.38	$ 0.38
Operating costs per capita	$ 0.88	$ 0.88	$ 1.41	$ 1.41
Total costs per capita	$ 2.02	$ 2.34	$ 2.60	$ 2.86

Assuming an 85% BOR and 5-day ALOS, an 80-bed hospital should provide 17,940 outpatient services and 4,964 inpatient admissions.

Based on BPHS staffing levels and standard costs for salaries, drugs and operating costs the hospital would need a total of 99 staff and its total costs would amount to $404,291, which translates to a total cost of $14.09 per IDE. In this scenario, there is one physician for every 68 patients, one registered nurse for every 7 patients, and one midwife for every 68 patients.

Using the same sized hospital, but the Ugandan staffing norms instead of the BPHS staffing norms, the number of staff would increase to 111. The total cost would amount to $467,667, with $16.29 per IDE. In this scenario, there is one physician for every 22 patients, one registered nurse for every 7 patients, and one midwife for every 5 patients. The normative number of staff

are related to the total number of occupied beds, so if the BOR and ALOS are adjusted, the number of staff will change, to reflect the changing number of services.

For the 120-bed hospital, also at a BOR of 85% and ALOS of 5 days, a total of 26,910 outpatient and 7,446 inpatient services would be required.

Under BPHS staffing norms, the 42,939 IDEs would be provided by a total of 155 staff. The total costs would amount to $779,794 and the cost per IDE at $18.11. Under the Ugandan staffing norms, 184 staff would be required, and the total costs would amount to $856,706, and the cost per IDE at $19.90. The beds per staff would decrease from 102 to 22 beds per physician and from 10 to 5 beds per midwife.

***WILL ADD COMPARISON SECTION WITH MALAWI AND CAMBODIA RESULTS….

5.   Conclusions and recommendations

The resources needed to provide services at different sized hospitals vary depending on the number of occupied beds and length of inpatient admissions. At the BPHS staffing levels, an 80-bed hospital at 85% Bed Occupancy Rate (BOR) and 5-day Average Length of Stay (ALOS) would cost a total of $404,291 per year, which comes to an average of $14.09 per Inpatient Day Equivalent (IDE). A 120-bed hospital would cost a total of $779,794 per year, which comes to an average of $18.11 per IDE.

It should be noted that the BPHS does not set out need norms for county hospitals (usually expressed in terms of beds per population). As stated in Section 1 of this report we assumed that a county hospital provides inpatient services to an average population of 200,000 persons but the BPHS does not state how many beds such a hospital should have. The average figures for admissions, beds and costs per capita are therefore not normative in terms of the need for inpatient services.

Increasing the staffing from the BPHS staffing norm of 68 beds and 102 beds per physician (at <100 and >100 sized hospitals) to a norm of 22 beds per physician would change the total annual costs at 80-bed and 120-bed hospitals to $467,667 and $856,706, respectively. The annual average per capita costs would change from $2.02 to $2.34 at the 80-bed hospital, and from $2.60 to $2.86 at the 120-bed hospital. 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 total actual annual costs at the hospitals sampled for 2008/09 were as follows: $312,882 total cost at Curran Hospital; $1,679,689 total cost at Phebe Hospital; and $453,177 total cost at Tellewoyan Hospital. The costs per IDE at the three hospitals were, respectively: $21.96, $38.51, and $31.91, with an average of $30.79. The costs per capita at the hospitals were, respectively: $3.13, $3.36, and $1.64, with an average of $2.71. There was not sufficient cost and utilization information gathered at Liberia Government Hospital in Tubmanburg to be included in this analysis. There was also not sufficient cost information gathered at Redemption to be included in the cost analysis.

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

- The MOHSW should establish catchment populations for each facility. This data was not readily available at the MOHSW, and had to be roughly estimated by hospital administrators. In addition, normative catchment populations for the hospitals at each size and level should be determined by the MOHSW.
- The MOHSW should review staffing norms for different sized hospitals at each level of care (primary, secondary, tertiary). For this study, staffing was based on norms provided in an older version of the BPHS. The BPHS norms were compared with Ugandan staffing norms determined in another study. The BPHS norms may not reflect accurately the needs of the hospitals and they do not take into account differences in patient mix.

- The figures used for staff remuneration were based on the BPHS salary structure from 2007; these figures should be reviewed and updated as necessary. In addition, several staff categories listed in the BPHS staffing norms are not found in the salary structure.
- 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.
- Hospitals should be encouraged to maintain detailed records of expenditure, allowing for the accurate allocation of staff, drugs across the hospitals wards and between inpatient and outpatient departments. Detailed operating cost records should also be kept.
- The MOHSW should continue rolling out the HMIS to hospitals, and ensure data are being collected correctly. Hospitals should additionally be encouraged to regularly maintain utilization records and statistics; in particular, total hospitalization days in order to calculate bed occupancy rate and average length of stay. These statistics should be monitored regularly to ensure hospitals are running efficiently and at a high level of quality.

A high level of detailed cost and utilization records will allow for better modeling of these costs. The budgets and plans based on the hospital cost models will therefore more accurately predict the resources required to provide different levels and numbers of services. The sample size used in this report is small, and we recommend increasingly the number of county hospitals in future analyses to ensure greater accuracy.

ANNEX 1. Basic Package of Health Services (Summary)

Table 2. An Abridged Summary of Key Elements of the BPHS

INTERVENTIONS and SERVICES	Community	Clinic	Health Center	County Hospital	Referral Hospital
I. MATERNAL & NEWBORN CARE					
1.1.1. ANTENATAL CARE					
Diagnosis of high-risk pregnancy	Yes	Yes	Yes	Yes	Yes
IPT with SP, Iron Supplementation, ITNs	Yes	Yes	Yes	Yes	Yes
Treatment of malaria, Tetanus toxoid immunization	-	Yes	Yes	Yes	Yes
1.1.2. LABOUR and DELIVERY CARE					
Identify fetal malpositions	Refer	Refer	Yes	Yes	Yes
Normal vaginal delivery	Yes	Yes	Yes	Yes	Yes
Emergency Obstetric Care	Refer	Refer	Yes/Refer	Yes	Yes
PMTCT Package	Yes	Yes	Yes	Yes	Yes
1.1.3. POST PARTUM CARE					
Prevention and detection of puerperal infection	Yes	Yes	Yes	Yes	Yes
Detection and treatment of anemia	Yes	Yes	Yes	Yes	Yes
Counseling on birth spacing and FP service	Yes	Yes	Yes	Yes	Yes
1.1.4. CARE OF THE NEWBORN					
Emergency neonatal care	Refer	Yes	Yes	Yes	Yes
Manage neonatal infections and sepsis	Yes & Refer	Yes & Refer	Yes	Yes	Yes
HIV care/Replacement feeding, Immunizations	-	Yes	Yes	Yes	Yes
2.0. CHILD HEALTH					
Vaccine security/cold chain	-	Yes	Yes	Yes	Yes
EPI, BF, GM, Vit. A, Deworming, ITNs, ORT	Yes	Yes	Yes	Yes	Yes
Management of pneumonia, fever and malaria	Yes	Yes	Yes	Yes	Yes
Identify & manage dehydration/ severe diarrhea	Yes & Refer	Yes & Refer	Yes	Yes	Yes
3.0 ADOLESCENT, SEXUAL, and REPRODUCTIVE HEALTH					
3.1 FAMILY PLANNING					
Distribute oral Contraceptives and condoms	Yes	Yes	Yes	Yes	Yes
DMPA injection	-	Yes	Yes	Yes	Yes
Intrauterine devices	-	-	Yes	Yes	Yes
3.2 ADOLESCENT HEALTH					
Substance abuse prevention, Family life education	Yes	Yes	Yes	Yes	Yes
Oral contraceptives and Condom distribution	Yes	Yes	Yes	Yes	Yes
4.0 DISEASE PREVENTION, CONTROL & MANAGEMENT					
4.1 HIV/AIDS					
ABC Promotion and Condom distribution	Yes	Yes	Yes	Yes	Yes
Home-based Care	Yes	-	-	-	-
Treatment of opportunistic infections	-	-	Yes	Yes	Yes
VCT, PMTCT	-	Yes	Yes	Yes	Yes
Blood Screening and Antiretroviral therapy	-	-	-	Yes	Yes
4.2 Control of Malaria					
Clinical diagnosis	Refer	Yes	Yes	Yes	Yes
RDT/Microscopy, Treating uncomplicated cases	-	Yes	Yes	Yes	Yes
Distribution of ITNs and IPT	Yes	Yes	Yes	Yes	Yes
4.2 Control of Tuberculosis					
Case detection - sputum smear	Refer	-	Yes	Yes	Yes
DOTS and Active case-finding in community/OPD	Yes	Yes	Yes	Yes	Yes
BCG vaccination	-	Yes	Yes	Yes	Yes
5.0 Essential Emergency Treatment					
Shock, Injuries, Poisoning	Yes & Refer	Yes & Refer	Yes & Refer	Yes	Yes

ANNEX 2. BPHS Programmes

Maternal and Newborn Health
- Antenatal care
- Labor and delivery care
- Emergency obstetric care
- Postpartum care
- Newborn care

Child Health
- Expanded Programme on Immunization
- Integrated management of childhood illnesses
- Infant and young child feeding

Reproductive and Adolescent Health
- Family planning
- Sexually transmitted infections
- Adolescent Health

Communicable Disease Control
- Control of STI/HIV/AIDS
- Control of tuberculosis
- Control of malaria
- Control and management of other diseases with epidemic potential

Mental Health

Emergency care

ANNEX 3. Actual Staffing Numbers for 2008/09

	Curran Hospital		Phebe Hospital		Tellewoyan Hospital	
	Position	**# of Staff**	**Position**	**# of Staff**	**Position**	**# of Staff**
Doctor, Physician, Physician's Assistant	Chief of Medical Staff	1	Medical Director	1	Physician	2
	Medical Director	1	Medical Staff	8	Physician Assistant	4
Sub-Total		2		9		6
Nurse, Midwife	BSc RN	3	Nursing Services	116	Nursing Director	1
	LPN	7			Nurse (RN)	9
	RN	2			Nurse Anesthetist	2
	Nurse Aide	13			Nurse Anesthetist Student	0
	Nursing Services Director	1			Nurse (Scrub, RN)	3
	Opthalmic Nurse	1			Nurse - Circulating (LPN, N/	1
	CM	7			Nurse Aide	14
					Licensed Practical Nurse	3
					Certified Midwife	5
Sub-Total		34		116		38
Pharmacy	Dispenser	1	Pharmacy	13	Pharmacist	0
	Dispenser Aide	1			Pharmacist Assistant	1
	Pharmacist	1			Dispenser	7
Sub-Total		3		13		8
Laboratory	Lab Aide	2	Laboratory	15	Laboratory Technician	1
	Lab Technician	2			Laboratory Assistant	3
Sub-Total		4		15		4
Admin/Finance	Accountant	2	Administration/Finance	19	Administrator	1
	Cashier	1			Procurement Officer	1
	Filing Clerk	1			Finance Assistant	0
	Logistician	1			Clerk	1
	Secretary	1			Registrar/Recorder	4
	General Operator	1				
	Registrar	1				
Sub-Total		8		19		7
Other Medical/Tech Staff	Med Surg Ward Superviso	1	Anesthesia	4	OR Technician	4
	Ward Supervisor	5	X-Ray	0	Ambulance Aide	4
			Ophthalmic	3	X-Ray Technician	0
					Assistant X-Ray Technician	2
					Environmental Technician	1
Sub-Total		6		7		11
Maintenance / Support	Cleaner	9	Maintenance	20	Security Guard	15
	Watchman	5	Motor Pool	11	Cleaner	13
	Yardman	3	Housekeeping	21	Laundry Worker	6
	Driver	2	Security	23	Store Keeper	1
	Driver / Mechanic	2	Dietary	6	Assistant Store Keeper	1
	House Mother	1	Laundry	4	Gardener	5
	Supervisor / HouseKeepe	1	Morgue Service	1	Cook	6
					Driver	4
					Ambulance Driver	4
					Maintenance Supervisor	1
					Electrician	1
					Mechanic	1
					Plumber	1
					Radio Technician	1
					Radio Operator	4
					Morgue Attendant	1
Sub-Total		23		86		65
TOTAL STAFF		**80**		**265**		**139**

Note: No staff information available for Redemption Hospital.

ANNEX 4. BPHS Staffing Structure

Liberia BPHS		
Position	**Hospital with <100 beds**	**Hospital with >100 beds**
Officer in Charge (MD)	1	1
Hospital Administrator	1	1
Nursing Director	1	1
Physician Assistant	3	7
Registered Nurse	10	20
Nurse Aide	12	24
Certified Midwife	6	10
Nurse Midwife	1	2
Pharmacist	0	1
Dispenser	4	4
Anesthetists	1	5
OR Techs	6	12
Lab Technician	2	4
Lab Assistants	0	0
Lab Aide	2	2
Environmental Tech	1	1
Social Worker	1	1
X-Ray Tech	1	1
Physiotherapist	1	1
Recorder/HIS	6	6
Security	12	12
Housekeeping	12	17
Laundry	2	5
Dietary	3	6
Maintenance	4	6
TOTAL	**93**	**150**

ANNEX 5. BPHS Annual Salary Structure (US$)

Position	MOHSW Staff Salary Schedule: Zone 1	MOHSW Staff Salary Schedule: Zone 2	MOHSW Staff Salary Schedule: Zone 3
Physician	14,400	12,000	10,800
Officer in Charge (MD)	3,000	2,556	2,100
Physician Assistant	2,700	2,256	1,800
Registered Nurse	2,400	1,956	1,500
Nurse Anesthetist	2,700	2,556	2,100
Nurse Midwife	2,400	2,100	1,800
Nurse Aide	960	960	960
LPN	1,800	1,500	1,200
Certified Midwife	2,100	1,716	1,320
Lab Technician	2,100	1,800	1,500
Lab Aide	900	900	900
Pharmacist	7,200	7,200	7,200
Dispenser	900	900	900
X-Ray Technician	2,700	2,256	1,800
Environmental Technician	960	960	960
Social Worker	900	900	900
Recorder/HIS	900	900	900
Security	900	900	900
Housekeeping	900	900	900
Physiotherapist	900	900	900
Hospital Administrator	2,100	2,100	2,100
Nursing Director	2,700	2,256	1,800
OR Techs	2,100	1,800	1,500
Laundry	900	900	900
Dietary	900	900	900
Maintenance	900	900	900
TOTAL	$ 61,320.00	$ 54,972.00	$ 49,440.00

Zone 1: Grand Gedeh, Grand Kru, Maryland, River Gee, Sinoe
Zone 2: Bomi, Bong, Gbarpolua, Grand Bassa, Grand Cape Mount, Lofa, Margibi, Montserrado, Nimba, River Cess
Zone 3: Greater Monrovia
For standard models, an average of the three zones was used.

Note: The following salaries were not listed in BPHS salary structure tables: Nursing Director, OR Techs, Laundry, Dietary, Maintenance. Assumed that Nursing Director would earn similar salary to PA; OR Techs similar to Lab Techs; and Laundry, Dietary, and Maintenance similar to Housekeeping/Security.

ANNEX 6. Standard Model for Hospital <100 Beds, BPHS Staffing

Standard Cost Model - BPHS Staffing Figures			
Range of beds	<100		
Utilization Assumptions			
Catchment population	200,000		
Number of beds	80		
BOR	85%		
Occupied beds	68.0		
Annual inpatient days	24,820		
ALOS	5		
Admissions/Discharges	4,964		
Outpatient visits	17,940		
Admissions per 100 population	2.48		
Inpatient Day Equivalents (IDE)	28,703		
STAFFING	**Norms for beds per staff (BPHS)**	**Numbers of Staff**	**Total Salary Cost**
Physician	68.0	1	12,400
Officer in Charge (MD)	68.0	1	2,552
Physician Assistant	22.7	3	6,756
Registered Nurse	6.8	10	19,520
Nurse Anesthetist	68.0	1	2,452
Nurse Midwife	68.0	1	960
Nurse Aide	5.7	12	18,000
LPN	17.0	4	8,400
Certified Midwife	11.3	6	10,272
Lab Technician	34.0	2	3,600
Lab Aide	34.0	2	1,800
Pharmacist	68.0	1	7,200
Dispenser	17.0	4	3,600
X-Ray Technician	68.0	1	2,252
Environmental Technician	68.0	1	960
Social Worker	68.0	1	900
Recorder/HIS	11.3	6	5,400
Security	5.7	12	10,800
Housekeeping	5.7	12	10,800
Physiotherapist	68.0	1	900
Hospital Administrator	68.0	1	2,100
Nursing Director	68.0	1	2,252
OR Techs	11.3	6	10,800
Laundry	34.0	2	1,800
Dietary	22.7	3	2,700
Maintenance	17.0	4	3,600
Total		99	**$ 152,776.00**
Drug and supplies costs - Inpatient Admissions		9.17	45,502.50
Drug and supplies costs - Outpatient Visits		1.68	30,150.69
Total Drugs and Supplies			**$ 75,653.19**
Total Operating Costs			**$ 175,861.32**
GRAND TOTAL			**$ 404,290.52**
Cost per capita			$ 2.02
Cost per inpatient day equivalent			$ 14.09
Cost per inpatient admission			$ 70.43

ANNEX 7. Standard Model for Hospital <100 Beds, Staffing Norms

Standard Cost Model - Normative Staffing Figures			
Range of beds	<100		
Utilization Assumptions			
Catchment population	200,000		
Number of beds	80		
BOR	85%		
Occupied beds	68.0		
Annual inpatient days	24,820		
ALOS	5		
Admissions/Discharges	4,964		
Outpatient visits	17,940		
Admissions per 100 population	2.48		
Inpatient Day Equivalents (IDE)	28,703		
STAFFING	**Norms for beds per staff (BPHS)**	**Numbers of Staff**	**Total Salary Cost**
Physician	21.9	4	49,600
Officer in Charge (MD)	68.0	1	2,552
Physician Assistant	22.7	3	6,756
Registered Nurse	6.9	10	19,520
Nurse Anesthetist	68.0	1	2,452
Nurse Midwife	5.0	14	13,440
Nurse Aide	5.7	12	18,000
LPN	17.0	4	8,400
Certified Midwife	5.0	14	23,968
Lab Technician	34.0	2	3,600
Lab Aide	34.0	2	1,800
Pharmacist	68.0	1	7,200
Dispenser	17.0	4	3,600
X-Ray Technician	68.0	1	2,252
Environmental Technician	68.0	1	960
Social Worker	68.0	1	900
Recorder/HIS	11.3	6	5,400
Security	5.7	12	10,800
Housekeeping	5.7	12	10,800
Physiotherapist	68.0	1	900
Hospital Administrator	68.0	1	2,100
Nursing Director	68.0	1	2,252
OR Techs	11.3	6	10,800
Laundry	34.0	2	1,800
Dietary	22.7	3	2,700
Maintenance	17.0	4	3,600
Total		123	$ 216,152.00
Drug and supplies costs - Inpatient Admissions		9.17	45,502.50
Drug and supplies costs - Outpatient Visits		1.68	30,150.69
Total Drugs and Supplies			$ 75,653.19
Total Operating Costs			$ 175,861.32
GRAND TOTAL			$ 467,666.52
Cost per capita			$ 2.34
Cost per inpatient day equivalent			$ 16.29
Cost per inpatient admission			$ 81.47

ANNEX 8. Standard Model for Hospital >100 Beds, BPHS Staffing

Standard Cost Model - BPHS Staffing Figures			
Range of beds	>100		
Utilization Assumptions			
Catchment population	300,000		
Number of beds	120		
BOR	85%		
Occupied beds	102.0		
Annual inpatient days	37,230		
ALOS	5		
Admissions/Discharges	7,446		
Outpatient visits	26,910		
Admissions per 100 population	2.48		
Inpatient Day Equivalents (IDE)	43,055		
STAFFING	**Norms for beds per staff (BPHS)**	**Numbers of Staff**	**Total Salary Cost**
Physician	102.0	1	12,400
Officer in Charge (MD)	102.0	1	2,552
Physician Assistant	14.6	7	15,764
Registered Nurse	5.1	20	39,040
Nurse Anesthetist	20.4	5	12,260
Nurse Midwife	51.0	2	1,920
Nurse Aide	4.3	24	36,000
LPN	25.5	4	8,400
Certified Midwife	10.2	10	17,120
Lab Technician	25.5	4	7,200
Lab Aide	51.0	2	1,800
Pharmacist	102.0	1	7,200
Dispenser	25.5	4	3,600
X-Ray Technician	102.0	1	2,252
Environmental Technician	102.0	1	960
Social Worker	102.0	1	900
Recorder/HIS	17.0	6	5,400
Security	8.5	12	10,800
Housekeeping	6.0	17	15,300
Physiotherapist	102.0	1	900
Hospital Administrator	102.0	1	2,100
Nursing Director	102.0	1	2,252
OR Techs	8.5	12	21,600
Laundry	20.4	5	4,500
Dietary	17.0	6	5,400
Maintenance	17.0	6	5,400
Total		155	$ 243,020.00
Drug and supplies costs - Inpatient Admissions		9.17	68,253.75
Drug and supplies costs - Outpatient Visits		1.68	45,226.04
Total Drugs and Supplies			$ 113,479.79
Total Operating Costs			$ 423,293.73
GRAND TOTAL			$ 779,793.52
Cost per capita			$ 2.60
Cost per inpatient day equivalent			$ 18.11
Cost per inpatient admission			$ 90.56

ANNEX 9. Standard Model for Hospital >100 Beds, Staffing Norms

Standard Cost Model - Normative Staffing Figures			
Range of beds	>100		
Utilization Assumptions			
Catchment population	300,000		
Number of beds	120		
BOR	85%		
Occupied beds	102.0		
Annual inpatient days	37,230		
ALOS	5		
Admissions/Discharges	7,446		
Outpatient visits	26,910		
Admissions per 100 population	2.48		
Inpatient Day Equivalents (IDE)	43,055		
STAFFING	**Norms for beds per staff (BPHS)**	**Numbers of Staff**	**Total Salary Cost**
Physician	21.9	5	62,000
Officer in Charge (MD)	102.0	1	2,552
Physician Assistant	14.6	7	15,764
Registered Nurse	6.9	15	29,280
Nurse Anesthetist	20.4	5	12,260
Nurse Midwife	5.0	21	20,160
Nurse Aide	4.3	24	36,000
LPN	25.5	4	8,400
Certified Midwife	5.0	21	35,952
Lab Technician	25.5	4	7,200
Lab Aide	51.0	2	1,800
Pharmacist	102.0	1	7,200
Dispenser	25.5	4	3,600
X-Ray Technician	102.0	1	2,252
Environmental Technician	102.0	1	960
Social Worker	102.0	1	900
Recorder/HIS	17.0	6	5,400
Security	8.5	12	10,800
Housekeeping	6.0	17	15,300
Physiotherapist	102.0	1	900
Hospital Administrator	102.0	1	2,100
Nursing Director	102.0	1	2,252
OR Techs	8.5	12	21,600
Laundry	20.4	5	4,500
Dietary	17.0	6	5,400
Maintenance	17.0	6	5,400
Total		184	$ 319,932.00
Drug and supplies costs - Inpatient Admissions		9.17	68,253.75
Drug and supplies costs - Outpatient Visits		1.68	45,226.04
Total Drugs and Supplies			$ 113,479.79
Total Operating Costs			$ 423,293.73
GRAND TOTAL			$ 856,705.52
Cost per capita			$ 2.86
Cost per inpatient day equivalent			$ 19.90
Cost per inpatient admission			$ 99.49

ANNEX 10. People Contacted

Name	Position	Organization
Ministry of Health and Social Welfare		
Dr. Walter T Gwenigale, MD	Minister of Health	MOHSW
Dr. Vivian J Cherue, LLB	Deputy Minister, Administration	MOHSW
Dr. Bernice T Dahn, MD, MPH	Deputy Minister, Chief Medical Officer	MOHSW
Rev Napoleon Braithwaite	Special Assistant to Ms Dahn	MOHSW
S. Tornolah Varpilah	Deputy Minister, Planning, Research and Development	MOHSW
Dr. Moses G.Y. Pewu, MD, MPH	Assistant Minister, Curative Services	MOHSW
Jacob Hughes	Mobilizer, Officer of Financial Management	MOHSW
Benedict Harris	Dept of Planning, Research and Development	MOHSW
Roland Kess	Dept of Planning, Research and Development	MOHSW
Dr. Linda Birch	Chief Health Officer - Bomi	MOHSW
Dr. Ansumana Camara	Chief Health Officer - Montserrado	MOHSW
William Zaza	Community Health Coordinator - Lofa	MOHSW
Gabriel Thompson	Director HMIS	MOHSW
National Drug Services		
Dr. Peyan Johnson		National Drug Services
Mr Wesley		National Drug Services
Mr Reeves		National Drug Services
Hospitals		
Peter Flomo	Hospital Administrator	Curran Lutheran Hospital
Davidson O. Rogers	Hospital Administrator	Liberia Government Hospital, Tubmanburg
Nathaniel Vah	Hospital Administrator (Acting)	Phebe Hospital
Dr. John T. Dada	Chief Medical Officer	Redemption Hospital
Mr Osantoe Korboi	Nursing Director	Redemption Hospital
Lucius Bolley	Hospital Administrator	Redemption Hospital
George Roberts	Accountant	Redemption Hospital
Dr. Zenebe Bekele	Chief Medical Officer	Tellewoyan Hospital
Farouk Iddrisu	Hospital Administrator	Tellewoyan Hospital (IMC)
Patrick Nyachio	Director of Finance and Administration	Tellewoyan Hospital (IMC)

ANNEX 11. References

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