Costing health care interventions at primary health facilities in Nouna, Burkina Faso

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SUMMARY

The main objective was to estimate sector wide disease specific cost of health care intervention at health facilities in Nouna, Burkina Faso. A step-down full costing procedure was used to estimate the costs of interventions for 33 ICD-9 diseases using the diagnosis and treatment algorithms developed by the Ministry of Health and used in the health facilities. These provide context-specific cost estimates that are important input in any economic evaluation. The study was based on four first line health facilities in north-west Burkina Faso serving a population of about 60,000 under a demographic surveillance System (DSS). This paper reports sectoral context and disease specific cost estimates of health care interventions at first line health facilities in rural Burkina Faso. Case management with hospitalization has the highest cost of $US27.6 and family planning is the least costly with $US0.51 per unit. In addition, the government and development partners contribute 58% of the total resources used at the health facilities. These intervention costs provide a valuable source of information that feeds into economic evaluations and allows comparisons from a total health perspective for sectoral resource allocation decisions.

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Introduction

Interest in the costs of health care interventions derives from the desire to undertake economic evaluation that are input in health sector resource allocation. Increasingly, cost-effectiveness is being used in setting sectoral disease control priorities[1, 2]. These cost-effectiveness rankings are based on cost estimates that are not either locally generated or that do not represent the sector as a whole. Therefore, there is a likelihood that once these estimates are used in sectoral resource allocation decisions, it may actually yield different decisions, since it may result in significantly different rankings [3]. Knowing how such interventions cost and distributed among diseases and profile of spending for each disease and health interventions is essential not only in economic evaluation but also in health policy and planning. To our knowledge, this is the first such analysis in Africa, and therefore makes a land mark in providing researchers and policy makers estimates that are not only context specific but also disease specific. This paper therefore reports context

and disease specific sectoral cost estimates of interventions at first line health facilities in rural Burkina Faso.

Although there are many studies of costs of interventions for specific diseases, these frequently employ different data sources and different methods so that alternative estimates for the same disease are not consistent, and the relative costs for different diseases are distorted [4, 5] Only by employing consistent methodology and data sources across all diseases can it be ensured that costs for various diseases can be compared and the sum of costs for all diseases totals to the value of the health sector costs. The initial pioneering analysis was by Dorothy Rice [6]. Rice estimated the economic cost for 16 major diagnostic categories of illness by age and sex. The costs were estimated in terms of the direct costs for prevention, detection, and treatment; morbidity losses due to disability; and the mortality losses resulting from premature death. This paved the way for many subsequent studies in the United States, Europe and Australia [7-10]. However, such studies in an Africa setting are limited.

The realities of vertical programs and disease targeting initiatives, for example Roll Back malaria initiative, contrasts with the ministry of health who oversee the functioning of the overall health system with a multitude of diseases. The ministries of health allocate block grants to health facilities, yet disease targeting provide conditional grants for specific diseases. The ministries of health have the task of incorporating such conditional grants within the total health system in a way that avoids conflict with advocates of initiatives. Having disease specific costs of interventions, provided in the paper, aids this process of resource allocation.

Materials and Methods

Data for health sector financial cost estimation was collected from four primary health facilities serving a rural population under demographic surveillance in rural Burkina Faso [11]. The data collected can be broadly categorized as recurrent expenditure (for example, expenditure on drugs, salaries and maintenance), resource consumption data (for example, staff time, drugs, and building space), disease data (for example the number of cases of each disease reported), equipment, intervention (the interventions being implemented at the health facilities like vaccination) and data on the distribution of costs by source. The health facilities keep annual records of recurrent expenditure (except salaries of government employees), diseases (morbidity), interventions and inventory of equipment within the facilities. No records are available on staff time and the use of building space. We reviewed the available records in the four facilities that pertain to the year 1999, the year of data collection, in order to have comparable data across the above categories. Data on staff time, salaries, building space and distribution of costs was obtained through interviews with health facility staff, district staff and through measurement where appropriate.

Local market prices were used for local resources (for example reed beds, chairs etc) and international catalogues for internationally available resources (for example, microscope, stereoscope etc). Average salaries for staff for each staff category was used, which included social security for the staff [12]. The use of building space was ascertained through on spot measurement. Costs were annualized assuming a length of life of 3 years for equipment, 4 years for motorbikes and 30 or 20 years for the building depending on the construction materials [13]. A real rate of interest of 3% was used in calculating annual costs [14]. Staff time as a resource and allocation parameter was obtained through interviews taking a month as a reference. Two months were selected, one in the dry season and the other in the rainy season. It is known that disease occurrence and demand is influenced by season in this part of the world [15] which may also affect the allocation of time by staff. Where it was

not possible to interview the individuals, appropriate proxies were identified. These proxies were as close in work assignment as possible. For example the proxy for a traditional birth attendant was a midwife. Pre-defined activities used in the survey were then reduced to 10 main categories which include; administration, maternity, drug dispensing and purchasing, family planning, inpatient, outpatient, vaccination, prenatal and postnatal consultations, training and management of the well child.

Health sector costs were computed using the average costing approach [16]. Costs were estimated by the **"step down"** cost accounting procedure. It is based on the scrutiny of the facility production process to enable the best assignment of costs to the outputs to which they are associated. All facility costs are attributed to specific cost centers, and then allocation criteria such as time use, are employed to distribute all the costs (including overhead and the cost of intermediate outputs) to final cost categories [17]

Figure 1: Costing procedure for the health facilities

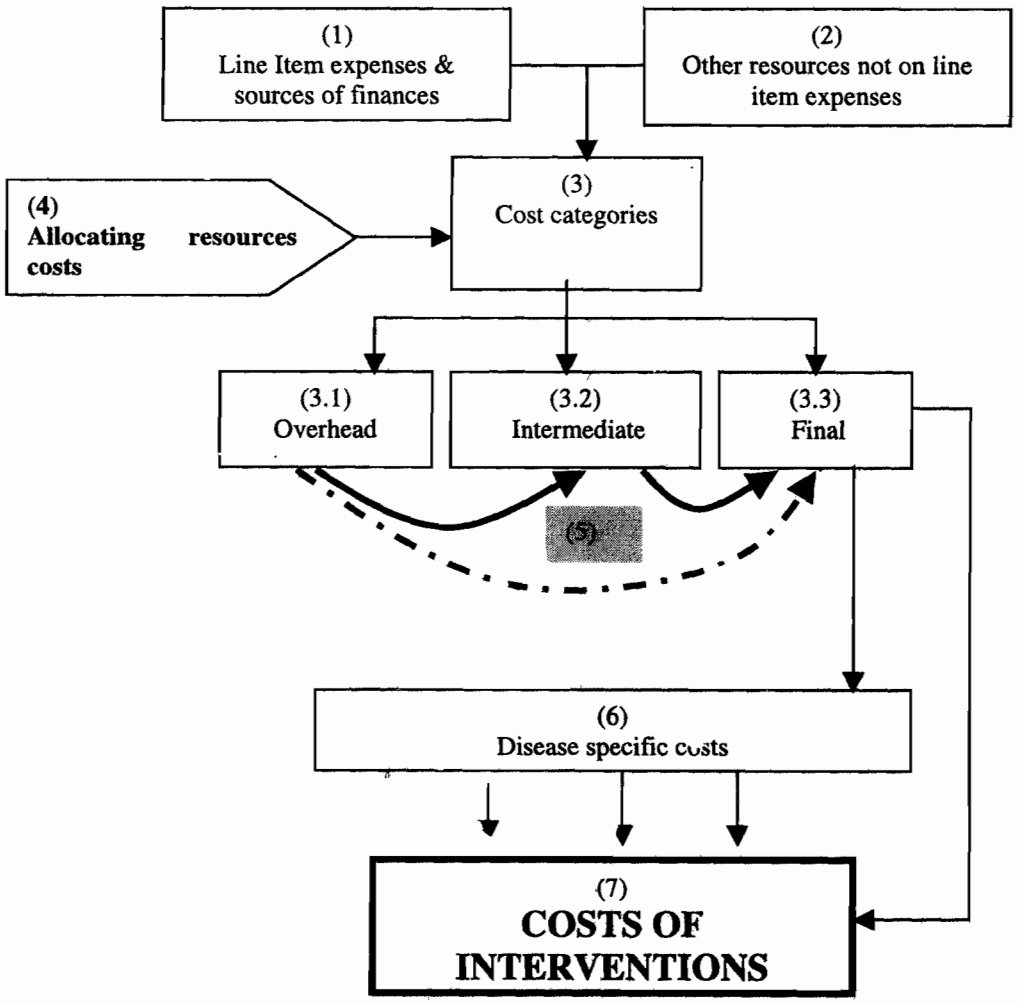

Figure 1 shows the costing procedure employed in the present study. The ***first*** step was to identify budget line item expenses. The expenditure at health facilities is usually by line items "line item spending" (typically in the format of salaries, drugs and other supplies, utilities etc), and there are a number of assorted means of making payments for different line items. The sources of these resources include the government, the community (collective contribution) and facility (resulting from user-fees and the sale of drugs and consumables).

However, not all resources consumed at health facilities are included on the "Line item" reports. Therefore to get a complete picture of the facility costs as possible, the line item budget is supplemented with information on resources used that don't appear on the facility "line item" financial statement. This involves for example valuing donated goods to the health facility. The **second** step therefore was to identify such resources. These included in-kind donations, buildings, equipment, vaccines and salaries of government employees.

For purposes of cost allocation, we identified different cost categories in the **third** step; overhead, intermediate and final cost categories. **Overhead** cost category includes departments or activities that provide services only to other departments of the health facility, not directly to patients. **Intermediate** cost category includes departments or activities that provide services to other departments but also provide services directly to patients. **Final** cost categories provide services directly to patients, not to other departments. Table 1 presents nine cost categories identified in this study; administration, drugs and consumables, maternity, family planning, inpatient, outpatient, training, vaccination and well child. The over riding factors for such classification is the way different reports were arranged, and the need to generate intervention groups. There are likely to be inter-linkages between the final cost categories, although this is not significant enough to affect the results.

Table 1. Costs categories identified at primary health facilities in Rural Burkina Faso

Overhead cost categories	Intermediate cost categories	Final cost categories
Administration	Drugs and consumables	Maternity Family planning Inpatient Outpatient Training Vaccination Well child

Once the cost categories were identified, in step ***four*** we allocated the resource costs to the different cost categories. The arrangement of the line item reports, inventory list, the time allocation and surface area enabled to attribute 80% of the costs. The remaining 20% of the cost were allocated to the different cost categories in proportion to the costs already allocated. That is, if administration had 29% of the directly allocated costs (of 80%), then 29% of the remaining 20% were allocated to administration.

In step ***five,*** we allocated the costs (C_{iO}) of the overhead cost category to intermediate and final cost categories, and intermediate cost categories to the final cost categories. Let C_{jI} be the direct costs in Intermediate cost category j, and C_{kF} be the direct costs in Final cost category k, (direct cost being the costs attributed to each cost category prior to their allocation to the cost categories associated with facility outputs). The proportions for allocating overhead costs to other cost categories and from intermediate costs to final cost categories can be represented as: α_{ij} = the proportion α of Overhead cost category i's costs "used" by Intermediate cost category j; α_{ik} = the proportion α of Overhead cost category i's costs "used" by Final cost category k; ρ_{jk} = the proportion ρ of Intermediate cost category i's costs "used" by Final cost category k; and

$$\sum_i \alpha_i = 1 \quad \sum_j \rho_j = 1$$

Explicitly,

$$C'_{jI} = C_{jI} + \sum_j \alpha_{jI} C_{io}$$

$$C'_{kF} = C_{kF} + \sum_j \alpha_{ik} C_{io}$$

where C'_{jI} = fully allocated costs of intermediate cost category j;

C'_{kF} = partially allocated costs to final cost category k.

and

$$C''_{kF} = C'_{kF} + \sum_j \rho_{jk} C'_{jI}$$

where C''_{kF} is the fully allocated costs of final cost categories.

The costs for administration category (overhead) were distributed to the drugs and consumables (intermediate), maternity, family planning, inpatient, outpatient, training, vaccination and well child (final) based on their resource consumption. The distribution of drugs and consumables cost category to the final cost categories was based on the diagnosis and treatment algorithms developed by the Ministry of Health of Burkina Faso and used by the health facility staff to facilitate diagnosis and treatment [18].

In step six, we distributed, the costs of the final categories to the specific diseases. The drugs and supplies were already distributed to the diseases and the only task was to allocate the rest of the costs. The cost of staff, building space, and other recurrent expenditures was distributed to the diseases in proportion to the cases reported.

Finally, in step ***seven***, we combined steps five and six to calculate the costs of interventions against different health conditions. The interventions identified were broadly outpatient case management without hospitalization, case management with hospitalization, and preventive (for example vaccination) for each disease where applicable. Some interventions could not be assigned to specific diseases (for example of delivery, family planning and health education). Some of the cost categories like family planning, inpatient, outpatient, vaccination and training correspond to different health care interventions, namely family planning, case management with hospitalization, outpatient case management, vaccination and health education respectively. Since the costs were attributed to diseases in step six, combining this with the reported cases for each disease provided unit cost of intervention for each disease.

Results

Resources used at health facilities

The health facility cost results were grouped into four categories; recurrent costs, equipment, buildings and staff resources. These were distributed by source to the government, health facility generated (from the sale of drugs, consumables and fee-for-service) and the community. The results are in US dollars (1US$ = 770 FCFA) at the exchange rate for the year 2000. It is estimated that the average cost for all the health facilities was 15,955US$ for the year 1999. Overall, the results show that the government contributes 58% of the resources used at health facilities, followed by the health facility through generating its own resources with 40% and finally the community with 3%[1].

Table 2: The sources and uses of revenue used at four primary health facilities in rural Burkina Faso, 1999 in US$ (US$1 = FCFA 770)

Resources	Government	Health Facility	Community	Total
Equipment	15,263(95)[i]	727(5)	-	15,990(25)[ii]
Recurrent revenue	4,833(19)	20,034(81)	-	24,867(39)
Staff resources	14,015(69)	4,496(22)	1,798(9)	20,309(32)
Buildings	2,617(99)	-	35(1)	2,652(4)
Total	36,728(58)	25,257(40)	1,833(3)	63,818(100)

Note: it was not possible using the available data to disaggregate government revenue into final sources like donors, taxation and so on

[1] Figures are corrected to the nearest whole percentage point

Table 2 shows that 81% of all the recurrent expenditure is borne by the health facility; are out of pocket payments from the patients as a result of user-fees, sale of drugs and consumables by the health facilities. The government contributes 19% of the recurrent expenditure, which is mainly related to vaccination and administration. The government provided 95% of the equipment and the facility 5%. The staff resources consumed at the health facilities costs were mainly in salaries and accommodation. Government contributed 69%, the health facility 22% and the community 9%.

Unit costs

The costs presented in the preceding section formed a basis for the estimation of unit costs for different services at primary health facilities. The costs were distributed to overhead, intermediate and final cost categories. In this initial direct allocation of resource costs to different cost categories, as table 3 shows, administration took the most resources with 26%, followed by drugs and consumables with 22%, outpatient 16%, vaccination 14% and family planning took the least proportion of resources with 1%.

The costs for the overhead cost category (administration) were distributed to the intermediate and final cost categories based on the directly allocated costs. This resulted into 30% going to drugs and supplies, 22% to outpatient and no change for family planning.

Table 3: Resource costs and unit costs for different cost categories in $US (US$ 1 = FCFA 770) *(The figures in brackets are percentages)*

Cost Category	Unit	All cost categories	Intermediate/ Final Categories	Final cost categories	Unit cost
Administration		16,909(26)[1]			
Drugs & consumables		13,862(22)	18,858(30)		
Family planning	Visit	507(1)	690(1)	1,249(2)	0.51
In-patient	Visit	2,756(4)	3,750(6)	9,613(15)	27.62
Out-patient	Visit	10,218(16)	13,901(22)	22,325(35)	3.08
Pre-& post-natal	Visit	3,739(6)	5,087(8)	5,087(8)	3.73
Health education	Session	2,069(3)	2,815(4)	2,815(4)	3.16
Vaccination	Dose	9,177(14)	12,485(20)	16,198(25)	1.17
Well child	Visit	777(1)	1,057(2)	1,057(2)	1.65
Maternity	Visit	3,803(6)	5,174(8)	5,472(9)	14.87
Total		63,818	63,818	63,818	

The intermediate (drugs and consumables) were then distributed to the final cost categories based on the value of consumption by the final cost categories. This resulted into 35% of the costs going to outpatient, 25% to vaccination and 2% family planning.

Finally, we calculated the unit costs of the final cost categories representing health services offered at the primary health facilities. The results show that the unit cost per hospitalization is US$ 27.62 while that of an outpatient visit is US$ 3.08. A family planning visit costs less than other categories at US$ 0.51.

Intervention costs

Having estimated the costs for the different cost categories, we extended the analysis to estimate the costs of disease interventions. A health care intervention is a set of deliberate procedures aimed at improving the health of an individual and/or population. For example, measles vaccination is an intervention aimed at protecting an individual from measles disease. In this study, interventions were broadly defined as a) outpatient case management, b) Case management with hospitalization, c) vaccination, d) family planning, e) Pre-and post-natal consultation, f) delivery (maternity) and g) health education. The Ministry of Health disease codes used for routine reporting at health facilities were converted to ICD-9 classification.

We estimated the costs for each disease for case management with and without hospitalization. This was based on the drugs that were recommended in the Ministry of Health of Burkina Faso laid out in the algorithms for the diagnosis and treatment of diseases [18]. After the initial allocation of drugs to different diseases, we calculated weighted total costs for each disease based on drug consumption and observed number of patients. Table 4 presents the results of case management with and without hospitalization for the first 33 most reported diseases. Treating malaria without hospitalization, which is the most diagnosed at the health facilities, costs US$ 4.7 and US$ 7.0 with hospitalization. A dog bite is the most expensive for case management without hospitalization and pregnancy complications are the most expensive with hospitalization.

The available data could not allow to stratify case management according to drugs used, for example the study does not distinguish between case management of malaria with chloroquine or quinine.

Owing to lack of appropriate data, some interventions, namely; vaccination, family planning, pre-and post-natal consultation, delivery and health education could not be disaggregated by disease. Their costs were therefore estimated in aggregate terms, and are shown in table 3. Each vaccination dose costs US$ 1.17, a family planning visit US$ 0.51, a pre-natal or post-natal consultation costs US$ 3.08, a delivery costs US$ 14.87 including hospitalization before and after delivery, and each training session costs US$ 3.16. We could not identify how many participants for each training session and the purpose of training from the available data.

Table 4: The total and unit costs treating different diseases at primary health facilities with case management with and without hospitalization

ICD 9 codes	MOH codes	Disease	Cases		Costs of Case management				
			Outpatient visits	Hospitalizations	Total	without Hospitalization		with Hospitalization	
						Total	per case	Total	per case
084	084	Malaria	1241	56	6,180	5,788	4.7	392	7.0
799	A11	Other ill-defined and unknown cause	990	15	59	58	0.1	1	0.1
480-518	A3	Diseases of lower airways	837		98	98	0.1	-	-
001	001	Cholera	495	60	425	360	0.7	65	1.1
004	004	Shigellosis	423	20	167	156	0.4	11	0.6
009.3	009.3 & A1	Diarrhea of presumed infectious origin	347	22	233	213	0.6	20	0.9
002	002	Typhoid and paratyphoid fever	338	32	29	25	0.1	4	0.1
690	690.8	Other erythematosquamous dermatosis	332		18	18	0.1	-	-
460-478	A2	Diseases of upper airways	304	4	186	182	0.6	4	0.9
379	379	Other disorders of the eye	287		135	135	0.5	-	-
129	129	Intestinal parasitism, unspecified	269		50	50	0.2	-	-
580-629	A10	Disease of the genitourinary system	179		140	140	0.8	-	-
520-579	A5	Diseases of the digestive system	122		120	120	1.0	-	-
022	022	Anthrax	98	4	-	-	-	-	-
032	032	Diphtheria	95	4	-	-	-	-	-
710-739	A7	Diseases of osteo-skeletal system	91		10	10	0.1	-	-
380.2	380.2	Other otitis Externa	85		36	36	0.4	-	-
	A6	Trauma with joint lesion	73		89	89	1.2	-	-
033	033	Whooping cough	67	4	66	61	0.9	5	1.4
036	036	Meningococcal infection	65	17	164	118	1.8	46	2.7
037	037	Tetanus	50	4	99	89	1.8	11	2.7
520-529(ex. 521)	A9	Other disorders of oral cavity	41	1	151	146	3.6	5	5.3
729.1	729.1	Myalgia	38		31	31	0.8	-	-
780.6	780.6	Fever of unknown origin	36	0	99	99	2.7	-	-
390-459	A4	Diseases of cardio-circulatory system	30		19	19	0.6	-	-
521	521	Diseases of the hard tissue of the teeth	27		27	27	1.0	-	-
E906.2	E906.2	Snake bit	19	12	54	28	1.5	26	2.2
055	055	Measles	12	1	18	16	1.4	2	2.0
E906.0	E906.0	Dog bit	4		54	54	13.6	-	-
869	A21	Internal trauma		3	52	-	-	52	17.3
440-459	A14	Other diseases of cardio-circulatory system		3	29	-	-	29	9.8
630-676	A18	Pregnancies complications		3	123	-	-	123	41.1
870-897,709	A32	Infected wounds and other diseases of skin		2	44	-	-	44	21.8

Discussion

This paper reports estimation results of costing health care interventions at the first line health facilities in rural Burkina Faso. The same methods and data were employed to estimate the intervention costs for each of the 33 ICD-9 diseases reported at primary health facilities. Consistent methods and data ensure that costs among diseases can be compared without fear or bias in relative magnitude of costs for different diseases(5). However, with existing data, some intervention costs like health education could not be assigned to the different diseases. One of the aims of health policy in priority setting is striking a balance between the expected benefits from interventions and their costs, and the paper provides information on the costs.

There are a number of health policy implications resulting from this study. First, providing costs of interventions by disease enables health planners to allocate efficiently and appropriately health care resource available to them balancing the need for specificity generated by disease targeting initiatives and the comprehensiveness of the health care system. Second, the results provide inputs into cost-effectiveness analysis of health care interventions in Burkina Faso, which will advance health policy debate. Third, the results will be an input into the designing of health care financing options for the Burkina Faso health ministry. In summary, the study provides basic information primarily for policy makers within the ministry of health and those interested in economic evaluation of health care interventions. Although this is by no means conclusive, it provides input into the health policy debate.

Conclusion

The study provides basic information for economic evaluation, health policy analysis regarding primary health care provision in Burkina Faso and other comparable districts and countries. The increasing use of cost-effectiveness analysis in priority setting requires locally generated cost information as part of the process. In this particular case, locally estimated burden of disease estimates already exists and are reported elsewhere(19). The study provides estimates for different health care interventions, vaccination, health education, case management with and without hospitalization. Although there are few studies that have used same data and methods to provide estimates for different diseases, separate studies do compare favorably with other studies. For example in a study conducted in Indonesia (20), the unit cost of immunization ranged from $US0.1 to $US2.2 in 1989 US dollars, family planning 0.2 to 4.1.

While information on costs of intervention are useful in their own right, knowledge of their distribution by source would guide the health planners in setting strategies for financing such interventions. For example, health sector resource requirements can be projected by source, which provides an opportunity to make realistic assumptions on the amount expected from each source. The results show that government is still a strong provider of health care resources even at the primary health level, even without considering staff training, supervision all of which affect the resource consumption at primary health level are included. Having said this, there is a possibility of cost recovery for day-to-day running of the health facilities as 81% of the recurrent expenditure is directly or indirectly from out of pocket. These results are within the framework of the Bamako Initiative.

Disaggregation of health sector costs means that its sum across all diseases equals the health sector resources for each type of service. The sum of costs across diseases does not exceed total costs, which has been known to happen when the results of independent studies using diverse data, methods, and assumptions are aggregated [4]. However, because health service utilization is classified according to the first-listed or primary diagnosis on medical records, the contribution of co-morbidities

o costs is ignored. The nature and magnitude of the distortion and which diagnoses are affected and by how much is unknown. The assumption that the health facility staffs use the established diagnosis and treatment algorithms provided by the ministry of health may not be true. If this is the case, we may over or under estimate the costs of some disease condition and may have no idea of the disease that is affected.

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