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Public Sector Pharmaceutical Pricing -- Assuring Financial Sustainability and Distributive Equity Under Alternative Drug Supply Modes in Moyen Chari, Chad

CHAD CHILD SURVIVAL PROJECT

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Recommendations

1. To establish a three-staged drug supply system based on: (a) an NGO clearing the drugs in N'Djamena and transporting them to Sarh; (b) storage of the drugs in Sarh at the public Prefectoral Pharmacy; and (c) distribution of the drugs to the health centers under multiple trip-by-trip contracts with private transporters.

2. To include all operating cost other than those of the Prefectoral Pharmacy staff (including amortization of equipment and buildings and transport from the Pharmacy to the health centers) in the break-even sale prices for pharmaceutical products sold by the Pharmacy on a cash-and-carry basis to the health centers.

3. To improve needs-based distributive equity by using (and relying primarily upon) the cost-of-treatment weighted equity pricing methodology introduced in this report, supplemented, as deemed necessary, by the use of the frequency-of-treatment weighted equity pricing methodology to reduce the subsidy provided to low frequency/high cost health problems.

4. To begin assessing the feasibility of using the Prefectoral Pharmacy as the procurement agent for hospitals in the prefecture on a cash-and-carry basis.

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It is my sincere hope that this report will help the Prefecture establish a sound and sustainable pharmaceutical pricing policy.

I. Introduction

Section II of the report presents a summary of the recurrent cost estimates for three alternative drug supply modes for the Prefecture of Moyen Chari -- public, private and Non-Governmental Organization-based. Detailed cost estimates can be found in Annexes 1 and 2.

Section III of the report begins with a review of how break-even pharmaceutical prices are calculated. This review can be skipped by readers who are less interested in the methodology employed than in the results. After this methodological review, the impact of the recurrent costs of the alternative supply modes cited above are considered on the level of break-even unit drug prices. Break-even prices for each supply mode with and without the Prefectoral Pharmacy personnel costs included are derived and contrasted. This is followed by an evaluation of how these different drug supply mode-related prices affect the drug treatment cost for the major health problems treated by health centers in Moyen Chari. These drug treatment costs are then employed in an examination of the impact of the alternative supply modes on the financial position of health centers under the assumption that user fees per episode of FCFA 700 per adult and FCFA 400 per are charged. In each case the financial position of an average health center is evaluated under alternative revenue leakage assumptions, and break-even user fee levels are derived that are sufficient to cover both drug and non-drug health center operating costs.

Section IV of the report evaluates the equity implications of the break-even drug pricing presented in Section III. The section begins with a definition of pharmaceutical drug pricing equity, and then presents a methodology for redistributing the drug supply operating costs across drug items so as to improve drug pricing equity. The redistributive pricing methodology is then applied to the NGO drug supply option which excludes the Prefectoral Pharmacy personnel costs.

The principal conclusions obtained from the drug pricing analysis are presented in Section V, and associated policy recommendations are reproduced in the Recommendations section at the beginning of the report.

II. The Cost of Alternative Drug Supply Modes for Moyen Chari

The cost analysis presented in this section is a reworking of a similar analysis which appeared in the report entitled Cost-Effectiveness Analysis of Alternative Modes of Drug Procurement, Storage and Distribution (Schwabe, 1993) prepared under the auspices of the USAID-sponsored Chad Child Survival Project (CCSP). The reworking of the cost estimates undertaken for this report was necessary due to a 50% devaluation in the FCFA relative to the French Franc which occurred subsequent to the initial reports production. Because the original report described the costing methodology in some detail, only summary analysis and tables will be presented here.[1]

Revised annual operating cost estimates for three alternative drug supply modes based on a sales volume for 15 health centers are summarized in Table 1. The three supply modes are: (1) a purely public mode in which all procurement, storage and distribution functions are undertaken by the public health authorities in Moyen Chari; (2) a private mode in which all supply functions other than the storage in Sarh (which remains the responsibility of the public health authorities) are undertaken under contract(s) to private clearing and transport agents; and, (3) a Non-Governmental Organization (NGO) mode in which all supply functions other than the storage in Sarh (which remains the responsibility of the public health authorities) are undertaken under contract(s) to an NGO. For each mode, the supply process is divided into four stages: (1) clearance, transport and storage in N'Djamena; (2) transport to Sarh; (3) storage in Sarh; and (4) transport to the community health centers. The cost estimates are further subdivided into fixed and variable costs. Fixed costs are defined as those costs which do not vary with the quantity of drugs procured, whereas variable costs do.[2]

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[1] The details underlying these summary statistics are reproduced in Annexes 1 and 2.

[2] The reader may note that inputs such as "personnel" and "transport" appear both as fixed and as variable costs. This is because some of the personnel and transport input costs vary with the quantity of drugs procured, and some do not. For example, the personnel costs of the staff working at the Prefectoral Pharmacy in Sarh do not vary with the quantity of drugs consumed, whereas per dia for staff who supervise and/or manage the transportation and distribution of drugs do.

An examination of the TOTAL row in Table 1 indicates clearly that the private and NGO drug supply modes are the least expensive to sustain from a recurrent cost financing standpoint. A purely public supply mode would increase annual operating costs at least 1.7 times above the private or NGO modes. As will be revealed more clearly in the ensuing analysis, requiring health centers to purchase drugs at prices that enable the prefectoral pharmacy to cover the total operating costs of the drug supply system under a public supply mode would very likely undermine their fiscal viability (and thus sustainability). For this reason, it is strongly recommended that Moyen Chari not adopt a purely public drug supply mode.

While there is a considerable difference between the operating costs of the public drug supply mode and the private or NGO modes, Table 1 reveals that there is relatively little difference in the recurrent costs of the NGO and private modes. The annual operating costs of each is approximately three times greater than the annual procurement cost of the drugs and medical materials (CIF in N'Djamena) required for the 15 health centers in Moyen Chari covered by the CCSP.[3] Moreover, in light of the effectiveness analysis presented in our earlier report (Schwabe, 1993) which accorded the NGO mode a higher subjective probability of assuring a sustainable drug supply than the private mode. it is recommended that the health authorities in Moyen Chari seek to contract with an NGO (e.g., the B.A.S.E.) to handle the clearance and transport between N'Djamena and Sarh.[4]

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[3] Readers are referred to page 7 for a discussion of the methodological problems encountered in estimating the annual drug utilization for these 15 health centers.

[4] Under the NGO drug supply mode the distribution of drugs from the Prefectoral Pharmacy to the health centers would be undertaken through multiple contracts with local private transporters.

Table 1: Annual Recurrent Costs of Alternative Drug Procurement, Storage and Distribution Modes in Moyen Chari, Chad, Based on a Pharmacy Sales Volume for 15 Health Centers

	Public					Private					NGO				
	N'Djamena	Transport to Sarh	Storage in Sarh	Transport to Health Centers	Total	N'Djamena	Transport to Sarh	Storage in Sarh	Transport to Health Centers	Total	N'Djamena	Transport to Sarh	Storage in Sarh	Transport to Health Centers	Total
Fixed Costs															
Personnel			3,181,200		3,181,200			3,181,200		3,181,200			3,181,200		3,181,200
Transport	152,802	3,590,82		3,896,427	7,640,057					0					0
Equipment			1,775,880		1,775,880			1,775,880		1,775,880			1,775,880		1,775,880
Furniture			19,557		19,557			19,557		19,557			19,557		19,557
Utilities					0					0					0
Buildings			537,468		537,468			537,468		537,468			537,468		537,468
Total Fixed Costs	152,802	3,590,828	5,514,105	3,896,427	13,154,162	0	0	5,514,105	0	5,514,105	0	0	5,514,105	0	5,514,105
Variable Costs															
										0					0
Personnel	126,700	120,000		70,000	316,700	113,200	15,000			128,200	324,022				324,022
Transport	22,152	866,527		859,544	1,748,223	64,000	1,158,300		1,424,000	2,646,300	64,000	1,158,300		1,424,000	2,646,300
Supplies	66,800				66,800			66,800		66,800			66,800		66,800
Other	642,482				642,482	719,682				719,682	869,642	47,556			917,198
Total Variable Costs	858,134	986,527	0	929,544	2,774,205	896,882	1,173,300	66,800	1,424,000	3,560,982	1,257,664	1,205,856	66,800	1,424,000	3,954,320
TOTAL	**1,010,936**	**4,577,355**	**5,514,105**	**4,825,971**	**15,928,367**	**896,882**	**1,173,300**	**5,580,905**	**1,424,000**	**9,075,087**	**1,257,664**	**1,205,856**	**5,580,905**	**1,424,000**	**9,468,425**

Notes: Refer to Annexes 1 and 2 for the detailed cost tables which underlay this summary analysis.

In order to evaluate whether drug and medical material pricing should fully cover the operating costs for all fixed and variable inputs identified in Table 1, it is necessary to assess the impact of these input costs on: (1) the break-even unit drug prices (i.e., the unit drug prices which assure that drug sale revenues will cover the total costs of drug supply); (2) the financial position of the 15 health centers in Moyen Chari when required to pay the break-even drug prices; and (3) the user fees that the health centers will need to establish in order to fully recover their operating costs (including drugs). After considering each of these issues, we examine the equity implications of break-even drug pricing, and introduce a pricing strategy which will enable health authorities in Moyen Chari to redistribute operating costs across drug items so as to render break-even drug pricing more equitable.

III. Break-Even Pricing Under Alternative Drug Supply Modes

A Description of the Break-Even Pricing Methodology

Break-even drug prices are those prices which assure that the Prefectoral Pharmacy balances its annual budget when an expected quantity of drugs are sold during the year. This balanced budget outcome is attained when the revenues derived from the sale of the drugs (plus from any other sources of income) equal the total operating costs of the Pharmacy. In mathematical terminology, a balanced budget occurs when profits, π, which equal the difference between total revenues, TR, and total costs, TC, are equal to zero, or that

[1] $$0 = \pi = TR - TC.$$

Break-even drug prices enter the balanced budget equation [1] through total revenues. In the simplified case where it is assumed that the Prefectoral Pharmacy only sells three drug items (z_1, z_2 and z_3), total revenues are derived as follows:

[2] $$TR = (P_1 \times z_1) + (P_2 \times z_2) + (P_3 \times z_3) + S$$

where P_1, P_2 and P_3 are the unit break-even prices, and S is the subsidy income from government or donors.

Total costs are the sum of fixed costs, C^F, and variable costs, C^V. As indicated in Section II, fixed costs are those costs that do not vary with the quantity of drugs sold, whereas variable costs are those that do. From the standpoint of drug pricing there are two important sub-categories of variable costs: drug costs and non-drug costs. As revealed in Table 1, non-drug variable costs include certain personnel costs, transport costs, supply costs, and other import fees and handling charges. Variable drug costs are the sum of the ***future expected drug costs*** for all drug items procured by the Prefectoral Pharmacy. The future expected purchase price (in period t+1) is the current purchase price adjusted for expected inflation, wastage, and currency fluctuation. Algebraically, variable costs are thus calculated as follows:

$$[3] \qquad C^V = C^V_{Non-Drug} + \left[\left(c_1^{t+1} \times z_1\right) + \left(c_2^{t+1} \times z_2\right) + \left(c_3^{t+1} \times z_3\right)\right],$$

where (c_1, c_2 and c_3) are the future expected unit drug costs[5], and (z_1, z_2 and z_3) are the quantities (number of units) of each drug procured.

Figure 1 presents a simplified example of how these formulas are used to derive the break-even prices for three pharmaceutical products.

As may be evident from the example provided in Figure 1, the derivation of break-even drug prices is sensitive to errors in the expected drug cost and expected drug utilization (or sales) variables. If, for example, the FCFA experiences an unexpectedly large devaluation, then the expected future drug costs (the c_i^{t+1}) will be underestimated, resulting in an underestimation of the break-even prices, a reduction in revenues, and

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[5] More accurately, the future expected unit cost of drug item 1 in period t+1 is $c_1^{t+1} = c_1^t \times (1 + i + w + e)$ where i is the rate of inflation, w is the wastage rate, and e is the currency exchange rate fluctuation.

ultimately a financial deficit. Similarly, if the quantities of drugs sold is less than what is expected, then break-even price will be underestimated, revenues will be lower than expected, and a deficit will result. Figure 2 provides examples of the effect of both types of errors on the break-even price calculations.

Errors in variables of this sort are much more likely to occur when there is no prior experience (or data on the experience) upon which to base the break-even pricing calculations. Unfortunately, this is currently the case in Moyen Chari since this is the first year that the Prefectoral Pharmacy has been in operation. The two potentially significant sources of error in the determination of drug pricing in the Moyen Chari case are in the estimates used for future expected currency fluctuation, and future expected drug sales. The former is a problem because the FCFA exchange rate is pegged to the French Franc and recently underwent a 50% devaluation. This kind of large discrete currency exchange rate fluctuation is virtually impossible to plan for and yet can fundamentally alter the determination of pricing. It will thus be necessary for the health authorities in Moyen Chari to be in a position to immediately recalculate their break-even drug sale prices in the event of further large currency exchange rate fluctuations.

There are two feasible methods of projecting future drug sales, each of which is susceptible to error. The first method is to use illness frequency data reported by the health information system coupled with standard treatment protocols to generate expected annual sales. One of the problem with this approach is that it assumes that nurses will follow these standard treatment protocols when there is considerable evidence that they do not.[6] Since nurses have a tendency to over-prescribe drugs, expected drug sales based on this first method are likely to be significantly underestimated. The second method is to use the per capita drug procurement experience from other areas and then project future drug sales using local population data. There are two sources of per capita drug procurement

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[6] Another problem is that data on illness conditions reported in the Annual Health Statistics Bulletin are overly aggregated for accurate determination of treatment protocols and thus drug use.

Figure 1: An Algebraic Example of Break-Even Pharmaceutical Pricing

The break-even prices for three pharmaceutical products sold by the Prefectoral Pharmacy are derived from the following balanced budget equation which is obtained by substituting equations [2] and [3] into equation [1]:

$$C^F + C^V_{Non-Drug} + \left[\left(c_1^{t+1} \times z_1\right) + \left(c_2^{t+1} \times z_2\right) + \left(c_3^{t+1} \times z_3\right)\right] = \left(P_1 \times z_1\right) + \left(P_2 \times z_2\right) + \left(P_3 \times z_3\right) + S$$

Without further information it is not possible to solve for the three unknown break-even sale prices P_1, P_2 and P_3. As a result, it is necessary to re-specify each of the break-even sale prices in terms of one unknown price factor, P^*. One way of doing this which ensures that break-even sale prices are proportional to the future expected cost of the drug, is to define the break-even sale price for the ith drug as follows:

[4] $$P_i = P^* \times \left(c_i^{t+1} \Big/ Max\left(c^{t+1}\right) \right),$$

where $Max\left(c^{t+1}\right)$ is the maximum future expected unit cost of all the three drugs.

If $C^F = 3{,}000$, $C^V_{Non-Drug} = 2{,}000$, $c_1^{t+1} = 10$, $c_2^{t+1} = 5$, $c_3^{t+1} = 1$, and $z_1 = z_2 = z_3 = 100$, P^* can be solved for as follows:

$$3{,}000 + 2{,}000 + (10 \times 100) + (5 \times 100) + (1 \times 100) = P^* \times \left\{\left[\left(\frac{10}{10}\right) \times 100\right] + \left[\left(\frac{5}{10}\right) \times 100\right] + \left[\left(\frac{1}{10}\right) \times 100\right]\right\}$$

$$\Rightarrow 5{,}000 + 1{,}000 + 500 + 100 = P^* \times \left\{[1 \times 100] + [1/2 \times 100] + [1/10 \times 100]\right\}$$

$$\Rightarrow 6{,}600 = P^* \times \{100 + 50 + 10\}$$

$$\Rightarrow 6{,}600 = P^* \times 160$$

$$\Rightarrow 6{,}600/160 = P^* = 41.25.$$

By substituting the solution value for P^* into equation [4] for each drug item, the break-even unit sale prices are derived:

$$P_1 = 41.25 \times (10/10) = 41.25$$
$$P_2 = 41.25 \times (5/10) = 20.63$$
$$P_3 = 41{,}25 \times (1/10) = 4.13.$$

The total revenue derived from the sale of these three drugs at their break-even unit prices is thus.

$$TR = (41.25 \times 100) + (20.63 \times 100) + (4.13 \times 100)$$
$$\Rightarrow TR = 4{,}125 + 2{,}063 + 413$$
$$\Rightarrow TR = 6{,}600 = TC.$$

Figure 2: The Effect of Errors in Variables on the Derivation of Break-Even Drug Prices

The derivation of break-even drug prices in Moyen Chari is particularly susceptible to errors in the determination of future expected procurement costs as a result of large unanticipated fluctuations in the FCFA exchange rate. It is also susceptible to errors in the determination of the quantity of future expected drug sales. The effect of each of these types of errors on the determination of break-even drug prices for the simple 3 drug case presented in Figure 1 is produced here.

Currency Exchange Rate Case: Assume that an unanticipated devaluation in the FCFA occurs which causes the future expected cost (CIF in N'Djamena) of the three drugs to double. In this case the drug procurement costs would be:

	Prior to Devaluation	After Devaluation
c_1^{t+1}	10	20
c_2^{t+1}	5	10
c_3^{t+1}	1	2

Assuming that all other variables remain as presented in Figure 1, then the after-devaluation break-even drug prices are derived as follows:

$$3{,}000+2{,}000+(20\times 100)+(10\times 100)+(2\times 100)=P^{*}\times\left\{\left[\left(\frac{20}{20}\right)\times 100\right]+\left[\left(\frac{10}{20}\right)\times 100\right]+\left[\left(\frac{2}{20}\right)\times 100\right]\right\}$$

$$\Rightarrow 5{,}000+2{,}000+1{,}000+200=P^{*}\times\{[1\times 100]+[1/2\times 100]+[1/10\times 100]\}$$

$$\Rightarrow 8{,}200=P^{*}\times\{100+50+10\}$$

$$\Rightarrow 8{,}200=P^{*}\times 160$$

$$\Rightarrow 8{,}200/160=P^{*}=51.25.$$

$$\Rightarrow P_1=51.25\times(20/20)=51.25$$

$$\Rightarrow P_2=51.25\times(10/20)=25.63$$

$$\Rightarrow P_3=51.25\times(2/20)=5.10.$$

Expected Drug Utilization Case: Assume that the expected future quantity of drug 1 is erroneously determined to be half the level it was in the example in Figure 1, and that all other variables remain unchanged. Break-even drug prices are thus:

$$3{,}000+2{,}000+(10\times\mathbf{50})+(5\times 100)+(1\times 100)=P^{*}\times\left\{\left[\left(\frac{10}{10}\right)\times\mathbf{50}\right]+\left[\left(\frac{5}{10}\right)\times 100\right]+\left[\left(\frac{1}{10}\right)\times 100\right]\right\}$$

$$\Rightarrow 5{,}000+500+500+100=P^{*}\times\{[1\times 50]+[1/2\times 100]+[1/10\times 100]\}$$

$$\Rightarrow 6{,}100=P^{*}\times\{50+50+10\}$$

$$\Rightarrow 6{,}100=P^{*}\times 110$$

$$\Rightarrow 6{,}100/110=P^{*}=55.45.$$

$$\Rightarrow P_1=55.45\times(10/10)=55.45$$

$$\Rightarrow P_2=55.45\times(5/10)=27.73$$

$$\Rightarrow P_3=55.45\times(1/10)=5.55.$$

data for Chad that can be used to derive expected annual drug sales in Moyen Chari. One is the FED experience in supplying drugs to public health centers in northern Chad, and the other is the NGO experience of BELACD in Goundi, Moyen Chari. While the FED data have the advantage that they are based on a public health system experience, they probably overstate drug needs since they reflect the total quantity of drugs supplied by the FED rather than facility-based consumption experience. Use of the FED's per capita drug utilization standards are thus likely to overstate drug sales in Moyen Chari, resulting in lower than break-even price setting. Although the BELACD data reflect drug prescription patterns of not-for-profit NGO health facilities, they are used in the ensuing analysis since they are believed by local health authorities to more accurately reflect expected future drug utilization in the CCSP project area where nurses are undergoing in-service training in improved illness diagnosis and treatment.[7]

[7] See Annex 3 for a comparison between the annual drug procurement estimates derived using standard treatment protocols, the FED and BELACD data.

Unit Break-Even Prices for Alternative Drug Supply Modes and Cost Recovery Levels

The break-even drug pricing methodology reviewed in the previous section (see Figure 1 in particular) distributes the annual operating costs of the Prefectoral Pharmacy proportionately across all drug and medical supply items sold. The unit break-even sale prices for all drugs or medical supplies are thus their future expected unit costs marked-up by a constant percentage sufficient to finance the Pharmacy operating costs. Since the same mark-up percentage is applied to all drugs, higher cost drugs are marked up more in absolute terms than lower cost drugs. Moreover, since the mark-up percentage is determined by the level of Pharmacy operating costs, the higher the operating costs, the higher the mark-up factor needs to be, and thus the higher all break-even prices will be.

Table 2 and Graph 1 illustrate the extent to which future expected unit drug and medical supply costs must be inflated to cover the operating costs of the Prefectoral Pharmacy under the alternative drug supply modes presented in Section II of this report. For each of the three modes (public, private and NGO), two different cost recovery options are examined: the first which includes the salaries of the Prefectoral Pharmacy staff in the operating costs, and the second which excludes them.[8]

Table 1 demonstrates that the adoption of a purely public drug supply system in Moyen Chari would require the Prefectoral Pharmacy to charge health centers approximately 10% more per unit of drug than if it adopted an NGO mode (i.e., one that contracted with an NGO to clear the drugs in N'Djamena and transport them to Sarh, and then contracted with multiple private transporters to distribute the drugs to the health centers) when 15 health centers purchase their drugs from the prefectoral pharmacy.[9]

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[8] The drugs and medical supplies selected for presentation in Table 2 and Graph 1 represent every 10th item in the Pharmacy's inventory database when sorted in ascending numerical order by unit price. Thus, the list contains a representative sample of drug pricing.

[9] It is important to note that as the volume of pharmacy drug sales increases, the percentage differential will decrease since overhead costs will decline as a share of total drug supply costs. Even so, adopting a purely public supply mode will, almost assuredly, always raise the unit sale prices of drugs relative to those that would need to be charged under an NGO supply mode.

Thus, a tablet of Cotrimoxazole that could be sold at FCFA 12.39 per tablet under an NGO supply mode, would have to be sold for FCFA 13.49 under a purely public supply mode. Since both the private and NGO supply modes are feasible (and are also more effective than the public mode from the standpoint of assuring drug supply sustainability according to the effectiveness analysis undertaken by the local health authorities (Schwabe, 1993)), the adoption of a public supply mode cannot be justified from a cost (or cost-effectiveness) standpoint.

Table 1 also reveals that, based on a sales volume for 15 health centers, future expected unit drug prices (CIF in N'Djamena) would need to be marked-up by approximately 10% in order to fully cover the operating costs of the Prefectoral Pharmacy under the NGO supply mode when ***Pharmacy personnel salaries are excluded*** from cost recovery. Incorporating the Pharmacy personnel costs in the break-even drug price calculations under the NGO supply mode would require future expected unit drug prices to be increased by 15%. Thus, ***if*** Pharmacy salaries can be assured by the Chadian Government, important price savings can be passed on to the health centers.

The relative impact of the alternative drug supply modes and cost recovery levels on break-even pharmaceutical pricing is depicted in Graph 1. It ranks the supply and cost recovery options by the percentage mark-up that each would require over the future expected unit cost when no operating costs are recovered. As can be seen, the mark-up ranges from 109% for the private supply mode when Prefectoral Pharmacy salaries are excluded from cost recovery, to 125% under the public mode with Pharmacy personnel costs included <u>when the sales volume of the prefectoral pharmacy is based on the demand of 15 health centers</u>. The graph also conveys a clear sense that it is the highest cost drugs (drug items 5, 6 and 7 on the x-axes of the graph) which contribute most to defraying the operating costs of the Pharmacy under the break-even pricing formulation since the same percentage mark-up on high priced drugs produces more absolute revenues for the Pharmacy. As will be discussed more fully in Section IV, the proportional distribution of operating costs across drug and medical supply items may be unappealing from an equity

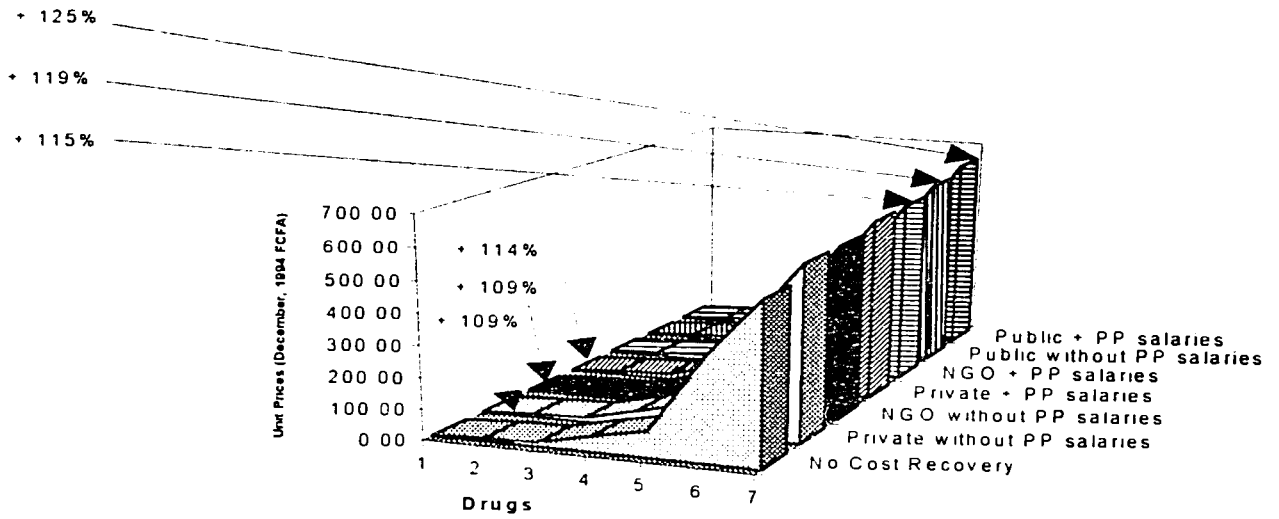
Table 2: The Impact of Alternative Drug Supply Modes and Cost Recovery Levels on Selected Pharmaceutical Product Break-Even Unit Pricing in Moyen Chari

Item Number	Name	Dose	Number per pack	Unit Break-Even Prices (December, 1994, FCFA)						
				No Cost Recovery	Public + PP salaries	Public without PP salaries	Private + PP salaries	Private without PP salaries	NGO + PP salaries	NGO without PP salaries
1	HYDROCHLORTHIAZIDE	Tab	1000	2.53	3.17	3.03	2.89	2.76	2.91	2.77
2	COTRIMOXAZOLE	Tab	1000	10.77	13.49	12.89	12.32	11.75	12.39	11.79
3	VITAMIN A Palmitate	Caps	500	14.65	18.35	17.54	16.76	15.99	16.85	16.04
4	ORAL REHYDRATION SALTS	Sachet	1000	51.46	64.44	61.59	58.86	56.16	59.18	56.32
5	INFUSION SET - PAED SCALP VEIN	Each	1	86.51	108.33	103.54	98.94	94.41	99.48	94.68
6	BENZYLPENICILLINE BENZATHINE	Amp	50	330.29	413.62	395.32	377.77	360.46	379.83	361.49
7	SUTURE SILK STERILE W/NEEDLE	Each	36	517.74	648.37	619.68	592.17	565.03	595.39	566.65

Source: USAID Chad Child Survival Project, and Délégation de Santé, Sarh, Chad

Notes: PP = Prefectoral Pharmacy; Item Numbers are for reference to Chart 1. The No Cost Recovery case is the CIF price based on air freight to N'Djamena. Break-Even prices were derived using the computerized Drug Pricing Module which is part of the Health Sector Financial Planning & Management Modules ©.

Graph 1: Break-Even Drug Pricing Under Alternative Drug Supply and Cost Recovery Modes



perspective. To the extent that this is the case, it will be important to develop a redistributive mechanism that enhances the distributive equity of break-even drug pricing.

Before proceeding with an evaluation of the impact of the break-even pricing on drug treatment costs, it is important to stress that Table 1 (and Figure 2 in Section III) should make clear that local health authorities cannot simply guess to what extent drug prices will need to be increased to ensure the Prefectoral Pharmacy's financial viability, and the sustainability of drug supply in general. The pricing mark-up factor will need to vary as the quantity of drugs purchased changes, as inflation rates, wastage rates and currency exchange rates fluctuate, as transport and other operating costs change, and as the level of Government and donor assistance changes. Providing the Pharmacist with the kind of automated drug procurement, price setting, inventory management and sales software that has been supplied under the CCSP is an essential step towards assuring drug supply and thus health service sustainability.

The Impact of Alternative Drug Supply Modes and Cost Recovery Levels on the Drug Treatment Cost for Major Health Problems in Moyen Chari

While the preceding analysis is informative from the standpoint of determining how the alternative supply modes will affect local pharmaceutical pricing decisions, it is not, on its own, very helpful from the standpoint of determining whether health centers will be able to afford the Pharmacy's break-even prices. To assess this, it is necessary to estimate drug treatment costs for the major health problems treated at these facilities. This is particularly important in Moyen Chari given the adoption of user fees on a per-illness-episode basis at the health center level. Under this type of financing arrangement, health centers need to be able to cover drug and other costs out of fee revenues. If the drug treatment costs for a relatively large number of the health problems exceed the user fee level then the health centers are likely to run a deficit.

Figure 3: Calculating Drug Treatment Costs

The estimated drug treatment costs for the major health problems is an average cost based on standard treatment protocols established by the project physicians using only drugs included on the essential drug list. It is calculated by adding up the total treatment cost for each drug prescribed in the treatment of a particular health problem, and then by dividing this sum by the total number of patients treated with the health problem in 1993 in Moyen Chari. The total treatment cost for each drug is obtained by multiplying the unit break-even price for the drug by the standard treatment protocol per patient (i.e., the number of units of the drug usually prescribed per patient per episode of the health problem), and then multiplying this by the number of patients who should receive this drug per year.

The following example demonstrates how the estimated drug treatment cost for a case of "Measles" is calculated when the unit prices are marked up to cover the drug supply system operating costs under an NGO supply mode with Prefectoral Pharmacy salaries excluded (see column [3] of Table 3).

Based on the standard treatment protocol, the following drugs sold by the pharmacy should be prescribed to the percentage of patients indicated:

[(ACETYLSALICYLIQUE ACID, 100mg, Tablet, 100 per pack) X (33% of patients)] + [(ACETYLSALICYLIQUE ACID, 75mg, Tablet, 5000 per pack) X (33% of patients)] + [(PARACETAMOL, 100mg, tablet, 1000 per pack) X (33% of patients)] +[(COTRIMOXAZOLE 400+80mg, tablet, 1000 per pack) X (33% of patients)] + [(ORAL REHYDRATION SALTS, 27.5mg for 1 litre, 1000 per pack) X (100% of patients)] + [(SULFAMETHOXAZOLE + TRIMETHOPRIM, 400mg+80mg+500, Tablet, 100 per pack) X (30% of patients)] + [VITAMIN A PALMITATE, 200,000 UI, Capsule, 500 per pack) X (100% of patients)] + [TETRACYCLINE OPTHALMIC OINTMENT, 1% 5g, Tube, 100 per pack) X (70% of patients)].

The average (per patient) drug treatment cost based on the prescription of these eight drugs according to a standard treatment protocol is thus,

$$\left(\frac{3.66\times 20\times 1{,}006}{3{,}047}\right)+\left(\frac{3.64\times 20\times 1{,}006}{3{,}047}\right)+\left(\frac{2.95\times 20\times 1{,}006}{3{,}047}\right)+\left(\frac{11.79\times 7\times 914}{3{,}047}\right)+\left(\frac{56.32\times 10\times 3{,}047}{3{,}047}\right)$$

$$+\left(\frac{53.31\times 7\times 914}{3{,}047}\right)+\left(\frac{16.04\times 1\times 3{,}047}{3{,}047}\right)+\left(\frac{172.61\times 1\times 2{,}133}{3{,}047}\right)=$$

$$24.17+24.04+19.48+24.76+563.2+111.94+16.04+120.83 = \text{FCFA } 904.46$$

It is important to stress here that this average drug treatment cost is probably a lower bound estimate of the actual drug treatment cost, since it is likely that the nurses actually prescribe a significantly greater quantity (and conceivably even a greater variety) of drugs than is indicated by the standard treatment protocol.

Notes: The standard treatment protocols account for the fact that certain drugs (such as Aspirin in the preceding example) are stocked under different dosage and packaging configurations by the pharmacy. In these cases, the percentage of patients treated with the drug is divided by the number of duplicate drug items so that the sum of the percentage of patients treated for this product is the correct percentage.

The methodology used to estimate drug treatment costs under the alternative break-even pricing arrangements presented in Table 2 is reviewed in Figure 3. As is indicated

there, the estimated drug treatment costs are an average cost per patient that are based on standard treatment protocols rather than on actual drug utilization data. As such, they probably represent lower bounds of the actual drug treatment costs to the extent that nurses actually prescribe a greater quantity and variety of drugs than is indicated by the standard treatment protocol.

The estimated drug treatment costs for the major health problems reported for Moyen Chari in 1993 are presented in Table 3.[10] Separate drug treatment costs are reported for a "Base Case" -- the case where none of the Pharmacy operating costs are recovered in the drug pricing -- as well as for the public, private and NGO cases elaborated in Section II when Pharmacy personnel costs are included and excluded from the break-even pricing calculations. The dark line running through the table divides the health problems up into those for which the drug treatment cost are less than the proposed FCFA 700 per adult user fee (those cases above the line) from those for which the treatment cost exceeds the FCFA 700 fee level. As can be readily seen, the drug treatment costs per illness episode will exceed what patients would be charged for a majority of the health problems identified. Whether the health centers can finance this depends upon the distribution of cases by health problem. If a large percentage of patients are treated for relatively inexpensive cases (health problems above the line), then surplus revenues could be generated with which to offset the per patient deficit that will be incurred for treating patients suffering from relatively expensive cases (problems below the line).

While Table 3 does not reveal how many patients are treated for relatively expensive or inexpensive health problems, it does indicate that if the adult user fee were increased to FCFA 1,600, then approximately 70% of the health problems under the NGO-excluding-pharmacy-salaries mode would have drug treatment costs less than the fee level.

Even if the user fee level were increased to this level, however, Table 3 suggests that health centers are likely to still have a difficult time financing some of the higher cost

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[10] See Annex 4 for a complete listing of the illness conditions and treatment protocols used for each of the drugs in the pharmacy database.

health problems under a fee-per-illness episode financing arrangement. Shifting the drug cost for these higher cost health problems onto the patients through the introduction of a two-part pricing arrangement that requires patients to pay a user fee to cover non-drug operating costs and then pay separately for all drugs consumed is not likely to work either.

Table 3: Drug Treatment Costs for Major Health Problems in Moyen Chari Under Alternative Drug Supply Modes (December, 1994 FCFA)

Health Problems	Base Case [1]	Private Without PP Salaries [2]	NGO Without PP Salaries [3]	Private + PP Salaries [4]	NGO + PP Salaries [5]	Public Without PP Salaries [6]	Public + PP Salaries [7]
Other problems	14.94	16.31	16.36	17.09	17.19	17.89	18.71
Muscle pains	70.15	76.56	76.78	80.24	80.68	83.97	87.85
Worms	97.29	106.18	106.48	111.28	111.88	116.45	121.84
Cough of 15 days or more	198.07	216.15	216.77	226.54	227.77	237.06	248.04
Malnutrition	212.50	231.91	232.57	243.05	244.37	254.34	266.11
Hematuria	226.52	247.20	247.91	259.08	260.49	271.11	283.66
Conjonctivitis	288.85	315.23	316.13	330.37	332.17	345.72	361.73
Trauma	380.50	415.25	416.44	435.19	437.56	455.41	476.49
Skin Infection	455.19	496.76	498.18	520.62	523.45	544.81	570.08
Diarrhea	632.92	690.72	692.70	723.89	727.84	757.53	792.60
Fever	776.24	847.13	849.56	887.82	892.65	929.07	972.08
Measles	826.35	901.81	904.40	945.13	950.23	989.05	1,034.83
Cough < 15 days	926.55	1,011.17	1,014.07	1,059.74	1,065.51	1,108.98	1,160.32
Asthma	975.63	1,064.73	1,067.79	1,115.88	1,121.95	1,167.73	1,221.78
Post-partum complic.	1,080.56	1,179.24	1,182.62	1,235.88	1,242.61	1,293.31	1,353.18
Purulent ureteritis	1,145.68	1,250.31	1,253.89	1,310.36	1,317.50	1,371.25	1,434.73
Prenatal consultations	1,198.00	1,307.41	1,311.16	1,370.21	1,377.67	1,433.88	1,500.25
Ear infection/Flu	1,400.44	1,528.33	1,532.71	1,601.74	1,610.47	1,676.17	1,753.76
Genital ulcers	1,724.00	1,881.44	1,886.83	1,971.81	1,982.55	2,063.44	2,158.96
Dysentery	1,846.32	2,014.93	2,020.71	2,111.72	2,123.22	2,209.84	2,312.14
Urinary infections	2,283.03	2,491.53	2,498.67	2,611.20	2,625.42	2,732.54	2,859.03
Hypertension	2,404.82	2,624.44	2,631.97	2,750.50	2,765.49	2,878.31	3,011.55
Neonatal tetanus	7,603.37	8,297.75	8,321.54	8,696.31	8,743.68	9,100.41	9,521.68
Other tetanus	9,182.10	8,929.33	8,954.93	9,358.23	9,409.21	9,793.09	10,246.41
Meningitis	63,503.97	69,303.50	69,502.17	72,632.32	73,027.97	76,007.40	79,525.83

Notes: See Figure 3 for example of how drug treatment cost are calculated.
The dark line running through the table divides the health problems whose drug treatment costs are less than FCFA 700 from those that are greater than FCFA 700, the adult user fee level originally proposed by health authorities in Moyen Chari. Assuming fee revenues are used only to finance the purchase of drugs from the Prefectoral Pharmacy, health centers charging the FCFA 700 per episode would appear to be able to finance those health problems above the line.

According to 1992 income estimates reported in Schwabe (1993b), the drug treatment cost of a single case of meningitis (priced to cover the Pharmacy operating costs under the NGO mode without Pharmacy salaries included), would surpass the ***annual*** income of 70% of rural households, and 25% of urban households! Clearly, if health centers move towards a two-part pricing arrangement, there will be a compelling need to redistribute drug costs so that catastrophically expensive health problems such as meningitis can be cross-subsidized by charging more for drugs used to treat the less costly health problems.[11] Fortunately, the redistributive pricing methodology introduced in Section IV will accommodate this kind of financing approach as well.

While the drug treatment cost estimates presented in Table 3 indicate that it may be difficult for health centers to pay Pharmacy break-even drug prices, a more accurate evaluation of health center capacity to pay requires an assessment of total drug treatment costs relative to projected revenues under user fee financing.

The Projected Impact of Break-Even Pharmaceutical Pricing on Health Center Financial Positions

In order to evaluate health center capacity to finance the Prefectoral Pharmacy's break-even level drug prices, it is necessary to project the revenue yield under proposed user fee levels, and then subtract total expenditures on drugs obtained my multiplying the drug treatment costs per illness case presented in Table 3 by the number of patients treated. If, after paying for the required drugs, the health centers have a net surplus that is ***insufficient*** to finance other necessary recurrent costs, then it can be concluded that the

[11] Readers interested in a more in-depth discussion of two-part pricing are referred to Schwabe (1992), Analysis of the Potential for Curative Care Cost Recovery in Togo and Proposal for a Uniform Curative Care Pricing Policy for Rural Health Facilities, Medical Care Development Interational, Washington D.C.

Pharmacy drug pricing level will probably undermine the financial viability of Moyen Chari's health centers.[12]

Table 4 presents summary estimates of the net (after drug expenditure) financial position of an average health center in Moyen Chari under alternative pharmaceutical pricing scenarios.[13] More specifically, estimates of the end-of-year net financial position of an average health center when alternative drug supply, cost recovery, and revenue leakage assumptions are employed are presented in column [5].[14] Health center annual surpluses are considered adequate if they are greater than or equal to FCFA 635,000 -- the rough estimate of non-drug operating costs produced by the Prefecture's Health Committee for a "typical" health center (see Schwabe, 1993).

The alternative pricing and cost recovery scenarios presented in Table 4 strongly suggests that the financial viability of the public health system (Prefectoral Pharmacy and health centers) in Moyen Chari will depend upon the health centers being able to charge user fees per episode that are nearly double the current official fixed rates of FCFA 700 per adult, and FCFA 400 per child. If current official fee per episode pricing levels are maintained, the analysis indicates that health centers with an average level of utilization will be unable to fully finance the purchase the drugs they require even when the drugs are sold at the CIF price in N'Djamena (i.e., without factoring in any of the recurrent costs of the in-country drug supply system) When these recurrent operating costs are factored in to the sale price of drugs, the average health center is projected to run an annual deficit of between FCFA 981,300 and FCFA 1,585,500, assuming there is no revenue leakage at the health center level! When a more realistic 25% revenue leakage rate at the health center level is assumed, the adult fee would have to be increased to FCFA 1,500 per

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[12] A complete example of this kind of analysis is presented in Annex 5 for the NGO supply mode excluding Pharmacy salaries.

[13] An average health center is defined as a health center with the average number of patients treated for the major health problems (see Table A5-1 in Annex 5).

[14] Revenue leakage can either occur as a result of mismanagement of fee revenues, or as the result of official exemption policies for particular classes of patients.

illness episode and the child fee would have to be increased to FCFA 600 per illness episode if the average health center is to be in a position to finance its non-drug operating costs while paying drug prices which ensure that the Prefectoral Pharmacy can cover its non-salary operating costs (including the fees paid to a local NGO for clearing, handling and shipping the drugs from N'Djamena to Sarh).

Table 4: Estimated Net (After Drug Expenditure) Financial Position of an Average Health Center in Moyen Chari Under Alternative Pharmaceutical Pricing Arrangements

Pharmaceutical Supply Options (a) [1]	Cost Recovery Rates for Prefectoral Pharmacy (PP) Pharmaceutical Pricing [2]	Health Center Pricing [3]	Health Center Revenue Leakage [4]	Estimated Average Health Center Net Annual (After Drug Expenditure) Surplus or Deficit (FCFA) [5]
	100% of expected future drug cost; 0% PP operating costs.	Adult = FCFA 700 Child = FCFA 400	0%	-637,900
	100% of expected future drug cost; 0% PP operating costs.	Adult = FCFA 700 Child = FCFA 400	25%	-1,419,800
	100% of expected future drug cost; 0% PP operating costs.	Adult = FCFA 1,400 Child = FCFA 600	25%	637,400
Option 1: PP supply including PP salaries	100% of expected future drug costs; 100% of labor and non-labor operating costs.	Adult = FCFA 700 Child = FCFA 400	0%	- 1,585,500
Option 2: PP supply excluding PP salaries	100% of expected future drug costs; 100% of non-labor operating costs; 0% of labor costs.	Adult = FCFA 700 Child = FCFA 400	0%	- 1,377,700
Option 3: Private supply including PP salaries	100% of expected future drug costs; 100% of labor and non-labor operating costs.	Adult = FCFA 700 Child = FCFA 400	0%	- 1,177,900
Option 4: Private supply excluding PP salaries	100% of expected future drug costs; 100% of non-labor operating costs; 0% of labor costs.	Adult = FCFA 700 Child = FCFA 400	0%	- 981,300
Option 5: NGO supply including PP salaries	100% of expected future drug costs; 100% of labor and non-labor operating costs.	Adult = FCFA 700 Child = FCFA 400	0%	- 1,202,000
Option 6: NGO supply excluding PP salaries	100% of expected future drug costs; 100% of non-labor operating costs; 0% of labor costs.	Adult = FCFA 700 Child = FCFA 400	0%	- 992,300
Option 6: NGO supply excluding PP salaries	100% of expected future drug costs; 100% of non-labor operating costs; 0% of labor costs.	Adult = FCFA 700 Child = FCFA 400	25%	- 1,774,200
Option 6: NGO supply excluding PP salaries	100% of expected future drug costs; 100% of non-labor operating costs; 0% of labor costs.	Adult = FCFA 1,000 Child = FCFA 500	0%	254,400
Option 6: NGO supply excluding PP salaries	100% of expected future drug costs; 100% of non-labor operating costs; 0% of labor costs.	Adult = FCFA 1,150 Child = FCFA 500	0%	626,200
Option 6: NGO supply excluding PP salaries	100% of expected future drug costs; 100% of non-labor operating costs; 0% of labor costs.	Adult = FCFA 1,500 Child = FCFA 600	25%	653,600

Notes: (a) PP = Prefectoral Pharmacy. See Section II for a costing of the alternative supply modes, and Annex 5 for a detailed example of how the last option in this table is derived.

Other than experimenting with the inclusion or exclusion of Pharmacy personnel costs (which represent approximately 33% of the Pharmacy's non-drug operating costs under the NGO mode), the options presented in Table 4 do not consider whether the financial position of the public health system could be improved through a reduction in, or exlcusion of, other Pharmacy operating costs. A review of Table 1 indicates that there are only a few inputs under the NGO mode, other than labor, over which local health authorities have much discretion. They presumably do not have much discretion over the contracted transport costs from N'Djamena to Sarh (which account for 27% of non-drug operating costs), nor over clearance and handling charges in N'Djamena (which account for a further 10% of non-drug operating costs). This leaves approximately 30% of non-drug operating costs over which they have some discretion, including 19% for the amortization of equipment, 6% for the amortization of the Pharmacy buildings, and 15% for the transport of drugs from the Prefectoral Pharmacy to the health centers.

One conceivable approach to reducing the sale price of Pharmacy drugs would be to shift the responsibility for the transport of drugs from the Pharmacy to the health centers onto the health centers, rather than incorporating these costs into the sale price of the drugs. While this strategy would without doubt reduce the actual sale price of drugs, it would not reduce the implicit price health centers would be paying, since they would simply bear these transport costs directly rather than indirectly through the sale price of the drugs. Moreover, transfering the financing responsibility for drug transport onto the health centers would have important adverse equity consequences. It would require rural health centers that are more distant from the Prefectoral Pharmacy to pay more for the acquisition of drugs than urban health centers that are closer to the Pharmacy. This would be inequitable from an income-based perspective since rural incomes are significantly lower than urban incomes on average (Schwabe, 1993). Incorporating the Pharmacy-to-health-center transport costs in the sale price of drugs forces all health centers to pay the same average transport cost, and thus requires urban health centers to cross-subsidize rural health centers. For this reason, <u>we recommend that the Pharmacy-to-health-center transport costs be incorporated within the sale price of drugs</u>.

The only two remaining inputs that are candidates for cost reduction or exclusion from break-even price determination, are the amortization of Pharmacy buildings and equipment. A review of Table A2-5 in Annex 2 reveals that over half of the equipment amortization cost is for computer equipment that has been supplied by the CCSP in order to enable the Pharmacist to more efficiently carry out procurement, inventory management, pricing and sales responsibilities. The amortization calculations assume a useful life of three years, and an annual inflation rate of 5%, both of which may be somewhat conervative. Excluding the amortization of the computer investment costs from the Pharmacy's break-even pricing calculation reduces equipment amortization from FCFA 1,775,880 per year to FCFA 569,588 per year, and results in only a 1.7% reduction in break-even prices as well as in the estimated drug cost of treatment for all health problems. Furthermore, our analysis indicates that excluding the amortization of computer investment costs from the Pharmacy's break-even pricing calculation would enable the average health center to reduce its user fees by FCFA 50 per adult and per child (i.e., to FCFA 1,450 per adult episode and FCFA 550 per child episode) while generating a net annual budgetary surplus of approximately FCFA 607,600 (still allowing for 25% revenue leakage).

While excluding the amortization of computer equipment does modestly reduce the price health centers have to pay for drugs, and thus enables them to potentially pass along savings to their patients, two points should be kept in mind when making a decision about whether to include or exclude these costs from the Pharmacy's drug pricing. First, eventhough their exclusion potentially reduces user fees at the health center level, our analysis still suggests that the current fee level will have to be approximately doubled in order for the average health center to break-even. Moreover, as has been stressed in previous reports, health authorities in Moyen Chari should expect considerable variation in operating costs from one health center to another, which means that some health centers might have to more than double their current fees in order to afford Pharmacy drug pricing even without the computer costs factored in. Second, the computers provide the only realistic means by which the health authorities in Moyen Chari will be able to effectively monitor the financial position of the Pharmacy and its health centers,and adjust drug

pricing and user fee levels accordingly. It will be important for them to be able to maintain at least one computer in operation, and the Pharmacy may offer the only way of doing this without access to external financing.[15]

The last possible input where a reduction in costs could be made is the amortization of building investment costs. While this may also appear to be an attractive candidate for exclusion, the amortization costs can be interpreted as annual maintenance costs of the Pharmacy buildings. Cutting the financing for building maintenance may be expedient in the short run, but the long run implications for drug wastage and ultimately, therefore, for drug pricing could be significant.

[15] A preferrable alternative to incorporating the computer costs in drug pricing would be for the health authorities in Moyen Chari to obtain an agreement from a donor to finance the purchase and installation of a new computer system three years hence.

IV. Pharmaceutical Pricing Equity

Defining Pharmaceutical Pricing Equity

While there is a growing literature on equity in the finance and delivery of health care, there has been relatively little focus placed specifically on the distributive equity implications of pharmaceutical pricing.[16] According to Van Doorslaer et al. (1993, p. 15) in the case of health care in general "there seems to be a broad measure of support for the notion that health care ought to be distributed according to need and financed according to ability to pay." Applied to the case of pharmaceuticals, this conception of equity would indicate that those patients in greater need (i.e., more severely ill) should have access to and use proportionately more drugs and medical supplies than patients who are in less need, while the cost of these pharmaceutical products should be financed by requiring higher income patients to pay proportionately more than lower income patients. To the extent that incomes and the need for care are negatively correlated (poorer patients tend to be sicker and therefore in greater need of care), then under this prescription for improving pharmaceutical pricing equity, the neediest patients would be charged less for drugs and medical supplies than patients with lesser needs.

The most obvious problem with this prescription for improving pharmaceutical pricing equity in the case of Moyen Chari is that pharmaceutical products are not sold directly to patients but are incorporated in the basket of goods and services that they receive in return for the payment of a user fee per episode of illness. Under this type of financing arrangement, drugs and medical supplies could conceivably be distributed proportionately more to the neediest patients, but all patients (regardless of incomes) would be required to pay the same user fee. To the extent that such a financing arrangement is sustainable, then the neediest patients would not only benefit from

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[16] See, for example, Culyer and Wagstaff (1991), Le Grand (1987), O'Donnel and Propper (1991), Mooney (1983), Periera (1992), Schwabe (1993), and Van Doorslaer, Wagstaff and Rutten (1993).

receiving proportionately more drugs, but would also benefit from actually paying less ***per unit*** of the drug as well.

As the example in Table 5 reveals, because revenues are fixed on a per illness episode basis in Moyen Chari, health centers must be able to offset financial losses incurred in treating the neediest patients with surpluses earned for treating less needy patients in order for such an arrangement to be financially sustainable. If the losses exceed the surpluses, then health centers will have to reduce the number of needy or costly patients it treats and/or under-prescribe the more expensive drugs in order to satisfy its budget constraint. Either way, the result would be that in order for the health center to balance its budget it would be forced to undermine needs-based distributive equity

Table 5: Hypothetical Example of Budgetary Problems Under User Fee-Per-Episode Financing of Drug Costs

Illness	User Fee Revenues per Episode	Drug Costs per Episode	Balance per Episode	Number of Episodes	Net Financial Position	Cumulative Financial Position
Muscle pains	FCFA 700	FCFA 78	FCFA 622	22,520	14,007,440	14,007,440
Worms	FCFA 700	FCFA 145	FCFA 555	3,353	1,860,915	15,868,355
Cough of less than 15 days	FCFA 700	FCFA 1,252	- FCFA 552	30,934	-17,075,568	-1,207,213
Neo-natal tetanus	FCFA 400	FCFA 8,858	- FCFA 8,458	132	-1,116,456	-2,323,669

Even if Moyen Chari were to adopt a two-part pricing arrangement discussed earlier in the report (one which allowed for the direct sale of pharmaceuticals to patients), and even if it were possible to price discriminate on the basis of incomes or need (e.g., establish different sale prices for aspirin depending upon the patients' income or severity of illness), it is unlikely that such a strategy would actually improve equity while achieving financial sustainability given: (1) the potential for the resale of these products in a secondary market between patients of different income or needs groups; (2) the increased opportunities for rent seeking or other strategic behaviors on the part of heath staff in order to profit from the sale of drugs; and (3) the potential reticence on the part of patients to be classified as poorer or wealthier, and thus their lack of willingness to participate in this type of scheme. Because of this, and because drugs are sold to health

centers in Moyen Chari and not directly to patients, we have abandoned the concept of price discriminating among different groups of patients (particularly on the basis of ability to pay), and have sought to achieve our distributive equity objectives through the establishment of a unique sale price for each pharmaceutical product.

In order to develop pricing rules that satisfy the dual objective of financial sustainability and needs-based distributive equity we have specified a public sector pricing model that will lower the drug treatment cost for the neediest patients while ensuring that the Prefectoral Pharmacy and health centers can balance their budgets. The formal model and the mathematical derivation of the pricing rules are presented in Annex 6. Given the model's technical complexity, however, the pricing rules will simply be summarized here. The pricing rules that satisfy financial sustainability and needs-based distributive equity concerns require pharmaceutical sale prices to be set at a level that are:

1. Inversely proportional to the price elasticity of demand for the product;
2. Inversely proportional to the aggregate level of health need of the patients who are treated with the product; and,
3. Inversely proportional to the treatment efficacy of the product.

In order to operationalize these rules, we make the following plausible assumptions. For rule (1) we first assume that patients (or in the Moyen Chari case, the nurses who are acting as the agents for the patients) are more concerned with the total cost of the drugs that they are prescribed than they are with the unit prices of the drug. As such, all else being equal, we assume that they would be indifferent between three units of aspirin that cost FCFA 15, and 2 units of Paracetamol that cost FCFA 15, even though the unit price of Paracetamol is higher. Second, we assume that the price elasticity of demand rises as the cost of treatment rises (a fact that has been confirmed by the empirical literature on the demand of health care). In other words, it is assumed that patients (or nurses acting as their agents) become more sensitive to drug pricing the higher the total drug costs become. Thus, rule (1) is satisfied if pharmaceutical sale prices are set so that they are

inversely proportional to the cost of treatment. According to rule (1), therefore, a smaller mark-up (to cover Pharmacy operating costs) should be made on the sale price of drugs used to treat illnesses for which the total drug treatment cost is high, than should be made on the sale price of drugs used to treat illnesses for which the total drug treatment cost is low.

For rule (2) we assume that a plausible proxy for the aggregate level of health need of patients is the frequency of illness episodes for which patients are treated with a given drug. As such, rule (2) is satisfied if the sale price of drugs used to treat the most frequent illness conditions is marked up less than the sale price of drugs used to treat less frequent illness conditions.

For rule (3), it is assumed that the manufacturer's drug cost reflects the efficacy of the drug. To the extent that this is the case, then drugs cost can be treated as a proxy for drug effectiveness. As such, rule (3) is embedded in rule (1), and is otherwise ignored in the remainder of this analysis.

A Description of an Equity Enhancing Break-Even Drug Pricing Methodology

Equity enhancing break-even prices are derived in virtually the same way as was described in Section III except that distributive equity weights are assigned to each drug to reflect the two pricing rules established above. Thus instead of total revenues being determined as represented in equation [2], they are now determined as follows:

[5] $$TR = (P_1 \times z_1 \times \omega_1) + (P_2 \times z_2 \times \omega_2) + (P_3 \times z_3 \times \omega_3)$$

where ω_1, ω_2, and ω_3 are distributive equity weights which reflect pricing rules (1) and (2). When $\omega > 1$, the break-even sale price of the product is increase by the factor ω. When

Figure 4: The Derivation of the Distributive Equity Weights

The distributive equity weight, ω, is a linear combination of two other distributive weights that are designed to redistribute Pharmacy non-drug operating costs across drug items so as to satisfy the pricing rules identified above. The first of these additional distributive weights, α, is designed to satisfy rule (1) which stipulates that pharmaceutical sale prices should be set so that they are inversely proportional to the cost of treatment. One functional form for α that satisfies this equity pricing rule is:

$$\alpha_1 = 0.632 + e^{-\left[\left(\frac{C_1^T}{C_M^T}\right)^{\frac{1}{a}}\right]}$$

where α_1 is the weight attached to the first drug in the Pharmacy inventory, C_1^T is the average total drug treatment cost for all the illness conditions for which the first drug is prescribed, C_M^T is the median of the C_i^T s for all (i=1...n) drugs in the Pharmacy inventory, and $1/a$ is a parameter which controls the degree of redistribution across drug items. Note that when $C_i^T = C_M^T$, then $\alpha_i = 1$. When $C_i^T > C_M^T$, then $\alpha_i < 1$. In words, this means that drugs for which the average total drug treatment cost exceed the median for all drugs receive a distributive weight less than 1. Thus, these drugs are marked-up proportionately less than (and may even be marked down relative to) other drugs in the break-even calculation.

The second of the additional distributive weights, β, is designed to satisfy rule (2) which stipulates that sale prices of drugs used to treat the most frequent illness conditions should be marked up less than the sale price of drugs used to treat less frequent illness conditions. One functional form for β that satisfies this equity pricing rule is:

$$\beta_1 = 0.632 + e^{-\left[\left(\frac{F_1^T}{F_M^T}\right)^{\frac{1}{b}}\right]}$$

where β_1 is the weight attached to the first drug in the Pharmacy inventory, F_1^T is cumulative frequency of illness conditions for which the first drug is prescribed, F_M^T is the median of the F_i^T s for all (i=1...n) drugs in the Pharmacy inventory, and $1/b$ is a parameter which controls the degree of redistribution across drug items. Again, note that when $F_i^T = F_M^T$, then $\beta_i = 1$. Also, when $F_i^T > F_M^T$, then $\beta_i < 1$. In words, this means that drugs for which the cumulative frequency of illnesses for which they are prescribed exceed the median for all drugs, receive a distributive weight less than 1. These drugs are thus marked-up proportionately less than (and may even be marked down relative to) other drugs in the break-even calculation.

The distributive equity weight, ω, is a linear combination of α and β. It is calculated as follows:

$$\omega = [d \times \alpha] + [(1-d) \times \beta]$$

where d is a redistributive coefficient set by the Pharmacist. Note that when d=1, $\omega = \alpha$, and that when d=0, $\omega = \beta$. When $d \in [0,1]$, then ω is the weighted average of α and β.

Figure 5: An Algebraic Example of Equitable Break-Even Pharmaceutical Pricing

Following the example presented in Figure 1, and incorporating equation [5], the equitable break-even pricing problem becomes one of solving for P^* in the following balanced budget equation:

$$C^F + C^V_{Non-Drug} + \left[\left(c_1^{t+1} \times z_1\right) + \left(c_2^{t+1} \times z_2\right) + \left(c_3^{t+1} \times z_3\right)\right] = \left(P_1 \times z_1 \times \omega_1\right) + \left(P_2 \times z_2 \times \omega_2\right) + \left(P_3 \times z_3 \times \omega_3\right) + S.$$

If $\omega_1 = 0.80$, and $\omega_2 = 1.0$, and $\omega_3 = 1.6$, and all other remain as in the example in Figure 1, then the solution to P^* is obtained as follows:

$$5{,}000 + (10 \times 100) + (5 \times 100) + (1 \times 100) = P^* \times \left\{\left[\left(\frac{10 \times 0.8}{10 \times 0.8}\right) \times 100\right] + \left[\left(\frac{5 \times 1.0}{10 \times 0.8}\right) \times 100\right] + \left[\left(\frac{1 \times 1.6}{10 \times 0.8}\right) \times 100\right]\right\}$$

$$\Rightarrow 6{,}600 = P^* \times \left[(1 \times 100) + \left((5/8) \times 100\right) + \left((1.6/8) \times 100\right)\right]$$
$$\Rightarrow 6{,}600 = P^* \times [(100) + (62.5) + (20)]$$
$$\Rightarrow 6{,}600 = P^* \times 182.5$$
$$\Rightarrow 6{,}600/182.5 = P^* = 36.16$$

The break-even unit sale prices are derived as follows:

$$P_1 = 36.16 \times (10 \times 0.8/10 \times 0.8) = 36.16$$
$$P_2 = 36.16 \times (5 \times 1.0/10 \times 0.8) = 36.16 \times (5/8) = 22.6$$
$$P_3 = 36.16 \times (1.6/8) = 7.23.$$

The total revenue derived from the sale of these three drugs at their break-even unit prices is thus.

$$TR = (36.16 \times 100) + (22.6 \times 100) + (7.23 \times 100)$$
$$\Rightarrow TR = 3{,}616 + 2{,}260 + 723$$
$$\Rightarrow TR = 6{,}600 = TC.$$

Comparing the break-even prices under the standard formulation presented in Figure 1 with the equitable formulation here, confirms that the mark-up on equitable break-even prices is proportionately less for drugs for which $\omega > 1$.

Drug [1]	ω [2]	Purchase price [3]	Break-Even Sale Price [4]	Equitable Break-Even Sale Price [5]	[5] as a % of [4] [6]
z_1	0.8	10	41.25	36.16	-12.34%
z_2	1.0	5	20.63	22.60	+9.58%
z_3	1.6	1	4.13	7.23	+75.27%

$\omega < 1$, the break-even sale price of the product is decreased by the factor ω. And, when $\omega = 1$, the break-even sale price remains unchanged.

The exact derivation of these distributive equity weights is presented in Figure 4 and a simple algebraic example of how equation [5] is used is presented in Figure 5. Readers who are more interested in the results than the methodology can skip these Figures.

Drug Pricing to Cross-Subsidize High Treatment Cost Illnesses

In this section we consider the case where all the weight is placed on cross-subsidizing drugs prescribed for high drug treatment cost illnesses.[17] Since drugs are often used in the treatment of a variety of illnesses, it is possible that the same drug is prescribed both to treat low cost illnesses as well as high cost illnesses. As indicated in Figure 4, this problem is accommodated in the procedure used to calculate cost-of-treatment weighted equity break-even drug prices by assigning a unique weight to each drug based on the ***average*** total drug treatment cost for all the illness conditions for which a drug is prescribed. Thus, for example, in the case just cited, the total drug treatment cost for the low and high cost illness would be added together and divided by two to obtain an average total drug treatment cost. After these average total drug treatment costs have been calculated for all the drugs that the Pharmacy sells, the drugs are sorted in ascending numerical order by these average drug treatment costs. All drugs for which the average total drug treatment cost exceeds the median are given an equity weight which is ***less*** than 1. This causes the equity break-even price to be lower than the pure break-even price (i.e., the break-even price without equity weights).

In order to confirm that the equity weighting scheme actually achieves the redistributive objectives established -- in other words, succeeds in cross-subsidizing the high drug treatment cost illnesses -- the total drug treatment costs for the health problems

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[17] This is the case where the redistributive parameter, d, is set to 1, which implies that $\omega = \alpha$, or that the equity weight is completely determined by the total drug cost of treatment.

presented earlier in this report are arrayed in Table 6 for the pure break-even price case, and for three alternative cost-of-treatment weighted equity pricing cases. The alternative equity pricing cases reflect different degrees of cross-subsidization between low and high drug treatment cost illnesses. As mentioned in Figure 4, the degree of cross-subsidization is controlled through the parameter $\frac{1}{a}$, which is constrained to take on a value between $\frac{1}{4}$ and $\frac{1}{2}$. The greater $\frac{1}{a}$ becomes, the more cross-subsidization there should be. The extent of the cross-subsidization is measured by the difference between the total drug cost under pure break-even prices and the total drug cost under the cost-of-treatment weighted equity break-even drug prices. The equity pricing methodology works if the level of cross-subsidization increases as the total drug cost of treatment increases.

A review of columns [4], [6] and [8] of Table 6, which report the level of cross-subsidization by health problem, indicates that the cost-of-treatment weighted equity pricing methodology succeeds in redistributing the Pharmacy's non-drug operating costs across drug line items, so as to cross-subsidize the most costly health problems. With few exceptions, the drug treatment costs for relatively low-cost health problems are increased (reflected in a negative cross-subsidy reported in columns [4], [6] and [8]), whereas the drug treatment costs for relatively high-cost health problems are decreased (reflected in a positive cross-subsidy).[18]

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[18] The three anomalies are "Other Problems," "Measles," and "Prenatal Consultations." "Other Problems" are subsidized despite being the least costly health problem, while the drug treatment cost for "Measles" and "Prenatal Consultations" are increased despite being relatively costly health problems. The "Other Problems" anomaly is explained by the fact that it is an amalgam of health problems some of which require drugs that on average are used to treat relatively costly health problems, and some of which require drugs that on average are used to treat relatively inexpensive health problems. The "Measles" and "Prenatal Consultations" anomalies are the result of the fact that the majority of drugs used in each case are drugs that on average are used to treat relatively inexpensive health problems, or are drugs that on average are used to treat health problems very near the median of drug treatment costs. In the "Measles" case, aspirin, vitamin A, and tetracycline eye ointment are drugs that on average are used to treat relatively inexpensive health problems, and Cotrimoxazole and ORS are used on average to treat health problems near the median of drug treatment costs. Despite the fact that both Cotrimoxazole and ORS

Table 6: The Total Drug Treatment Cost and the Level of Cross-Subsidization by Major Health Problem Under Cost-of-Treatment Weighted Equity Break-Even Pricing

Health Problem [1]	Total Drug Treatment Cost Under Pure Break-Even Pricing [2]	Total Drug Treatment Cost Under Equity Break-Even Pricing $\left(\frac{1}{a}=\frac{1}{4}\right)$ [3]	Cross-Subsidy $\left(\frac{1}{a}=\frac{1}{4}\right)$ [4]	Total Drug Treatment Cost Under Equity Break-Even Pricing $\left(\frac{1}{a}=\frac{1}{3}\right)$ [5]	Cross-Subsidy $\left(\frac{1}{a}=\frac{1}{3}\right)$ [6]	Total Drug Treatment Cost Under Equity Break-Even Pricing $\left(\frac{1}{a}=\frac{1}{2}\right)$ [7]	Cross-Subsidy $\left(\frac{1}{a}=\frac{1}{2}\right)$ [8]
Other Problems	16.36	15.72	0.64	15.51	0.84	14.63	1.72
Muscle Pain	76.78	90.02	-13.24	94.38	-17.60	100.62	-23.84
Worms	106.48	126.90	-20.42	133.32	-26.83	142.38	-35.90
Cough of 15 days or more	216.77	250.56	-33.79	261.80	-45.03	277.28	-60.51
Malnutrition	232.57	251.64	-19.07	257.41	-24.84	261.44	-28.87
Hematuria	247.91	266.84	-18.93	273.35	-25.44	278.09	-30.18
Conjunctivitis	316.13	359.48	-43.35	374.00	-57.87	392.78	-76.65
Trauma	416.44	379.55	36.89	377.31	39.12	378.50	37.94
Skin infection	498.18	483.15	15.04	478.99	19.19	459.74	38.44
Diarrhea	692.70	671.53	21.17	665.82	26.88	636.88	55.82
Fever	849.56	736.72	112.84	723.68	125.88	717.61	131.94
Measles	904.40	928.05	-23.65	935.94	-31.54	923.48	-19.09
Cough of less than 15 days	1,014.07	929.10	84.97	907.40	106.66	859.48	154.59
Asthma	1,067.79	1,065.49	2.29	1,065.10	2.69	1,032.88	34.90
Post partum complications	1,182.62	1,088.95	93.67	1,066.77	115.85	1,020.04	162.58
Purulent Uretritis	1,253.89	1,114.42	139.47	1,079.37	174.52	1,015.20	238.69
Prenatal consultation	1,311.16	1,383.75	-72.59	1,408.42	-97.26	1,414.44	-103.28
Ear Infections/Flu	1,532.71	1,469.92	62.79	1,451.94	80.77	1,381.94	150.77
Genital ulcers	1,886.83	1,822.33	64.51	1,803.86	82.97	1,721.53	165.30
Dysentery	2,020.71	1,943.68	77.03	1,921.44	99.27	1,828.19	192.52
Urinary infection	2,498.67	2,357.46	141.21	2,315.89	182.78	2,181.19	317.48
Hypertension	2,631.97	2,290.71	341.2[illegible]	2,198.84	433.12	2,028.43	603.53
Neonatal tetanus	8,321.54	7,203.52	1,118.02	6,917.06	1,404.48	6,419.96	1,901.57
Other tetanus	8,954.93	7,867.88	1,087.04	7,591.48	1,363.45	7,090.38	1,864.55
Meningitis	69,502.17	51,095.91	18,406.27	49,271.84	20,230.33	49,113.98	20,388.19

Notes: This analysis is based on pharmaceutical prices which include the operating costs of the NGO supply mode with pharmacy salaries excluded. $1/a$ is a parameter that controls the degree of cross-subsidization. The greater $1/a$, the more cross-subsidization takes place. All values are in December, 1994 FCFA. Drug prices and health problem treatment costs were derived using the Health Sector Financial Planning & Management Drug Pricing Module ©

have cost-of-treatment equity coefficients that are slightly less than 1 (0.98 and 0.93 respectively), and thus would be expected to have break-even equity prices that are less than their pure break-even prices, their equity prices are actually increased in order to compensate for the revenue loss caused by the subsidization of a number of very high cost health problems (in particular, the tetanus and meningitis cases).

The cross-subsidization is most clear when comparing the subsidy for one of the lowest cost health problem, "Worms," with the highest cost health problem, "Meningitis." When the greatest degree of cross-subsidization is built into the pricing formula ($1/a=1/2$), the drug cost of treating patients suffering from "Worms" is increased by 34% per illness episode, while the cost of treating patients suffering from "Meningitis" is reduced by 31% per illness episode.

It is also evident from a comparison of columns [4], [6] and [8], that the level of the cross-subsidization increases in absolute terms the greater the $1/a$ parameter becomes. For example, in the case of "Other Tetanus" patients, the level of cross-subsidization increases from FCFA 1,087.04 per episode when $1/a=1/4$, to FCFA 1,363.45 when $1/a=1/3$, and to FCFA 1,864.55 when $1/a=1/2$.

In order to confirm the overall performance of the cost-of-treatment weighted equity pricing methodology, the following simple regression equation was evaluated by method of Ordinary Least Squares:

$$(Cross-Subsidy) = \phi_1 + \phi_2 \times (Break-Even\ Drug\ Cost) + e.$$

The cost-of-treatment equity weighted pricing methodology is considered to be performing well if $\phi_2 > 0$ and is statistically significant. As can be seen from Table 7, not only is $\phi_2 > 0$ under each of the $1/a$ parameter specifications, but it is highly significant, and its value increases as $1/a$ increases.

Table 7: Ordinary Least Squares Regression Test of the Performance of the Equity Pricing Methodology Under Cost-of-Treatment Weighted Pricing

Degree of cross-subsidization	ϕ (t)	ϕ_2 (t)	R^2	F
$1/a = 1/4$	-281.74 (4.20)	0.265 (56.15)	0.993	3,153
$1/a = 1/3$	-292.25 (4.54)	0.292 (58.42)	0.994	4,131
$1/a = 1/2$	-228.47 (5.74)	0.295 (105.03)	0.998	11,031

Under the type of fee-per-episode financing arrangement that is being employed in Moyen Chari, the objective of equity drug pricing is to reduce the total drug treatment cost for high cost illnesses by shifting a larger proportion of the Pharmacy non-drug operating costs onto patients suffering from low cost illnesses. In so doing, it anticipated that this will reduce the incentive that health center staff have to cut down on the number of high cost patients they treat (by referring them), or to under-prescribe the drugs needed to cure these high cost patients. The preceding equity pricing analysis indicates that the health authorities in Moyen Chari can improve needs-based distributive equity by employing the cost-of-treatment weighted equity price determination formula presented above to cross-subsidize drugs prescribed primarily for high drug treatment cost illnesses by marking up the sale price of drugs prescribed primarily for low cost illnesses..[19]

Drug Pricing to Cross-Subsidize the Most Frequently Treated Illnesses

In this section we consider the case where all the weight is placed on cross-subsidizing drugs prescribed for the most frequently treated illnesses.[20] As in the previous case, since drugs are often used in the treatment of a variety of illnesses, it is possible that the same drug is prescribed to treat an illness which occurs frequently, while also being prescribed for the treatment of another illness which occurs infrequently. As indicated in Figure 4, this problem is accommodated in the calculation of frequency-of-treatment weighted equity break-even drug prices by assigning a unique weight to each drug based

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[19] This would involve setting the HSFP&M Drug Module equity parameters as follows: $d = 1$, $1/a = 1/2$. The parameter $1/b$ can be ignored (set at any value) in this case.

[20] This is the case where the redistributive parameter, d, is set to 0, which implies that $\omega = \beta$, or that the equity weight is completely determined by the frequency of cases for which drugs are prescribed.

on the ***cumulative*** frequency of all the illness conditions for which the drug is prescribed. Thus, for example, in the case just cited, the number of cases treated for the low and high frequency illnesses would be added together to obtain the cumulative frequency for a drug. After these cumulative frequencies have been calculated for all the drugs that the Pharmacy sells, the drugs are sorted in ascending numerical order by these cumulative treatment frequencies. All drugs for which cumulative treatment frequency exceeds the median are given an equity weight which is ***less*** than 1. This causes the equity break-even price to be lower than the pure break-even price.

In order to confirm that the frequency-of-treatment weighted equity pricing formula actually achieves the redistributive objectives established -- in other words, succeeds in cross-subsidizing the most frequently treated illnesses -- a table similar to Table 6 is created (Table 8) which contrasts the pure break-even price case, with three alternative frequency-of-treatment weighted equity break-even pricing cases. The alternative equity pricing cases reflect different degrees of cross-subsidization between low and high treatment frequency illnesses. As mentioned in Figure 4, the degree of cross-subsidization is controlled through the parameter $\frac{1}{b}$, which is constrained to take on a value between $\frac{1}{4}$ and $\frac{1}{2}$. The greater $\frac{1}{b}$ becomes, the more cross-subsidization there should be. The extent of the cross-subsidization is measured by the difference between the total drug cost under pure break-even prices and the total drug cost under the equitable break-even drug prices. The frequency-of-treatment weighted equity pricing methodology works if the level of cross-subsidization increases as the treatment frequencies increase.

Unlike in the cost-of-treatment weighted subsidy analysis presented in Table 6 which demonstrated a clear positive relationship between the absolute level of subsidization and the drug cost of treatment, there is a less discernible relationship between the frequency-of-treatment weighted subsidies and treatment frequencies reported in Table 8. The reason for this appears to be that revenues gained by increasing the treatment cost for the relatively low frequency "Meningitis" cases, are substantial enough to obviate the need for increasing the treatment cost of most other low-frequency health problems.

Table 8: The Total Drug Treatment Cost and the Level of Cross-Subsidization by Major Health Problem Under Frequency-of-Treatment Weighted Break-Even Prices

Health Problem [1]	Treatment Frequency [2]	Total Drug Treatment Cost Under Pure Break-Even Pricing [3]	Total Drug Treatment Cost Under Equity Break-Even Pricing $\left(\frac{1}{b}=\frac{1}{4}\right)$ [4]	Cross-Subsidy $\left(\frac{1}{b}=\frac{1}{4}\right)$ [5]	Total Drug Treatment Cost Under Equity Break-Even Pricing $\left(\frac{1}{b}=\frac{1}{3}\right)$ [6]	Cross-Subsidy $\left(\frac{1}{b}=\frac{1}{3}\right)$ [7]	Total Drug Treatment Cost Under Equity Break-Even Pricing $\left(\frac{1}{b}=\frac{1}{2}\right)$ [8]	Cross-Subsidy $\left(\frac{1}{b}=\frac{1}{2}\right)$ [9]
Other Tetanus	67	8,954.93	8,944.60	10.32	8,973.07	-18.14	9 010.38	-55.45
Neonatal Tetanus	132	8,321.54	8,132.92	188.61	8,117.57	203.96	8,095.12	226.42
Malnutrition	214	232.57	210.94	21.63	205.79	26.78	197.26	35.31
Meningitis	222	69,502.17	77,942.61	-8,440.44	80,508.15	-11,005.98	84,614.47	-15,112.30
Post-partum complications	801	1,182.62	1,113.04	69.58	1,098.97	83.65	1,077.18	105.44
Hematuria	1048	247.91	267.30	-19.38	274.53	-26.62	288.00	-40.09
Genital ulcers	1180	1,886.83	1,598.22	288.61	1,527.14	359.69	1,419.53	467.31
Asthma	1628	1,067.79	1,046.71	21.08	1,045.64	22.15	1,044.30	23.48
Cough of 15 days or more	2125	216.77	182.64	34.13	173.70	43.08	158.64	58.13
Purulent Uretritis	2184	1,253.89	1,177.91	75.99	1,162.67	91.22	1,140.06	113.83
Measles	3047	904.40	748.19	156.21	707.83	196.57	643.07	261.33
Worms	3353	106.48	102.82	3.66	102.17	4.32	100.95	5.53
Hypertension	5037	2,631.97	2,476.88	155.09	2,441.45	190.52	2,374.93	257.03
Dysentery	6822	2,020.71	1,621.84	398.87	1,520.06	500.65	1,363.47	657.24
Conjunctivitis	7502	316.13	276.48	39.66	266.97	49.16	252.35	63.79
Urinary infection	8242	2,498.67	1,982.60	516.06	1,851.64	647.03	1,653.04	845.63
Fever	9545	849.56	821.57	27.99	819.76	29.80	822.19	27.36
[illegible] infection/Flu	9870	1,532.71	1,241 72	290.99	1,168.68	364.03	1,058.66	474.05
Skin infection	11838	498.18	506.52	-8.34	511.80	-13.62	522.25	-24.07
Diarrhea	14820	692.70	597.58	95.12	573.87	118.83	536.70	156.00
Trauma	20261	416.44	401.35	15.08	399.78	16.66	399.41	17.03
Muscle pains	22560	76.78	59.16	17.62	54.90	21.88	48.99	27.79
Cough of less than 15 days	30934	1,014.07	894.79	119.27	866.25	147.82	822.34	191.73
Prenatal consultations	42524	1,311.16	1,051.17	259.99	991.99	319.16	913.08	398.07
Other problems	58659	16.36	17.48	-1.12	17.91	-1.56	18.73	-2.37

Notes: This analysis is based on pharmaceutical prices which include the operating costs of the NGO supply mode with pharmacy salaries excluded. $1/b$ is a parameter that controls the degree of cross-subsidization. The greater $1/b$, the more cross-subsidization takes place. All values in columns [3] through [9] are in December, 1994 FCFA. Drug prices and health problem treatment costs were derived using the Health Sector Financial Planning & Management Drug Pricing Module ©.

The lack of discernible relationship between the frequency-of-treatment weighted subsidies and treatment frequencies is confirmed by the performance test reported in Table 9.[21]

[21] The performance of the frequency-of-treatment weighted equity pricing formulation is tested using the following least squares linear regression model: $(Cross-Subsidy) = \varphi_1 + \varphi_2 \times (Frequency\ of\ Treatment) + e$. If $\varphi_2 > 0$ and is statistically significant, then the equity pricing methodology is considered to be performing well. As can be seen from Table 8, although φ_2 is positive, it is very small in magnitude and is insignificant statistically under all of the $1/b$ parameter specifications.

Table 9: Ordinary Least Squares Regression Test of the Performance of the Equity Pricing Methodology Under Drug-Treatment-Frequency Weighted Pricing

Degree of cross-subsidization	φ_1 (t)	φ_2 (t)	R^2	F
$1/b = 1/4$	-407.20 (0.94)	0.017 (0.70)	0.021	0.49
$1/b = 1/3$	-541.90 (0.96)	0.031 (0.71)	0.021	0.48
$1/b = 1/2$	-758.25 (0.98)	0.04 (0.71)	0.021	0.50

Despite the absence of a systematic linear relationship between the subsidy level and treatment frequencies under frequency-of-treatment weighted drug pricing, a comparative analysis between treatment costs under frequency-of-treatment weighted pricing and cost-of-treatment weighted pricing reveals that the former does exert a discernible effect on the cost of treatment in a number of cases. In order to see this, four comparative cases are presented in Figure 6: (1) a low cost, low frequency case (Hematuria); (2) a low cost, high frequency case (Conjunctivitis); (3) a high cost, low frequency case (Meningitis); and (4) a high cost, high frequency case (Ear Infection/Flu).

In each of the cases presented in Figure 6 the frequency-of-treatment weighted cross-subsidization formula works as expected: drug treatment costs for low frequency cases are increased, while drug treatment costs for high frequency cases are reduced.

Based on the preceding analysis, it is recommended the health authorities in Moyen Chari can rely primarily on the cost-of-treatment weighted equity pricing approach to improve needs-based distributive, while using the frequency-of-treatment weights to reduce the level of subsidization for infrequent and relatively high cost health problems such as meningitis.[22]

[22] Health authorities in Moyen Chari might start with the following parameter configuration when using the HSFP&M Drug Module to set pharmaceutical prices: $d = 0.8$, $1/a = 1/2$, $1/b = 1/4$.

Figure 6

Cost of Treatment	Frequency of Treatment: Low	Frequency of Treatment: High
Low	**Hematuria** $TC_{BE} = 248$ $TC_{\alpha} = 278$ $TC_{\beta} = 288$	**Conjunctivitis** $TC_{BE} = 316$ $TC_{\alpha} = 393$ $TC_{\beta} = 252$
High	**Meningitis** $TC_{BE} = 69{,}502$ $TC_{\alpha} = 49{,}114$ $TC_{\beta} = 84{,}614$	**Ear Infection/Flu** $TC_{BE} = 1{,}533$ $TC_{\alpha} = 1{,}382$ $TC_{\beta} = 1{,}059$

Notes: TC_{BE} = Total drug treatment cost under pure break-even pricing. TC_{α} = Total drug treatment cost under cost-of-treatment weighted equity break-even pricing. TC_{β} = Total drug treatment cost under frequency-of-treatment weighted equity break-even pricing. All values are in December, 1994 FCFA, and are based on a pharmaceutical sales volume equal to the demand of 15 health centers.

V. Conclusion

Of the three drug supply modes evaluated in this report, the analysis makes clear that the purely public option (i.e., where the health authorities in Moyen Chari take responsibility for clearance, transport and storage of drugs between N'Djamena and the health center level) is not feasible, and therefore should not be adopted. This is because:

1. annual operating costs under the purely public mode are approximately 1.7 times greater than under the NGO or private modes;
2. break-even drug pricing under the purely public mode would need to be at least 10% greater per unit of drug than under the NGO mode; and,
3. health centers will not be able to afford the drug prices that cover Pharmacy operating costs under this mode without charging user fees that exceed what the majority of Moyen Chari's population has the ability or willingness to pay.

In light of the fact that there is relatively little difference between the recurrent costs of the NGO and private supply modes, but that the NGO mode is deemed to be more likely to assure the sustainability of drug supply, the health authorities in Moyen Chari should seek to contract with an NGO (e.g., the B.A.S.E.) to handle the clearance and transport of drugs from N'Djamena to Sarh. The authorities should then contract with multiple local transporters on a trip-by-trip basis to distribute the drugs from the Prefectoral Pharmacy in Sarh to the health centers.

Regardless of which drug supply mode is ultimately adopted in Moyen Chari, the analysis in this report demonstrates clearly that for health centers to be able to afford the Pharmacy's break-even drug pricing (even when Pharmacy personnel costs are excluded), user fee levels will have to be considerably higher than the FCFA 700 per adult and FCFA 400 per child originally envisaged. Under fairly conservative revenue leakage assumptions (25% of fee revenues), fees for the average health center would have to be nearly doubled (e.g., FCFA 1,150 per adult and FCFA 700 per child) for the health center to break-even <u>assuming utilization does not decrease when fees are increased</u>!

It is extremely important to recognize that fee levels will have to be even higher if personnel costs -- which account for one third of the Pharmacy's annual operating costs -- are not financed by the Government of Chad.

Other than the savings that can be generated from the exclusion of personnel costs from the Pharmacy drug pricing calculations, the analysis suggests that there is relatively little scope for further reducing break-even pricing by reducing or excluding other input costs. While health authorities in Moyen Chari could opt to reduce or exclude amortization outlays for equipment (especially the Pharmacy computer) and buildings, we recommend that this not be done, if at all possible, since doing so will have adverse effects on the long run sustainability of drug supply.

In addition, we strongly recommend against shifting the Pharmacy-to-health center transport costs directly onto the health centers. These costs should be financed at the Pharmacy level by incorporating them in the break-even sale price of drugs sold, since to do otherwise would have adverse equity (and thus sustainability) effects on the rural health centers.

Even if user fee levels are increased to around the FCFA 1,150 per adult and FCFA 700 level indicated above, the analysis reveals that health centers are likely to have considerable difficulty financing the drug treatment costs for certain relatively high cost/low frequency health problems such as meningitis and tetanus. It is recommended, therefore, that health authorities in Moyen Chari explore the feasibility of shifting the responsibility for the treatment of these cases to the hospital level so that they do not undermine the financial viability of the health centers or render all care unaffordable to the majority of the population.

While the equity analysis presented in this report demonstrates that it is possible to redistribute the non-drug Pharmacy operating costs across drug items so as to reduce the total drug treatment cost for high cost illness, we do not believe that its adoption will be sufficient to render the high cost/low frequency cases mentioned above affordable without an unacceptably high increase in user fees at the health center level. If the treatment of these few cases is shifted to the hospitals, however, the analysis makes clear that needs-

based distributive equity can be substantially improved by relying primarily on the cost-of-treatment weighted equity pricing approach supplemented in part by the use of the frequency-of-treatment weights to reduce the subsidy provided to low frequency/high cost cases. Moreover, given the use of fee-per-episode financing at the health center level in Moyen Chari, by adopting equity pricing health authorities can reduce the incentives health center staff have to either cut down on the treatment of high cost cases or under-prescribe drugs to these cases.

Finally, the analysis of break-even pharmaceutical pricing has revealed that price setting needs to be responsive to changes in the volume of drugs sold by the Pharmacy, to changes in inflation and drug wastage rates, to currency exchange fluctuations, to changes in transport or other operating costs, and to changes in the level of Government or donor subsidization. If it is not, the financial viability of the Prefectoral Pharmacy, and ultimately, the sustainability of drug supply and health service delivery could be easily undermined. Because of this, we contend that will be important for local health authorities to make regular use of the computerized drug pricing module that has been provided under the CCSP. Drug pricing cannot be based on a simple guessing game if the sustainability of the public health system is to be assured.

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Annex 1: Input List for Recurrent Cost Analysis of Alternative Drug Procurement, Storage and Distribution Modes

Fixed Costs	Public	Privé	ONG
Personnel	**3,181,200**	**3,181,200**	**3,181,200**
Prefectoral Pharmacy Salaries (Table A2-5)	3,181,200	3,181,200	3,181,200
Transport	**7,640,057**	**0**	**0**
Amortization of truck/from airport to stores in N'Djamena (Table A2-2)	152,802		
Amortization of truck/transport to Sarh (Table A2-4)	3,590,828		
Amortization of truck /Pharmacy to health centers (Table A2-7)	3,896,427		
Equipment	**1,775,880**	**1,775,880**	**1,775,880**
Amortization/Pharmacy (Table A2-5)	1,775,880	1,775,880	1,775,880
Furniture	**19,557**	**19,557**	**19,557**
Amortization/Pharmacy (Table A2-5)	19,557	19,557	19,557
Utilities	**0**	**0**	**0**
Buildings	**537,468**	**537,468**	**537,468**
Amortization/Prefectoral Pharmacy (Table A2-5)	537,468	537,468	537,468
Total Fixed Costs	**13,154,162**	**5,514,105**	**5,514,105**

Variable Costs	Public	Privé	ONG
Personnel	**316,700**	**128,200**	**324,022**
Administration in N'Djamena for customs and reception of goods (Table A2-1)	30,000		
Labor/administration between airport and stores in N'Djamena (Table A2-2)	36,700	63,200	309,622
Guard fees at N'Djamena stores (Table A2-3)	18,000	18,000	14,400
Loading fees at N'Djamena stores (Table A2-3)	12,000	12,000	
Per diem for Prefectoral Pharmacy personnel in N'Djamena (Table A2-3)	30,000	20,000	
Labor/administration/per diem for transport to Sarh (Table A2-4)	120,000	15,000	
Per diem for transport from Prefectoral Pharmacy to Health Centers (Table A2-7)	70,000		
Transport	**1,748,223**	**2,646,300**	**2,646,300**
Diesel/lubricants/maintenance of Prefectoral Pharmacy truck for transport in N'Djamena (Table A2-2)	22,152		
Diesel/lubricants/maintenance of Prefectoral Pharmacy truck for transport to Sarh (Table A2-4)	866,527		
Deisel for Prefectoral Pharmacy truck for transport from Prefectoral Pharmacy to HEALTH CENTERS (Table A2-6)	517,432		
Maintenance of Prefectoral Pharmacy truck for transport from Prefectoral Pharmacy to health centers (Table A2-7)	342,112		
Transport in N'Djamena between airport and stores (Table A2-2)		64,000	64,000
Transport from N'Djamena to Sarh (Table A2-4)		1,158,300	1,158,300
Transport from Pharmacy to health centers (Table A2-8)		1,424,000	1,424,000
Supplies	**66,800**	**66,800**	**66,800**
Office supplies/Prefectoral Pharmacy (Table A2-5)	66,800	66,800	66,800
Other	**642,482**	**719,682**	**917,198**
LTA in N'Djamena (Table A2-1)	140,552	140,552	140,552
Airport clearance in N'Djemana -- small shipping agent (Table A2-1)	501,930	501,930	501,930
Administration costs for customs clearance and reception of drugs under private contract (Table A2-1)		10,000	159,960
Storage in N'Djamena/NGO stores (Table A2-7)		67,200	67,200
Adminstration costs of UNAD and labor for transport between N'Djamena and Sarh (Table A2-4)			47,556
Total Variable Costs	**2,774,205**	**3,560,982**	**3,954,320**
TOTAL	**15,928,367**	**9,075,087**	**9,468,425**

Annex 2: Recurrent Operating Cost Estimates of Alternative Drug Supply Modes

Table A2-1: Annual Recurrent Costs of Alternative Drug Customs Clearance and Reception Modes in N'Djamena

Reception and Customs Clearance Mode (a) [1]	LTA (bi-annual) [2]	Airport Clearance (bi-annual) (b) [3]	Administration (bi-annual) [4]	Total (Annual) [5]
PP and Private	CFA 8,500 + (# kg x 8 CFA) ⇨ 8,500 + (7,722 kg x 8 CFA) = **CFA 70,276**	(A) Small Shipping Agent in N'Djaména: CFA 32,5 per Kg ⇨ 7,722 x 32,5 = **CFA 250,965**	(1) PP tranports drugs.: (Per diem = CFA 2,500 per night and per person) x (2 nights) x (Materials Chief + Driver + apprentice) ⇨ 2,500 x 2 x 3 = **CFA 15,000**	(A.1) CFA 336,241 x 2 = **CFA 672,482** (A.2) CFA 326,241 x 2 = **CFA 652,482**
		(B) Big Shipping Agent in N'Djaména: CFA 143,0 per Kg ⇨ 7,722 x 143,0 = **CFA 1,104,246**	(2) Private contract for transport of drugs: CFA 2,500 x 2 x (Materials Chief) ⇨ 2,500 x 2 x 1= **CFA 5,000**	(B.1) CFA 1,189,522 x 2 = **CFA 2,379,044** (B.2) CFA 1,179,522 x 2 = **CFA 2,359,044**
NGO and Private	CFA 8,500 + (kg x 8 CFA) ⇨ 8,500 + (7,722 kg x 8) = **CFA 70,276**	Small shipping agent in N'Djaména: CFA 32,5 per Kg ⇨ 7,722 x 32,5 = **CFA 250,965**	UNAD administration fee = 0,37% of total cost (CIF) of drugs (c) Cost (CIF) of a six month order (based on IDA order of 9/93) = CFA 21,616,000 ⇨ 0,0037 x 21,616,000 = **CFA 79,980**	CFA 401,221 x 2 = **CFA 802,442**
		Big shipping agent in N'Djaména: CFA 143,0 per Kg ⇨ 7,722 x 143,0 = **CFA 1,104,246**		CFA 1,254,502 x 2= **CFA 2,509,004**

Notes: PP = Prefectoral Pharmacy. (a) Assumptions: The drugs are cleared in less than 4 days which implies there are no demeurrage charges at the airport.
(b) Actual UNAD experience in N'Djaména, 1993.
(c) CIF = Cost, Insurance, Freight. The assumption is that UNAD will charge the Prefectoral Pharmacy a commission of 1% of the value of the order CIF in N'Djamena. The commission is attributed to the different stages in the drug distribution circuit in N'Djamena in proportion to the other operating expenditures incurred in N'Djamena (52% for airport to stores; 37% for loading trucks at the airport; 11% re-loading at the stores in N'Djamena for transport to Sarh).

Table A2-2: Annual recurrent costs of alternative modes of transport in N'Djaména (airport to stores)

Transport Mode [1]	Transport (bi-annual) [2]	Labor/administration (bi-annual) [3]	Total (annual) [4]
MSP (a)	MOH truck (20km x 2): • Deisel = CFA 450 x 40km ÷ 4,0 km per litre = CFA 4,500 • Lubricants = CFA 0 • Incentive for Driver (x2) = CFA 2,000 • Maintenance = (CFA 32,000 - CFA 6,500) = CFA 25,500 ⇨ Minimum: **CFA 6,500** Maximum: **CFA 32,000**	• 3 supervisors x 4 hours x CFA 400 per hour x 2 voyages = CFA 9,600 • Materials Chief (PPA) x 1 night x per diem (CFA 2,500 per night) = CFA 2,500 • 7 laborers x 4 hours x CFA 350 per hour x 2 voyages = CFA 19,600 ⇨ **CFA 31,700**	Minimum: CFA 38,200 x 2 = **CFA 76,400** Maximum: CFA 63,700 x 2 = **CFA 127,400**
Private (b)	**CFA 32,000**	• 3 supervisors x 6 hours x CFA 400 per hour x 1 voyage = CFA 7,200 • 1 foreman x 6 hours x CFA 400 per hour x 1 voyage = CFA 7,200 • Materials Chief (PPA) x 1 night x per diem (CFA 2,500 per night) = CFA 2,500 • 7 laborers x 6 hours x CFA 350 per hour x voyage = CFA 14,700 ⇨ **CFA 31,600**	CFA 63,600 x 2 = **CFA 127,200**
PPA	PPA truck (20km x 2): • Deisel = CFA 450 x 40km ÷ 4,0 km per litre = CFA 4,500 • Lubricants = CFA 0 • Maintenance (c) = (2% x CFA 328,800) = CFA 6,576 • Amortization (d) = (2% x CFA 3,820,029) = CFA 76,401 ⇨ **CFA 87,448**	• 3 supervisors x 4 hours x CFA 400 per hour x 2 voyages = CFA 9,600 • {Materials Chief (PPA) + Driver + apprentice} x 1 night x per diem (CFA 2,500 per night) = CFA 7,500 • 7 laborers x 4 hours x CFA 350 per hour x 2 voyages = CFA 19,600 ⇨ **CFA 36,700**	CFA 124,177 x 2 = **CFA 248,354**
NGO	Private contract = **CFA 32,000**	• Private contract = CFA 31,600 • UNAD administration fee = 0,57% of total cost (CIF) of drugs (e) = CFA 123,211 ⇨ CFA 31,600 + CFA 123,211 = **CFA 154,811**	CFA 186,811 x 2 = **CFA 373,622**

Notes: (a) Assumptions: (I) The MOH will use its own truck for transporting the drugs; and (ii) the truck will have a 4 tonne capacity. The Prefectoral Pharmacy will be responsible for covering certain maintenance costs associated with the operation of the MOH truck. The maintenance financing rule that the Prefectoral Pharmacy would use would be that it would defray maintenance costs if and only if they are less than or equal to the cost of renting a private truck less the cost of fuel plus the incentive for the driver.

(b) Based on UNAD's actual experience (1993) adjusted by a factor of 1.6 to account for post-devaluation gas price increases.

(c) The mileage driven in N'Djamena is equal to 2% of the total mileage.

(d) See notes from Table A2-7 concerning the methodology used to amortize capital investment costs. The mileage travelled in N'Djamena is equal to 2% of the total mileage driven.

(e) See Table A2-7 note (c).

Table A2-3: Annual Recurrent Cost of Storage in N'Djaména

Storage Mode [1]	Rental of Stores (bi-annual) [2]	Labor/Administration (bi-annual) [3]	Total (annual) [4]
MSP	CFA 0	(A) Dry Season: (10 days Airport Clearance) • Guard fees = CFA 750 per night ⇨ CFA 750 x 10 = **CFA 7,500** • Truck loading fees = CFA 1,000 x 6 = **CFA 6,000** (1) PPA Transport: • Per diem = CFA 2,500 x 2 nights x (Materials Chief + Driver + apprentice) ⇨ CFA 2,500 x 2 x 3 = **CFA 15,000** (2) Private Transport: • Per diem = CFA 2,500 x 2 nights x (Materials Chief) + bus ticket (Sarh to N'Djaména) ⇨ (CFA 2,500 x 2 x 1) + CFA 5,000 = **CFA 10,000** (B) Rainy Season: (14 days Airport Clearance) • Guard fees = CFA 750 per night ⇨ CFA 750 x 14 = **CFA 10,500** • Truck loading fees = CFA 1,000 x 6 = **CFA 6,000** (1) PPA Transport: • Per diem = CFA 2,500 x 2 nights x (Materials Chief + Driver + apprentice) ⇨ CFA 2,500 x 2 x 3 = **CFA 15,000** (2) Private Transport: • Per diem = CFA 2,500 x 2 nights x (Materials Chief) + cost of bus ticket (Sarh to N'Djaména) ⇨ (CFA 2,500 x 2 x 1) + CFA 5,000 = **CFA 10,000**	(A.1) +(B.1) CFA 28,500 + CFA 31,500 = **CFA 60,000** (A.2) + (B.2) CFA 23,500 + CFA 26,500 = **CFA 50,000**
NGO (a)	(A) Dry Season (CFA 2,800 per day) x (10 days) ⇨ CFA 2,800 x 10 = **CFA 28,000** (B) Rainy Season: (CFA 2,800 per day) x (14 days) ⇨ CFA 2,800 x 14 = **CFA 39,200**	(A) Dry Season Guard fees = (CFA 600 per night) x (10 days) ⇨ CFA 600 x 10 = **CFA 6,000** (B) Rainy Season: Guard fees = (CFA 600 per night) x (14 days) ⇨ CFA 600 x 14 = **CFA 8,400**	(A) + (B) CFA 34,000 + CFA 47,600 = **CFA 87,600**

Notes: (a) Based on UNAD experience.

Table A2-4: Annual Recurrent Cost of Transport to Sarh

Mode of transport [1]	Transport (bi-annual) [2]	Labor (bi-annual) [3]	Total (annual) [4]
PP	(A) Dry Season: PPA truck (1,120 km x 2): • Deisel = CFA 450 x 2,240 km ÷ 4,0 km per litre = **CFA 252,000** • Maintenance (a) = (47% x CFA 328,800) = **CFA 154,536** • Amortization (b) = (47% x CFA 3,820,029) = **CFA 1,795,414** (B) Rainy Season: PPA truck (1,120 km x 2): • Deisel = CFA 450 x 2,240 km ÷ 3,3 km per litre = **CFA 305,455** • Maintenance (a) = (47% x CFA 328,800) = **CFA 154,536** • Amortization (b) = (47% x CFA 3,820,029) = **CFA 1,795,414**	(A) Dry Season: (2 voyages: Sarh to N'Djaména = 2 days N'Djaména to Sarh = 2 days Sarh to N'Djaména = 2 days N'Djaména to Sarh = 2 days Total = 8 days) • Per diem = CFA 2,500 per night x 6 nights x (Materials Chief + Driver + apprentice) ⇨ CFA 2,500 x 6 x 3 = **CFA 45,000** (B) Rainy Season: (2 voyages: Sarh to N'Djaména = 3 days N'Djaména to Sarh = 3 days Sarh to N'Djaména = 3 days N'Djaména to Sarh = 3 days Total = 12 days) • Per diem = CFA 2,500 per night x 10 nights x (Materials Chief + Driver + apprentice) ⇨ CFA 2,500 x 10 x 3 = **CFA 75,000**	(A) + (B) CFA 2,246,950 + CFA 2,330,405 = **CFA 4,577,355**
Private (c)	CFA 75 per kg x 7,722 kg (d) ⇨ CFA 75 x 7,722 = **CFA 579,150**	Contract Negotiation: Per diem CFA 2,500 per night x 3 nights x Materials Chief ⇨ CFA 2,500 x 3 x 1 = **CFA 7,500**	CFA 586,650 x 2 = **CFA 1,173,300**
NGO	CFA 75 per kg x 7,722 kg (d) ⇨ CFA 75 x 7,722 = **CFA 579,150**	Administration fee (UNAD) = 0,11% of total cost (CIF) of drugs (e) Cost (CIF) of a six month drug order (IDA bid of 9/93) = CFA 21,616,000 ⇨ 0.0011 x 21,616,000 = **CFA23,778**	CFA 602,928 x 2 = **CFA 1,205,856**

Notes: PP = Prefectoral Pharmacy.

(a) The mileage travelled between Sarh and N'Djaména is equal to 47% of the total mileage.

(b) See notes on Table A2-7 concerning the methodology used to amortize capital investment costs. The mileage travelled between Sarh and N'Djaména is equal to 47% of the total mileage.

(c) Based on UNAD experience.

(d) See Table A2-1.

(e) See note (c) of Table A2-7

Table A2-5: Annual Recurrent Cost of Storage in Sarh

Cost (annual) [1]	Total (annual) [2]
Building Maintenance: (a) Amortization of PP rehabilitation costs (7/94) = $\left[10{,}000{,}000 \times (1+1.05)^{15}\right] / \left[15 \times (1+0.07)^{14}\right] =$ CFA 20,789,282/38.68 = **CFA 537,468**	Including PP salaries: **CFA 5,580,905** Excluding PP salaries: **CFA 2,399,705**
Salaries: (b) • Pharmacist = 12 months x CFA 132,000 = **CFA 1,584,000** • A-Pharmacist = 12 months x CFA 56,100 = **CFA 673,200** • A-Pharmacist x 2 = 12 months x CFA 45,100 = **CFA 541,200** • Driver = 12 months x CFA 31,900 = **CFA 382,800** **CFA 3,181,200**	
Furniture: Investment Costs: • Chairs = 6 x CFA 7,000 = CFA 42,000 • Tables = 3 x CFA 27,000 = CFA 81,000 • Ladder = 1 x CFA 5,000 = CFA 5,000 Total = CFA 128,000 Assumptions: Useful life = 7 years; inflation = 5%; interest rate = 7% ⇨ Amortization = [CFA 205,540/10.51] = **CFA 19,557**	
Equipment: Investment Costs: • Computer (including printer) = CFA 3,360,000 • Air conditioner x 2 = CFA 1,680,000 • Fan x 4 = CFA 392,000 • Calculator = CFA 5,000 Total = CFA 5,437,000 Assumption: Useful life of computer and air conditioner = 3 years; Useful life of fan and calculator = 5 years; inflation = 5%; interest rate = 7% ⇨ Amortization = $\{[\text{CFA } 5{,}834{,}430/3.43] + [506{,}683/6.55]\}$ = **CFA 1,775,880**	
Office materials: **CFA 66,800**	

Notes: PP = Prefectoral Pharmacy.
(a) Based on investment cost financed by l'Institute Tropical Suisse.
(b) The salaries of PP personnel are usually financed by the Chadian government Because of the adverse economic conditions in Chad, an assumption used in this study is that the salaries of the PP personnel will be financed by the funds generated from the sale of pharmaceutical products.

Table A2-6: Bi-annual deisel costs for the distribution of drugs from the Prefectoral Pharmacy to the Health Centers

Itinerary	Total Distance (km) (a)				Cost of Deisel (b)	Kilometers per litre (c)				Bi-annual Deisel Costs (d)			
	Truck		Pickup			Truck		Pickup		Truck		Pickup	
	Dry	Rainy	Dry	Rainy	(CFA)	Dry	Rainy	Dry	Rainy	Dry	Rainy	Dry	Rainy
I (Danamadji = 8 Health Centers)	660	660	2,212	2,212	450	4.0	3.3	5.6	5.0	74,250	90,000	177,750	199,080
II. (Djoli = 4 Health Centers)	820	240	1,692	240	450	4.0	3.3	5.6	5.0	92,250	27,000	135,964	21,600
III. (Koumra = 7 Health Centers)	880	880	4,240	4,240	450	4.0	3.3	5.6	5.0	99,000	120,000	340,714	381,600
IV. (Sarh = 7 Health Centers)	60	60	102	102	450	4.0	3.3	5.6	5.0	6,750	8,182	8,196	9,180
Total										272,250	245,182	683,954	611,460

Notes: (a) See diagram 1 - 4 in Cost-Effectiveness Analysis of Alternative Drug Supply Modes (Schwabe, 1993).
(b) 7/94 prices.
(c) Average based on CCSP experience.
(d) = $[(a)\ (c)] \times b$.

Table A2-7: Estimate of other recurrent costs of distributing drugs from the Prefectoral Pharmacy to the Health Centers

Itinerary	Annual Maintenance Cost of vehicles (a)		Amortization of Vehicles (b)			Personnel Costs (Driver, apprentice Driver) (d)							
			Truck (c)			Community Inventory Check at PPA				Community Inventory Check at Health Center			
	Truck	Pickup	C1	C2	Pickup	Truck		Pickup		Truck		Pickup	
						Dry	Rainy	Dry	Rainy	Dry	Rainy	Dry	Rainy
I (Danamadji = 8 Health Centers)	90,768	178,004	1,069,608	2,062,815	1,071,592	10,000	20,000	20,000	50,000	60,000	40,000	50,000	70,000
II, (Djoli = 4 Health Centers)	113,504	205,048	1,298,810	2,597,619	1,349,413	10,000	0	20,000	0	20,000	10,000	30,000	10,000
III, (Koumra = 7 Health Centers)	132,528	257,924	1,451,611	2,826,821	1,468,479	10,000	20,000	40,000	180,000	30,000	40,000	60,000	100,000
IV, (Sarh = 7 Health Centers)	5,312	9,544	76,400	152,801	79,377	0	0	0	0	0	0	0	0
Total	342,112	650,520	3,896,429	7,640,057	3,968,861	30,000	40,000	80,000	230,000	110,000	90,000	140,000	180,000

Notes: (a) Vehicle maintenance costs comprise a number of large costs incurred once during the useful life of a vehicle (See Annexes 2(i) and 2(j) of Schwabe (1993)). These costs are attributed to each circuit of the Prefectoral Pharmacy/health centers distribution route in proportion to the total mileage of each circuit (See Annexes 2(a) to 2(h) of Schwabe (1993)).

(b) Amortized investment costs, A = $\left[TC_0 \times (1+i)^t\right] / \left[t \times (1+r)^{t-1}\right]$, where TC_0 is the total vehicle cost (purchase price), i is the rate of inflation, t is the number of years of useful life of the vehicle, and r is the interest rate. Amortized investment costs are attributed to each circuit of the Prefectoral Pharmacy to health centers distribution route in proportion to the total mileage of each circuit. For example, the amortized investment cost for a truck on the Danamadji circuit (under hypothesis C2 -- see note (c)) is calculated as follows: $30{,}800{,}000 \times (1+0.05)^4 \;/\; 4 \times (1+0.07)^{4-1} \times 0.27 = 7{,}640{,}057 \times 0.27 = 2{,}062{,}815$.

The amortized investment cost for a pickup is: $16{,}000{,}000 \times (1+0.05)^4 \;/\; 4 \times (1+0.07)^{4-1} \times 0.27 = 3{,}968{,}861 \times 0.27 = 2{,}062{,}815$

(c) Hypothesis C1 = the same truck is also used to transport drugs from N'Djamena to Sarh. In this case, 49% of the amortized investment cost is attributed to the N'Djaména to Sarh leg (the proportion of the total mileage). Hypothesis C2 = the truck only transports drugs from the Prefectoral Pharmacy to the health centers.

(d) It is assumed that the drivers sleep on the road each night rather than returning to Sarh, and that the per diem is 2,500 CFA per night, per Driver.

Table A2-8: Bi-Annual Total Recurrent Cost of Alternative Drug Distribution Modes from the Prefectoral Pharmacy to Health Centers

Itinerary	Public Mode												Private Mode	
	PPA						Health Centers							
	Truck (C1)		Truck (C2)		Pickup		Truck (C1)		Truck (C2)		Pickup			
	Dry	Rainy	Dry	Rainy	Dry	Rainy	Dry	Rainy	Dry	Rainy	Dry	Rainy	Dry	Rainy
I (Danamadji = 8 Health Centers)	664,438 (a)	690,188	1,161,042	1,186,792	822,548	873,878	714,438	710,188	1,211,042	1,206,792	938,355	893,878	160,000	240,000
II, (Djoli = 4 Health Centers)	808,407	733,157	1,457,812	1,382,559	933,195	798,831	818,407	743,157	1,467,812	1,392,559	943,195	808,831	120,000	160,000
III, (Koumra = 7 Health Centers)	901,070	932,070	1,588,675	1,619,675	1,243,916	1,424,802	921,070	952,070	1,608,675	1,639,675	1,263,916	1,344,802	300,000	360,000
IV, (Sarh = 7 Health Centers)	47,606	49,038	85,807	87,239	52,657	53,640	47,606	49,038	85,807	87,239	52,657	53,640	40,000	44,000
Total	2,421,521	2,404,453	4,293,336	4,276,265	3,052,316	3,151,151	2,501,521	2,454,453	4,437,336	4,326,265	3,198,123	3,101,151	620,000	804,000

Notes: (a) 664,438 = 74,250 + (90,768 / 2) + (1,069,608 / 2) + 10,000, where 74,250 is the dry-season deisel cost for a truck (see Table A2-6), 90,768 is the annual maintenance cost for a truck (see Table A2-7), 1,069,608 is the amortization cost of a truck under hypothesis C1 (see Table A2-7), and 10,000 is the dry-season personnel cost for drivers under the assumption that the community checks the inventory of their consignment at the pharmacy before it is shipped.

Annex 3: Contrasting Estimated Annual Drug Requirements Using Different Methodologies and Data

Standard Treatment Protocol Method	Utilization Data Method (Goundi Data)	Utilization Data Method (FED Data)
Chloroquine (100mg tablet)		
1,470,000	259,000	607,000
Diazepam (injection 5mg/ml)		
15,300	1,200	17,800
Aluminium Hydroxide (500mg tablet)		
166	70	232
Methylergometrine (200 mg/ 1ml)		
100	500	4,700
Metronidazole (250gm tablet)		
35,000	75,000	499,000
Paracetamol (500mg tablet)		
601,000	159,000	490,000
Mebendazole (100mg tablet)		
5,000	9,000	48,600
Oral Rehydration Salts		
24,250	15,000	81,000

Annex 4: Illnesses for which Pharmaceutical Products are Prescribed, and Standard Treatment Protocols

Sys ID	Generic Name	Dose	Unit	Number Units per Pack	Health Problem	# Outpatients treated in 1993	% of Outpatients to whom drug is prescribed	# Inpatients treated in 1993	% of Inpatients to whom drug is prescribed	Standard Treatment Protocol (in units of drug)
1	ACETYLSALICYLIQUE Acide	500 mg	Co	100	Meningitis	222	33	0	0	42
1	ACETYLSALICYLIQUE Acide	500 mg	Co	100	Cough of 15 days or more	2125	50	0	0	15
1	ACETYLSALICYLIQUE Acide	500 mg	Co	100	Ear infections/Flu	9870	33	0	0	15
1	ACETYLSALICYLIQUE Acide	500 mg	Co	100	Conjunctivitis	7502	50	0	0	15
1	ACETYLSALICYLIQUE Acide	500 mg	Co	100	Muscle pains	22560	33	0	0	15
1	ACETYLSALICYLIQUE Acide	500 mg	Co	100	Cough of less than 15 days	30934	37	0	0	9
1	ACETYLSALICYLIQUE Acide	500 mg	Co	100	Traumatismes	20261	33	0	0	15
2	ACETYLSALICYLIQUE Acide	100 mg	Co	100	Measles	3047	33	0	0	20
2	ACETYLSALICYLIQUE Acide	100 mg	Co	100	Cough of less than 15 days	30934	18	0	0	9
2	ACETYLSALICYLIQUE Acide	100 mg	Co	100	Fever	38182	25	0	0	15
3	ACETYLSALICYLIQUE Acide	500 mg	Co	100	Meningitis	222	33	0	0	42
3	ACETYLSALICYLIQUE Acide	500 mg	Co	100	Cough of 15 days or more	2125	50	0	0	15
3	ACETYLSALICYLIQUE Acide	500 mg	Co	100	Ear infections/Flu	9870	33	0	0	15
3	ACETYLSALICYLIQUE Acide	500 mg	Co	100	Conjunctivitis	7502	50	0	0	15
3	ACETYLSALICYLIQUE Acide	500 mg	Co	100	Muscle pains	22560	33	0	0	15
3	ACETYLSALICYLIQUE Acide	500 mg	Co	100	Cough of less than 15 days	30934	37	0	0	9
3	ACETYLSALICYLIQUE Acide	500 mg	Co	100	Traumatismes	20261	33	0	0	15
4	ACETYLSALICYLIQUE Acide	75 mg	Co	5000	Measles	3047	33	0	0	20
4	ACETYLSALICYLIQUE Acide	75 mg	Co	5000	Cough of less than 15 days	30934	18	0	0	9
4	ACETYLSALICYLIQUE Acide	75 mg	Co	5000	Fever	38182	25	0	0	15
5	ALUMINIUM Hydroxyde	500 mg	Co	1000	Prenatal Consultations	42524	20	0	0	80
6	AMOXYCILLINE	250 mg	Caps	1000	Cough of less than 15 days	30934	10	0	0	20
6	AMOXYCILLINE	250 mg	Caps	1000	Urinary infection	8242	10	0	0	40
6	AMOXYCILLINE	250 mg	Caps	1000	Post-partum complications	801	20	0	0	40
6	AMOXYCILLINE	250 mg	Caps	1000	Prenatal Consultations	42524	10	0	0	40
6	AMOXYCILLINE	250 mg	Caps	1000	Malnutrition	214	50	0	0	10
7	BUTYLSCOPOLAMINE Bromhydrate	10 mg	Co	1000		0	0	0	0	0
8	CHLOROQUINE	100 mg	Co	1000	Prenatal Consultations	42524	100	0	0	90
8	CHLOROQUINE	100 mg	Co	1000	Fever	38182	80	0	0	15
9	CHLORPHENIRAMINE Maléate	4 mg	Co	1000	Worms	3353	70	0	0	10
9	CHLORPHENIRAMINE Maléate	4 mg	Co	1000	Skin infections	11838	50	0	0	10
10	COTRIMOXAZOLE	400+80mg	Co	1000	Measles	3047	30	0	0	7
10	COTRIMOXAZOLE	400+80mg	Co	1000	Dysentery	6822	75	0	0	28
10	COTRIMOXAZOLE	400+80mg	Co	1000	Cough of less than 15 days	30934	30	0	0	20

Sys ID	Generic Name	Dose	Unit	Number Units per Pack	Health Problem	# Outpatients treated in 1993	% of Outpatients to whom drug is prescribed	# Inpatients treated in 1993	% of Inpatients to whom drug is prescribed	Standard Treatment Protocol (in units of drug)
10	COTRIMOXAZOLE	400+80mg	Co	1000	Ear infections/Flu	9870	70	0	0	28
10	COTRIMOXAZOLE	400+80mg	Co	1000	Genital ulcers	1180	50	0	0	40
10	COTRIMOXAZOLE	400+80mg	Co	1000	Purulent Uretritis	2184	25	0	0	16
10	COTRIMOXAZOLE	400+80mg	Co	1000	Urinary infection	8242	90	0	0	40
11	DIAZEPAM oral	5 mg	Co	100	Neonatal tetanus	132	50	0	0	10
11	DIAZEPAM oral	5 mg	Co	100	Other tetanus	67	50	0	0	240
12	DIAZEPAM oral	5 mg	Co	1000	Neonatal tetanus	132	50	0	0	10
12	DIAZEPAM oral	5 mg	Co	1000	Other tetanus	67	50	0	0	240
13	FER SULFATE + FOLIQUE ACIDE	200 + 0.25 mg	co	1000	Prenatal Consultations	42524	33	0	0	180
13	FER SULFATE + FOLIQUE ACIDE	200 + 0.25 mg	co	1000	Worms	3353	27	0	0	30
14	FER SULFATE + FOLIQUE ACIDE	60mg+0,25mg	co	1000	Prenatal Consultations	42524	33	0	0	180
14	FER SULFATE + FOLIQUE ACIDE	60mg+0,25mg	co	1000	Worms	3353	27	0	0	30
15	HYDROCHLORTHIAZIDE	50 mg	co	1000	Hypertension	5037	100	0	0	30
16	MEBENDAZOLE	100 mg	co	100	Malnutrition	214	50	0	0	6
16	MEBENDAZOLE	100 mg	co	100	Worms	3353	40	0	0	6
16	MEBENDAZOLE	100 mg	co	100	Asthme	1628	25	0	0	6
17	MEBENDAZOLE	100 mg	co	1000	Malnutrition	214	50	0	0	6
17	MEBENDAZOLE	100 mg	co	1000	Worms	3353	40	0	0	6
17	MEBENDAZOLE	100 mg	co	1000	Asthme	1628	25	0	0	6
18	METHYL ERGOMETRINE	125 µg	co	500	Post-partum complications	801	10	0	0	24
19	METHYL ERGOMETRINE	125 µg	co	1000	Post-partum complications	801	10	0	0	24
20	METHYLERGOMETRINE	0,5mg	co	1000	Post-partum complications	801	10	0	0	1
21	METOCLOPRAMIDE Chlorhydrate	10 mg	co	1000	Autres problèmes	58659	2	0	0	0.5
22	METRIFONATE	100 mg	co	1000	Hematuria	1048	100	0	0	6
23	METRONIDAZOLE oral	250 mg	Co	1000	Dysentery	6822	50	0	0	42
24	MULTIVITAMINES	A+B1+B2+PP+C	Co	5000	Prenatal Consultations	42524	100	0	0	30
24	MULTIVITAMINES	A+B1+B2+PP+C	Co	5000	Malnutrition	214	100	0	0	15
25	NICLOSAMIDE	500 mg	co	100	Worms	3352	10	0	0	4
26	NICLOSAMIDE	500mg	co	1000	Worms	3352	10	0	0	4
27	NOSCAPINE	15 mg	co	1000		0	0	0	0	0
28	PARACETAMOL	100 mg	co	1000	Measles	3047	33	0	0	20
28	PARACETAMOL	100 mg	co	1000	Cough of less than 15 days	30934	50	0	0	9
28	PARACETAMOL	100 mg	co	1000	Fever	38182	25	0	0	15
29	PARACETAMOL	500 mg	co	1000	Meningitis	222	33	0	0	42
29	PARACETAMOL	500 mg	co	1000	Cough of less than 15 days	30934	38	0	0	9
29	PARACETAMOL	500 mg	co	1000	Conjunctivitis	7502	50	0	0	15
29	PARACETAMOL	500 mg	co	1000	Ear infections/Flu	9870	33	0	0	15

Sys ID	Generic Name	Dose	Unit	Number Units per Pack	Health Problem	# Outpatients treated in 1993	% of Outpatients to whom drug is prescribed	# Inpatients treated in 1993	% of Inpatients to whom drug is prescribed	Standard Treatment Protocol (in units of drug)
29	PARACETAMOL	500 mg	co	1000	Urinary infection	8242	50	0	0	15
29	PARACETAMOL	500 mg	co	1000	Traumatismes	20261	33	0	0	15
29	PARACETAMOL	500 mg	co	1000	Post-partum complications	801	70	0	0	30
29	PARACETAMOL	500 mg	co	1000	Fever	38182	25	0	0	15
29	PARACETAMOL	500 mg	co	1000	Muscle pains	22560	33	0	0	15
29	PARACETAMOL	500 mg	co	1000	Prenatal Consultations	42524	10	0	0	15
30	PHENOXYMETHYLPENICILLINE Potas	250 mg	co	1000	Ear infections/Flu	9870	10	0	0	60
30	PHENOXYMETHYLPENICILLINE Potas	250 mg	co	1000	Skin infections	11838	20	0	0	30
31	PROBENECIDE	500 mg	co	500	Purulent Uretritis	2184	75	0	0	2
32	QUININE	300mg	co	100	Fever	38182	10	0	0	18
33	QUININE Sulfate	200mg	co	1000	Fever	38182	10	0	0	18
34	SALBUTAMOL	2 mg	co	1000	Prenatal Consultations	42524	5	0	0	40
35	SELS DE REHYDRATATION ORALE	27,5 mg pour 1 Lit.	Sachet	1000	Measles	3047	100	0	0	10
35	SELS DE REHYDRATATION ORALE	27,5 mg pour 1 Lit.	Sachet	1000	Diarrhée	14820	100	0	0	10
35	SELS DE REHYDRATATION ORALE	27,5 mg pour 1 Lit.	Sachet	1000	Dysentery	6822	100	0	0	10
36	SELS DE REHYDRATATION ORALE	27,5mg pour 1 Lit.	Sachet	50	Measles	3047	0	0	0	10
36	SELS DE REHYDRATATION ORALE	27,5mg pour 1 Lit.	Sachet	50	Diarrhée	14820	0	0	0	10
36	SELS DE REHYDRATATION ORALE	27,5mg pour 1 Lit.	Sachet	50	Dysentery	6822	0	0	0	10
37	SULFAMETHOXAZOLE+TRIMETHOPRIM	400mg+80mg+500	co	100	Measles	3047	30	0	0	7
37	SULFAMETHOXAZOLE+TRIMETHOPRIM	400mg+80mg+500	co	100	Dysentery	6822	75	0	0	28
37	SULFAMETHOXAZOLE+TRIMETHOPRIM	400mg+80mg+500	co	100	Cough of less than 15 days	30934	30	0	0	20
37	SULFAMETHOXAZOLE+TRIMETHOPRIM	400mg+80mg+500	co	100	Ear infections/Flu	9870	70	0	0	28
37	SULFAMETHOXAZOLE+TRIMETHOPRIM	400mg+80mg+500	co	100	Genital ulcers	1180	50	0	0	40
37	SULFAMETHOXAZOLE+TRIMETHOPRIM	400mg+80mg+500	co	100	Purulent Uretritis	2184	25	0	0	16
37	SULFAMETHOXAZOLE+TRIMETHOPRIM	400mg+80mg+500	co	100	Urinary infection	8242	90	0	0	40
38	VITAMINE A PALMITATE	200,000 UI	caps	500	Measles	3047	100	0	0	1
38	VITAMINE A PALMITATE	200,000 UI	caps	500	Malnutrition	214	100	0	0	1
39	VITAMINE A Palmitate	200.000 UI	caps	1000	Measles	3047	0	0	0	1
39	VITAMINE A Palmitate	200.000 UI	caps	1000	Malnutrition	214	0	0	0	1
40	BENZYLPENICILLINE BENZATHINE	2.4 Méga UI	FI	50	Ear infections/Flu	9870	30	0	0	1
40	BENZYLPENICILLINE BENZATHINE	2.4 Méga UI	FI	50	Genital ulcers	1180	70	0	0	2
41	BENZYLPENICILLINE PROCAINE	3 + 1 Méga UI	FI	50	Neonatal tetanus	132	50	0	0	15
41	BENZYLPENICILLINE PROCAINE	3 + 1 Méga UI	FI	50	Other tetanus	67	50	0	0	15
41	BENZYLPENICILLINE PROCAINE	3 + 1 Méga UI	FI	50	Cough of less than 15 days	30934	10	0	0	5
41	BENZYLPENICILLINE PROCAINE	3 + 1 Méga UI	FI	50	Purulent Uretritis	2184	37	0	0	2
41	BENZYLPENICILLINE PROCAINE	3 + 1 Méga UI	FI	50	Post-partum complications	801	5	0	0	10

Sys ID	Generic Name	Dose	Unit	Number Units per Pack	Health Problem	# Outpatients treated in 1993	% of Outpatients to whom drug is prescribed	# Inpatients treated in 1993	% of Inpatients to whom drug is prescribed	Standard Treatment Protocol (in units of drug)
42	BENZYLPENICILLINE PROCAINE	3 + 1 Méga UI	Fl	100	Neonatal tetanus	132	50	0	0	15
42	BENZYLPENICILLINE PROCAINE	3 + 1 Méga UI	Fl	100	Other tetanus	67	50	0	0	15
42	BENZYLPENICILLINE PROCAINE	3 + 1 Méga UI	Fl	100	Cough of less than 15 days	30934	10	0	0	5
42	BENZYLPENICILLINE PROCAINE	3 + 1 Méga UI	Fl	100	Purulent Uretritis	2184	37	0	0	2
42	BENZYLPENICILLINE PROCAINE	3 + 1 Méga UI	Fl	100	Post-partum complications	801	5	0	0	10
43	BUTYLSCOPOLAMINE Bromhydrate	20 mg 1 ml	Amp	100		0	0	0	0	0
44	DIAZEPAM	5mg/ml	Amp	50	Neonatal tetanus	132	50	0	0	15
44	DIAZEPAM	5mg/ml	Amp	50	Other tetanus	67	50	0	0	15
44	DIAZEPAM	5mg/ml	Amp	50	Fever	38182	5	0	0	1
45	DIAZEPAM injectable	10 mg 2 ml	Amp	100	Neonatal tetanus	132	50	0	0	15
45	DIAZEPAM injectable	10 mg 2 ml	Amp	100	Other tetanus	67	50	0	0	15
45	DIAZEPAM injectable	10 mg 2 ml	Amp	100	Fever	38182	5	0	0	1
46	EAU POUR INJECTION	10ml	Amp, flapule	50	Neonatal tetanus	132	33	0	0	15
46	EAU POUR INJECTION	10ml	Amp, flapule	50	Other tetanus	67	33	0	0	15
46	EAU POUR INJECTION	10ml	Amp, flapule	50	Cough of less than 15 days	30934	7	0	0	5
46	EAU POUR INJECTION	10ml	Amp, flapule	50	Purulent Uretritis	2184	25	0	0	4
46	EAU POUR INJECTION	10ml	Amp, flapule	50	Post-partum complications	801	10	0	0	10
47	EAU POUR INJECTION	5ml	Amp, flapule	50	Ear infections/Flu	9870	15	0	0	1
47	EAU POUR INJECTION	5ml	Amp, flapule	50	Genital ulcers	1180	35	0	0	4
48	EAU POUR INJECTION	5 ml	Fl	100	Ear infections/Flu	9870	15	0	0	1
48	EAU POUR INJECTION	5 ml	Fl	100	Genital ulcers	1180	35	0	0	4
49	EAU POUR INJECTION	10 ml	Fl	100	Neonatal tetanus	132	33	0	0	15
49	EAU POUR INJECTION	10 ml	Fl	100	Other tetanus	67	33	0	0	15
49	EAU POUR INJECTION	10 ml	Fl	100	Cough of less than 15 days	30934	7	0	0	5
49	EAU POUR INJECTION	10 ml	Fl	100	Purulent Uretritis	2184	25	0	0	4
49	EAU POUR INJECTION	10 ml	Fl	100	Post-partum complications	801	10	0	0	10
50	GLUCOSE + SET IV	5% 500ml	Perf	1	Meningitis	222	50	0	0	28
50	GLUCOSE + SET IV	5% 500ml	Perf	1	Traumatismes	20261	5	0	0	2
50	GLUCOSE + SET IV	5% 500ml	Perf	1	Fever	38182	2	0	0	10
51	GLUCOSE + SET IV	10 % 500 ml	Perf	20	Meningitis	222	50	0	0	28
51	GLUCOSE + SET IV	10 % 500 ml	Perf	20	Traumatismes	20261	5	0	0	2
51	GLUCOSE + SET IV	10 % 500 ml	Perf	20	Fever	38182	3	0	0	10
52	LIDOCAINE	2 % 50 ml	Fl	25	Traumatismes	20261	15	0	0	1
53	LIDOCAINE	2% 50 ml	Fl	5	Traumatismes	20261	15	0	0	1
54	METHYL ERGOMETRINE	200 µg 1 ml	Amp	100	Post-partum complications	801	0	0	0	1
55	METHYL ERGOMETRINE	0,2mg/ml	Amp	10	Post-partum complications	801	10	0	0	1

Sys ID	Generic Name	Dose	Unit	Number Units per Pack	Health Problem	# Outpatients treated in 1993	% of Outpatients to whom drug is prescribed	# Inpatients treated in 1993	% of Inpatients to whom drug is prescribed	Standard Treatment Protocol (in units of drug)
56	METHYLERGOMETRINE	0,5mg/ml	Amp	100	Post-partum complications	801	10	0	0	1
57	NORAMIDOPYRINE	1 g 2 ml	Amp	100	Fever	38182	2	0	0	1
58	QUININE	300mg/ml	Amp	10	Fever	38182	2	0	0	5
59	QUININE Dichlorhydrate	600 mg 2 ml	Amp	100	Fever	38182	3	0	0	5
60	RINGER LACTATE + SET IV	500 ml	Perf	12	Diarrhée	14820	5	0	0	2
61	RINGER LACTATE + SET IV	500ml	Perf	1	Diarrhée	14820	5	0	0	2
62	SALBUTAMOL injectable	0,5 mg 1 ml	Amp	10	Prenatal Consultations	42524	5	0	0	5
62	SALBUTAMOL injectable	0,5 mg 1 ml	Amp	10	Asthme	1628	100	0	0	6
63	SERUM ANTIVENIMEUX Polyvalent	(EBND)	Fl	10		0	0	0	0	0
64	SET PERFUSION complet UU	avec aig. 18G	Set	100		0	0	0	0	0
65	ANTI-HEMORROIDAIRE pommade	15 g	Tube	10	Autres problèmes	58659	2	0	0	1
66	BENZYL BENZOATE à diluer	90%	Litre	1	Skin infections	11838	20	0	0	0.25
67	CHLORHEXIDINE Gluc.+ CETRIMIDE	1.5 + 15 % 5lt	Bidon	1		0	0	0	0	0
68	CHLOROHEXEDINE	5%	Bidon	1		0	0	0	0	0
69	EAU de JAVEL (HYPOCHLORITE K)	8% à dil. 250ml	Poche	1		0	0	0	0	0
70	ICHypertensionMOL pommade	10 % 800 g	Pot	1	Skin infections	11838	10	0	0	0.03
71	IODE POVIDONE	10 % 200 ml	Bout	1		0	0	0	0	0
72	NEOMYCINE + BACITRACINE pomm.d	0.5% + 500 UI/g	Tube	50	Skin infections	11838	10	0	0	1
73	NEOMYCINE + BACITRACINE pomm.d	5mg + 500UI 20g	Tube	1	Skin infections	11838	10	0	0	1
74	NYSTATINE	100000 UI vagin	co v.	15	Post-partum complications	801	10	0	0	14
74	NYSTATINE	100000 UI vagin	co v.	15	Prenatal Consultations	42524	10	0	0	10
75	NYSTATINE	100000 UI vagin	Co. v.	100		801	10	0	0	14
75	NYSTATINE	100000 UI vagin	Co. v.	100		42524	10	0	0	10
76	OXYDE DE ZINC pommade	10 % 800 g	Pot	1	Skin infections	11838	5	0	0	0.06
77	SALICYLIQUE Ac.+BENZOIQUE Ac.	3%+6%, 800g	Pot	1	Skin infections	18838	10	0	0	0.03
78	SALICYLIQUE Ac.+BENZOIQUE Ac.	3%+6%, 500g	Pot	1	Skin infections	18838	10	0	0	0.03
79	TALC	poudre 1 kg	Pot	1	Skin infections	11838	5	0	0	0.1
80	TETRACYCLINE Opthalmique	1% de 5g	Tube	1	Measles	3047	35	0	0	1
80	TETRACYCLINE Opthalmique	1% de 5g	Tube	1	Conjunctivitis	7502	50	0	0	1
81	TETRACYCLINE Opthalmique	1% 5 g	Tube	100	Measles	3047	35	0	0	1
81	TETRACYCLINE Opthalmique	1% 5 g	Tube	100	Conjunctivitis	7502	50	0	0	1
82	VASELINE BLANCHE	1 kg	Pot	2.5		0	0	0	0	0
83	VIOLET DE GENTIANE	25g	Bouteille	1	Skin infections	11838	20	0	0	0.01
83	VIOLET DE GENTIANE	25g	Bouteille	1	Post-partum complications	801	2	0	0	0
84	VIOLET de GENTIANE	poudre 100 g	Bout	1	Skin infections	11838	20	0	0	0
84	VIOLET de GENTIANE	poudre 100 g	Bout	1	Post-partum complications	801	3	0	0	0

Sys ID	Generic Name	Dose	Unit	Number Units per Pack	Health Problem	# Outpatients treated in 1993	% of Outpatients to whom drug is prescribed	# Inpatients treated in 1993	% of Inpatients to whom drug is prescribed	Standard Treatment Protocol (in units of drug)
85	AIG. SUTURE Pointe TRIANGUL.	set / 7 aig.	Set	12						
86	AIGUILLE HYPODERMIQUE UU LUER	18G * 1½"	Pièce	100						
87	AIGUILLE HYPODERMIQUE UU LUER	21G * 1½"	Pièce	100						
88	AIGUILLE HYPODERMIQUE UU LUER	23G * 1"	Pièce	100						
89	AIGUILLE HYPODERMIQUE UU LUER	23G	Pièce	100						
90	AIGUILLE PL QUINCKE UU LUER	19G * 3½"	Pièce	25						
91	AIGUILLE PL QUINCKE UU LUER	22G * 1½"	Pièce	25						
92	ASPIRATEUR Nv-Nè complet	CH 10	Pièce	1						
93	BANDE CREPE	10 cm x 4 m	Bande	10						
94	BANDE DE GAZE 17 f.	8 cm x 4 m	Rouleau	10						
95	CATGUT CHROME SERTI	3.5 Metric, 2/0	Set	36						
96	COMPRESSE NON STER. 17 f. 8 p.	5 x 5 cm	Compr	1						
97	COMPRESSE NON STER. 17 f. 8 p.	10 x 10 cm	Compr	100						
98	CONDOM LUBRIFIE avec RESERVOIR	diam. 52 mm	Pièce	144						
99	COTON HYDROPHILE	500g	Rouleau	1						
100	DOIGTIER VAGINAL LATEX UM	UM avec collet	Pièce	1						
101	DOIGTIER VAGINAL POLYETHYLENE	UU avec collet	Pièce	100						
102	EMBOUT CAOUTCHOUC pour KIGLISS	2 cc	Pièce	1						
103	EMBOUT CAOUTCHOUC pour KIGLISS	5 cc	Pièce	1						
104	EPICRANIENNE UU	23G	Pièce	12						
105	FIL DE SUTURE STERILE + AIGUILLE	SZ 000	Pièce	36						
106	FIL DE SUTURE STERILE+AIGUILLE	(obstetrique)	Pièce	36						
107	GANTS D'EXAMEN LATEX NON STERILES	t 7 (petit)	Paire	20						
108	GANTS D'EXAMEN LATEX NON STERILES	t 7,5	Paire	20						
109	GANTS d'EXAMEN NON STERILES UM	t.7 avec collet	Paire	100						
110	GANTS d'EXAMEN NON STERILES UM	t.7.5 av.collet	Paire	100						
111	GANTS d'EXAMEN NON STERILES UM	t.8 avec collet	Paire	100						
112	GARROT	0	Pièce	1						
113	LAME de BISTOURI UU	N° 20	Lame	100						
114	POLYESTER TRESSE SERTI	3 Metric, 2/0	Set	36						
115	ROULEAU DE GAZE 17 f.	90 cm x 100 m	Roul	1						
116	SERINGUE GAVAGE UU emb CONIQUE	50 ml	Pièce	1						
117	SERINGUE HYPODER POLYP. LUER	5ccx 0.5 ml	Piece	1						
118	SERINGUE HYPODER POLYP. LUER	2ccx0,1ml	Pièce	1						
119	SERINGUE HYPODERMIQUE UM	2ml	Pièce	50						
120	SERINGUE HYPODERMIQUE UM	5ml	Pièce	50						
121	SERINGUE UM NYLON KIGLISS LUER	2 cc	Pièce	1						

Sys ID	Generic Name	Dose	Unit	Number Units per Pack	Health Problem	# Outpatients treated in 1993	% of Outpatients to whom drug is prescribed	# Inpatients treated in 1993	% of Inpatients to whom drug is prescribed	Standard Treatment Protocol (in units of drug)
122	SERINGUE UM NYLON KIGLISS LUER	5 cc	Pièce	1						
123	SONDE GASTRIQUE type LEVIN	CH 16	Pièce	100						
124	SONDE GASTRIQUE type LEVIN	CH 8, 350 ml	Pièce	100						
125	SONDE VESICALE DROITE p. FEMME	CH 16 20 cm	Pièce	100						
126	SONDE VESICALE DROITE p. HOMME	CH 16 40 cm	Pièce	10						
127	SPARADRAP	2.5 cm x 5 m	Roul	8						
128	THERMOMETRE RECTAL	°C	Pièce	1						
129	TRIOXYMETHYLENE (FORMOL)	1 g	Co	1000		0	0	0	0	0
130	DOXYCYCLINE Chlorhydrate	100 mg	Caps	1000	Cough of 15 days or more	2125	100	0	0	11
130	DOXYCYCLINE Chlorhydrate	100 mg	Caps	1000	Conjunctivitis	7502	20	0	0	10
130	DOXYCYCLINE Chlorhydrate	100 mg	Caps	1000	Fever	38182	20	0	0	8
131	FER SULFATE	60 mg Fe++	co	1000	Prenatal Consultations	42524	33	0	0	180
131	FER SULFATE	60 mg Fe++	co	1000	Worms	3353	27	0	0	30
132	METHYLDOPA	250mg	co	100	Hypertension	5037	100	0	0	90
133	METHYLDOPA (Alpha)	250mg	co	1000	Hypertension	5037	0	0	0	90
134	SALBUTAMOL	4mg	co	100	Prenatal Consultations	42524	2	0	0	40
134	SALBUTAMOL	4mg	co	100	Asthme	1628	50	0	0	18
135	SALBUTAMOL	4mg	co	1000	Prenatal Consultations	42524	3	0	0	40
135	SALBUTAMOL	4mg	co	1000	Asthme	1628	50	0	0	18
136	ADRENALINE	1 mg 1 ml	Amp	100	Asthme	1628	0	0	0	1
137	ADRENALINE	1mg/ml	Amp	10	Asthme	1628	100	0	0	1
138	CHLORAMPHENICOL	1g	Fl	5	Meningitis	222	100	0	0	84
139	CHLORAMPHENICOL	1g	Fl	50	Meningitis	222	0	0	0	84
140	DEXAMETH. .SONE Phosphate Sod.	5 mg 1 ml	Amp	50	Asthme	1628	10	0	0	1
141	DEXAMETHASONE Sodium Phosphate	5mg/ml	Amp	100	Asthme	1628	0	0	0	1
142	EAU POUR INJECTION	2ml	Amp, fiapule	50	Neonatal tetanus	132	33	0	0	75
142	EAU POUR INJECTION	2ml	Amp, flapule	50	Other tetanus	67	33	0	0	75
142	EAU POUR INJECTION	2ml	Amp, flapule	50	Cough of less than 15 days	30934	7	0	0	25
142	EAU POUR INJECTION	2ml	Amp, flapule	50	Purulent Uretritis	2184	25	0	0	20
142	EAU POUR INJECTION	2ml	Amp, flapule	50	Post-partum complications	801	10	0	0	50
143	METOCLOPRAMIDE Chlorhydrate	10 mg 2 ml	Amp	100	Autres problèmes	58659	0	0	0	0.5
144	CHLORHEXEDINE Gluc +CETRIMIDE	20% 5lt	Bidon	1		0	0	0	0	0
145	NYSTATINE Pommade dermique	10000UI/g	Tube/30g	1	Skin infections	11838	5	0	0	1
146	AIGUILLE HYPOD LUER UU	25Gx5,8	Pièce	100						
147	AIGUILLE HYPODERMIQUE UU LUER	19G x 1.5	Pièce	100						
148	AIGUILLE HYPODERMIQUE UU LUER	22G x 1 1/4	Pièce	100						
149	AIGUILLE HYPODERMIQUE UU LUER	20G	Pièce	100						

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Sys ID	Generic Name	Dose	Unit	Number Units per Pack	Health Problem	# Outpatients treated in 1993	% of Outpatients to whom drug is prescribed	# Inpatients treated in 1993	% of Inpatients to whom drug is prescribed	Standard Treatment Protocol (in units of drug)
150	AIGUILLE HYPODERMIQUE UU LUER	27G	Pièce	100						
151	AIGUILLE PL QUINCKE UU	22Gx3 1/2"	Pièce	1						
152	AIGUILLE PL UU QUINCKE	20G 0.9 x70 mm	Pièce	1						
153	BANDE DE GAZE 17 f.	7.5 cm x 4 m	Rouleau	1						
154	BANDE DE GAZE NON STERILE	50mm x 9m	Rouleau	1						
155	BANDE DE GAZE NON STERILE	75mm x 9m	Roule	1						
156	BANDE DE GAZE	5 cm x 10 m	Rouleau	10						
157	BANDE DE GAZE	76 mm x 10 m	Rouleau	10						
158	BANDE PLATREE	20 cm x 2,75 m	Bande	1						
159	COMPRESSE DE GAZE NON STERILE	100 mm x 10 m	Rouleau	100						
160	COTON HYDROPHILE	100 g	Rouleau	1						
161	EMBOUT CAOUTCHOUC pour KIGLISS	10 cc	Pièce	1						
162	EPICRANIENNE UU	25G	Piece	1						
163	EPICRANIENNE UU	19G	Pièce	100						
164	EPICRANIENNE UU	21G	Piece	100						
165	EPICRANIENNE UU	21G	Pièce	1						
166	GANTS CHIRURGICAUX LATEX UU	t 7	Paire	2						
167	GANTS CHIRURGICAUX LATEX UU	t 7 1/2	Paire	2						
168	GANTS CHIRURGICAUX LATEX UU	t 6 1/2	Paire	2						
169	GANTS CHIRURGICAUX NON STERILES	t.7	Paire	50						
170	GANTS CHIRURGICAUX NON STERILES	t.7,5	Paire	50						
171	GANTS CHIRURGICAUX NON STERILES	t.8	Paire	50						
172	GANTS CHIRURGICAUX STERILES	t.7	Paire	50						
173	GANTS CHIRURGICAUX STERILES	t.7,5	Paire	50						
174	GANTS CHIRURGICAUX STERILES	t.8	Paire	50						
175	GANTS de PROTECTION latex ép.	taille unique	Pièce	100						
176	GAZE ABSORBANT NON STERILE	200mmx6m	Rouleau	1						
177	LAME DE BISTOURI	No 21	Pièce	5						
178	LAME de BISTOURI UU	N° 15	Lame	100						
179	LAME de BISTOURI UU	N° 15	Lame	5						
180	SAC à URINE avec VALVE de VIDANGE	2000 ml	Piece	1						
181	SERINGUE GAVAGE UM emb.CONIQUE	50 cc	Pièce	10						
182	SERINGUE HYPOD KIGLISS LUER 10cc	10ccx0,5ml	Pièce	1						
183	SERINGUE HYPODERMIQUE UM	10ml	Pièce	50						
184	SERINGUE UM NYLON KIGLISS LUER	10 cc	Pièce	1						
185	SONDE DE GAVAGE NASALE	CH8	Pièce	1						
186	SONDE DE GAVAGE NASALE	CH16, 50cm	Pièce	1						

Sys ID	Generic Name	Dose	Unit	Number Units per Pack	Health Problem	# Outpatients treated in 1993	% of Outpatients to whom drug is prescribed	# Inpatients treated in 1993	% of Inpatients to whom drug is prescribed	Standard Treatment Protocol (in units of drug)
187	SONDE DE GAVAGE NASALE	5Fr 380m	Pièce	1						
188	SONDE VESICALE 2 VOIES DROITE	CH 14,18 cm	Pièce	1						
189	SONDE VESICALE 2 VOIES DROITE	CH14, 40cm	Pièce	1						
190	SPARADRAP	2.5 cm x 10 m	Roule	1						
191	TOURNIQUET LATEX	25 cm	Ruban	1		0	0	0	0	0

Annex 5: The Projected Impact of Break-Even Pharmaceutical Pricing on Health Center Financial Positions

As mentioned in Section III, in order to evaluate health center capacity to finance the Prefectoral Pharmacy's break-even level drug prices, it is necessary to project the revenue yield under proposed user fee levels, and then subtract total expenditures on drugs. An example of this analysis for the NGO supply mode excluding pharmacy salaries with user fees per episode set at FCFA 1,500 per adult, and FCFA 600 per child and an assumed revenue leakage rate of 25% (the last option presented in Table 4) is presented here.

The first step is to project the volume of health problems that are likely to be treated at public health centers annually. We do this by assuming that future utilization will be equivalent to past utilization, and thus base our analysis on the most recent health utilization information for the Prefecture. This is undertaken in Table A5-1 which reports the number of cases treated at public health centers in Moyen Chari in 1993.

The second step is to project the maximum annual user fee revenues assuming a revenue leakage rate of 0.25 occurs. This is done by multiplying the number of adult new cases reported in Table A12-1 by (FCFA 1,500 X 0.75) (the total number multiplied by one minus the proportion of child cases), and then adding this to the number of new child cases reported multiplied by (FCFA 600 X 0.75). The results are reported in Table A5-2.

The third step is to project the total drug treatment cost by health problem based on the Prefectoral Pharmacy's break-even pricing. This is done by multiplying the drug treatment cost per health problem reported in Table 3 of the main text by the projected treatment frequencies reported in Table A5-3. Note that no distinction is made between the adult and child cost of treatment in these projections.

The fourth and final step is to project the health center annual net (after drug expenditure) financial position based on the Prefectoral Pharmacy's break-even pricing.

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This is done in Table A5-4 by subtracting the total drug costs reported in Table A5-3 from the total projected user fee revenues reported in Table A5-2. It is important to recognize that these net revenue projections most likely reflect the best case situation. This is because: (1) the total drug cost estimates are based upon standard treatment protocols rather than on actual drug utilization experience causing drug expenditures to be underestimated; and, (2) the revenue projections assume that utilization will not decrease when fees are introduced (a possible result of the introduction of user fees if the quality of care is not improved concomitantly).

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Table A5-1: Monthly Utilization of Public Health Facilities in Moyen Chari by Major Health Problem in 1993

Major Health Problem	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL	Number of Child Episodes (0-4 years)	Child Episodes as a % of Total Episodes
Asthma	161	144	130	96	90	89	106	165	168	183	170	126	1628	893	0.548
Other Problem	4756	4785	4887	4974	4673	4431	4946	5657	4936	5080	5704	4408	59236	9077	0.153
Post-Partum complications	42	47	40	40	61	62	50	89	70	85	97	118	801	0	0
Conjunctivitis	488	545	662	878	910	724	564	596	533	604	621	377	7502	2385	0.317
Pre-Natal consultations													42524	0	0
Diarrhea	1406	1042	1126	1717	2076	1310	1232	1319	916	796	937	943	14820	10346	0.698
Muscle Pains	1619	1770	1907	1616	1734	1721	2153	2450	1988	2066	1862	1674	22560	1309	0.058
Dysentery	603	471	577	535	760	554	534	511	424	525	606	722	6822	2874	0.421
Fevers	2086	1953	1812	1643	1606	2483	4511	6338	4773	4475	4054	2448	38182	15695	0.411
Hematuria	69	91	75	101	96	121	74	90	60	66	89	116	1048	91	0.086
Hypertension													5037	0	0
Infection of the skin	902	751	821	842	982	1111	992	1262	1012	1114	1205	844	11838	4953	0.418
Urinary Infections	596	580	701	667	758	635	716	850	674	686	778	601	8242	353	0.0428
Malnutrition	5	7	3	4	20	28	59	34	16	11	14	13	214	165	0.771
Meningitis	19	52	59	51	8	3	4	3	4	6	4	9	222	0	0
Ear infection/Flu	842	812	952	871	765	779	760	983	806	790	904	606	9870	4571	0.463
Measles	446	605	854	572	277	80	61	20	20	52	27	25	3047	2310	0.758
Tetanus (non-neonatal)	11	8	3	12	3	1	4	9	4	8	3	1	67	9	0.134
Neo-Natal tetanus	9	7	4	8	9	16	12	22	13	14	13	5	132	132	1
Cough of 15 days or more	184	219	155	163	201	128	181	178	136	157	223	200	2125	201	0.094
Cough of less than 15 days	3064	2743	2469	1830	1710	1686	2006	3136	3194	3476	3236	2384	30934	16957	0.548
Trauma	1574	1406	1746	2014	1903	1715	1615	1676	1500	1574	1899	1639	20261	3758	0.185
Genital ulcers	105	96	110	86	79	111	93	113	74	97	108	108	1180	20	0.016
Purulent Uretritis	206	181	185	193	198	199	176	169	159	160	185	173	2184	0	0
Worms	269	271	277	281	265	251	280	320	279	288	323	249	3352	514	0.153
Total new cases treated	19462	18586	19555	19194	19184	18238	21129	25998	21759	22313	23062	17789	293828	82801	0.281
Number of health centers furnishing reports	56	56	55	60	59	61	61	62	60	58	60	53	58.41	58.41	
Average number of episodes per health center	348	332	356	320	325	299	346	419	363	385	384	336	5030	1417	

Source: Rapport Mensuels d'Activités MSPAS/DSIS

Table A5-2: Maximum Projected User Fee Revenues by Major Health Problem in Moyen Chari

No.	Health Problem	TOTAL			JANUARY			FEBRUARY			MARCH		
		Adult	Child	Total	Adult	Child	Total	Adult	Child	Total	Adult	Child	Total
1	Asthma	826,875	401,850	1,228,725	81,773	39,741	121,514	73,139	35,544	108,683	66,028	32,089	98,117
2	Other Problems	56,429,494	4,084,560	60,514,054	4,530,661	327,945	4,858,606	4,558,125	329,933	4,888,058	4,655,577	336,987	4,992,564
3	Post-Partum Complications	901,125	0	901,125	47,250	0	47,250	52,875	0	52,875	45,000	0	45,000
4	Conjunctivitus	5,756,625	1,073,250	6,829,875	374,465	69,814	444,279	418,203	77,969	496,172	507,983	94,707	602,690
5	Pre-natal consultations	47,839,500	0	47,839,500									
6	Diarrhea	5,033,250	4,655,700	9,688,950	477,513	441,695	919,208	353,890	327,344	681,234	382,418	353,733	736,151
7	Douleurs musculaires/Cephalées	23,907,375	589,050	24,496,425	1,715,693	42,273	1,757,966	1,875,712	46,215	1,921,927	2,020,894	49,792	2,070,686
8	Dysentry	4,441,500	1,293,300	5,734,800	392,586	114,315	506,901	306,647	89,291	395,938	375,659	109,386	485,045
9	Fevers	25,297,875	7,062,750	32,360,625	1,382,101	385,860	1,767,961	1,293,980	361,258	1,655,238	1,200,559	335,176	1,535,735
10	Hematurie	1,076,625	40,950	1,117,575	70,885	2,696	73,581	93,486	3,556	97,042	77,049	2,931	79,980
11	Hypertension	5,666,625	0	5,666,625									
12	Skin infections	7,745,625	2,228,850	9,974,475	590,180	169,828	760,008	491,381	141,398	632,779	537,182	154,577	691,759
13	Urinary infections	8,875,125	158,850	9,033,975	641,783	11,487	653,270	624,554	11,178	635,732	754,849	13,511	768,360
14	Malnutrition	55,125	74,250	129,375	1,288	1,735	3,023	1,803	2,429	4,232	773	1,041	1,814
15	Miningitis	249,750	0	249,750	21,375	0	21,375	58,500	0	58,500	66,375	0	66,375
16	Otite moyenne/Angine	5,961,375	2,056,950	8,018,325	508,559	175,476	684,035	490,439	169,224	659,663	574,998	198,401	773,399
17	Measles	829,125	1,039,500	1,868,625	121,362	152,155	273,517	164,628	206,399	371,027	232,384	291,347	523,731
18	Tetanus (other than neonatal)	65,250	4,050	69,300	10,713	665	11,378	7,791	484	8,275	2,922	181	3,103
19	Neonatal tetanus	0	59,400	59,400	0	4,050	4,050	0	3,150	3,150	0	1,800	1,800
20	Cough of 15 days or more	2,164,500	90,450	2,254,950	187,420	7,832	195,252	223,071	9,322	232,393	157,881	6,598	164,479
21	Cough of less than 15 days	15,724,125	7,630,650	23,354,775	1,557,468	755,813	2,313,281	1,394,300	676,630	2,070,930	1,255,022	609,041	1,864,063
22	Trauma	18,565,875	1,691,100	20,256,975	1,442,312	131,375	1,573,687	1,288,368	117,353	1,405,721	1,599,922	145,731	1,745,653
23	Genital Ulcers	1,305,000	9,000	1,314,000	116,123	801	116,924	106,169	732	106,901	121,653	839	122,492
24	Urétrite Purulente (hommes)	2,457,000	0	2,457,000	231,750	0	231,750	203,625	0	203,625	208,125	0	208,125
25	Worms	3,192,750	231,300	3,424,050	256,220	18,562	274,782	258,125	18,700	276,825	263,840	19,114	282,954
Total User Fee Revenues		244,367,494	34,475,760	278,843,254	14,759,480	24,680	17,613,598	150,169	2,628,109	16,966,920	15,107,093	2,756,982	17,864,075
Number of health centers				58			56			56			55
Average health center revenues		4,183,181	590,170	4,773,351	263,562	441	314,529	2,682	46,931	302,981	274,674	50,127	324,801

Notes: The following user fees have been assumed: FCFA 2,000 per adult illness episode, and FCFA 900 per child illness episode. In addition, a 25% revenue leakage rate is assumed.

Table A5-2 Continued

No.	APRIL			MAY			JUNE			JULY			AUGUST		
	Adult	Child	Total	Adult	Child	Total	Adult	Child	Total	Adult	Child	Total	Adult	Child	Total
1	48,759	23,696	72,455	45,712	22,215	67,927	45,204	21,968	67,172	53,838	26,165	80,003	83,805	40,728	124,533
2	4,737,969	342,950	5,080,919	4,451,813	322,237	4,774,050	4,221,470	305,564	4,527,034	4,711,391	341,027	5,052,418	5,389,130	390,084	5,779,214
3	45,000	0	45,000	68,625	0	68,625	69,750	0	69,750	56,250	0	56,250	100,125	0	100,125
4	673,729	125,608	799,337	698,284	130,186	828,470	555,558	103,577	659,135	432,783	80,687	513,470	457,338	85,265	542,603
5															
6	583,137	539,395	1,122,532	705,063	652,175	1,357,238	444,909	411,536	856,445	418,419	387,033	805,452	447,966	414,364	862,330
7	1,712,514	42,194	1,754,708	1,837,562	45,275	1,882,837	1,823,785	44,936	1,868,721	2,281,586	56,216	2,337,802	2,596,324	63,970	2,660,294
8	348,315	101,424	449,739	494,802	144,079	638,881	360,685	105,026	465,711	347,664	101,235	448,899	332,689	96,874	429,563
9	1,088,586	303,915	1,392,501	1,064,072	297,071	1,361,143	1,645,137	459,295	2,104,432	2,988,809	834,426	3,823,235	4,199,307	1,172,377	5,371,684
10	103,759	3,947	107,706	98,622	3,751	102,373	124,305	4,728	129,033	76,021	2,892	78,913	92,458	3,517	95,975
11															
12	550,922	158,531	709,453	642,524	184,890	827,414	726,929	209,178	936,107	649,067	186,773	835,840	825,729	237,608	1,063,337
13	718,237	12,855	731,092	816,227	14,609	830,836	683,779	12,239	696,018	771,001	13,800	784,801	915,294	16,382	931,676
14	1,030	1,388	2,418	5,152	6,939	12,091	7,213	9,715	16,928	15,198	20,471	35,669	8,758	11,797	20,555
15	57,375	0	57,375	9,000	0	9,000	3,375	0	3,375	4,500	0	4,500	3,375	0	3,375
16	526,075	181,520	707,595	462,052	159,429	621,481	470,508	162,347	632,855	459,032	158,387	617,419	593,722	204,861	798,583
17	155,648	195,141	350,789	75,375	94,500	169,875	21,769	27,292	49,061	16,599	20,810	37,409	7,619	9,552	17,171
18	11,687	725	12,412	2,922	181	3,103	974	60	1,034	3,896	242	4,138	8,765	544	9,309
19	0	3,600	3,600	0	4,050	4,050	0	7,200	7,200	0	5,400	5,400	0	9,900	9,900
20	166,030	6,938	172,968	204,736	8,556	213,292	130,379	5,448	135,827	184,364	7,704	192,068	181,309	7,577	188,886
21	930,211	451,416	1,381,627	869,214	421,815	1,291,029	857,014	415,894	1,272,908	1,019,674	494,830	1,514,504	1,594,067	773,573	2,367,640
22	1,845,500	168,100	2,013,600	1,743,787	158,835	1,902,622	1,571,516	143,144	1,714,660	1,479,882	134,797	1,614,679	1,535,778	139,889	1,675,667
23	95,110	656	95,766	87,369	603	87,972	122,758	847	123,605	102,852	709	103,561	124,970	862	125,832
24	217,125	0	217,125	222,750	0	222,750	223,875	0	223,875	198,000	0	198,000	190,125	0	190,125
25	267,650	19,390	287,040	252,410	18,286	270,696	239,075	17,320	256,395	266,697	19,321	286,018	304,797	22,081	326,878
	14,884,368	2,683,389	17,567,757	14,858,073	2,689,682	17,547,755	14,349,967	2,467,314	16,817,281	16,537,523	2,892,925	19,430,448	19,993,450	3,701,805	23,695,255
			60			59			61			61			62
	248,073	44,723	292,796	251,832	45,588	297,420	235,245	40,448	275,693	271,107	47,425	318,532	322,475	59,707	382,182

Table A5-2 Continued

No.	SEPTEMBER			OCTOBER			NOVEMBER			DECEMBER		
	Adult	Child	Total	Adult	Child	Total	Adult	Child	Total	Adult	Child	Total
1	85,329	41,469	126,798	92,947	45,171	138,118	86,344	41,962	128,306	63,996	31,101	95,097
2	4,701,646	340,321	5,041,967	4,838,965	350,261	5,189,226	5,433,426	393,290	5,826,716	4,199,322	303,961	4,503,283
3	78,750	0	78,750	95,625	0	95,625	109,125	0	109,125	132,750	0	132,750
4	408,995	76,252	485,247	463,477	86,409	549,886	476,521	88,841	565,362	289,289	53,934	343,223
5												
6	311,097	287,761	598,858	270,342	250,063	520,405	318,229	294,358	612,587	320,267	296,243	616,510
7	2,106,731	51,907	2,158,638	2,189,390	53,944	2,243,334	1,973,206	48,618	2,021,824	1,773,978	43,709	1,817,687
8	276,047	80,381	356,428	341,804	99,528	441,332	394,540	114,884	509,424	470,062	136,875	606,937
9	3,162,400	882,890	4,045,290	2,964,957	827,767	3,792,724	2,686,019	749,892	3,435,911	1,621,947	452,821	2,074,768
10	61,639	2,344	63,983	67,803	2,579	70,382	91,431	3,478	94,909	119,168	4,533	123,701
11												
12	662,153	190,539	852,692	728,892	209,743	938,635	788,434	226,877	1,015,311	552,231	158,908	711,139
13	725,775	12,990	738,765	738,696	13,221	751,917	837,764	14,995	852,759	647,167	11,583	658,750
14	4,121	5,551	9,672	2,834	3,817	6,651	3,606	4,857	8,463	3,349	4,511	7,860
15	4,500	0	4,500	6,750	0	6,750	4,500	0	4,500	10,125	0	10,125
16	486,815	167,974	654,789	477,152	164,639	641,791	546,006	188,397	734,403	366,018	126,293	492,311
17	5,442	6,823	12,265	14,150	17,740	31,890	7,347	9,211	16,558	6,803	8,529	15,332
18	3,896	242	4,138	7,791	484	8,275	2,922	181	3,103	974	60	1,034
19	0	5,850	5,850	0	6,300	6,300	0	5,850	5,850	0	2,250	2,250
20	138,528	5,789	144,317	159,918	6,683	166,601	227,145	9,492	236,637	203,718	8,513	212,231
21	1,623,549	787,881	2,411,430	1,766,893	857,443	2,624,336	1,644,898	798,241	2,443,139	1,211,816	588,074	1,799,890
22	1,374,503	125,199	1,499,702	1,442,312	131,375	1,573,687	1,740,121	158,502	1,898,623	1,501,874	136,800	1,638,674
23	81,839	564	82,403	107,275	740	108,015	119,441	824	120,265	119,441	824	120,265
24	178,875	0	178,875	180,000	0	180,000	208,125	0	208,125	194,625	0	194,625
25	265,745	19,252	284,997	274,317	19,873	294,190	307,655	22,288	329,943	237,170	17,182	254,352
	16,748,375	3,091,979	19,840,354	17,232,290	3,147,780	20,380,070	18,006,805	3,175,038	21,181,843	14,046,090	2,386,704	16,432,794
			60			58			60			53
	279,140	51,533	330,673	297,108	54,272	351,381	300,113	52,917	353,031	265,021	45,032	310,053

Table A5-3: Projected Total Annual Health Center Drug Costs Under Pharmacy Break-Even Pricing Based on the NGO Drug Supply Mode Excluding Pharmacy Salaries

Health Problem	Drug costs per episode	Total Annual Drug Cost	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPT	OCT	NOV	DEC
Asthma	1,068	1,738,362	171,914	153,762	138,813	102,508	96,101	95,033	113,186	176,185	179,389	195,406	181,524	134,542
Other Problems	16	969,107	77,808	78,280	79,954	81,369	76,454	72,499	80,912	92,552	80,745	83,103	93,312	72,118
Post-Partum Complications	1,183	947,263	49,669	55,582	47,304	47,304	72,139	73,321	59,130	105,251	82,782	100,521	114,712	139,547
Conjunctivitus	316	2,370,632	154,208	172,220	209,192	277,448	287,560	228,784	178,224	188,336	168,428	190,864	196,236	119,132
Pre-natal consultations (a)	1,311	55,748,964												
Diarrhea	693	10,270,260	974,358	722,106	780,318	1,189,881	1,438,668	907,830	853,776	914,067	634,788	551,628	649,341	653,499
Douleurs musculaires/Cephalées	77	1,737,120	124,663	136,290	146,839	124,432	133,518	132,517	165,781	188,650	153,076	159,082	143,374	128,898
Dysentry	2,021	13,787,262	1,218,663	951,891	1,166,117	1,081,235	1,535,960	1,119,634	1,079,214	1,032,731	856,904	1,061,025	1,224,726	1,459,162
Fevers	850	32,454,700	1,773,100	1,660,050	1,540,200	1,396,550	1,365,100	2,110,550	3,834,350	5,387,300	4,057,050	3,803,750	3,445,900	2,080,800
Hematurie	248	259,904	17,112	22,568	18,600	25,048	23,808	30,008	18,352	22,320	14,880	16,368	22,072	28,768
Hypertension	2,632	13,257,384												
Skin infections	498	5,895,324	449,196	373,998	408,858	419,316	489,036	553,278	494,016	628,476	503,976	554,772	600,090	420,312
Urinary infections	2,499	20,596,758	1,489,404	1,449,420	1,751,799	1,666,833	1,894,242	1,586,865	1,789,264	2,124,150	1,684,326	1,714,314	1,944,222	1,501,899
Malnutrition	233	49,862	1,165	1,631	699	932	4,660	6,524	13,747	7,922	3,728	2,563	3,262	3,029
Miningitis	69,502	15,429,444	1,320,538	3,614,104	4,100,618	3,544,602	556,016	208,506	278,008	208,506	278,008	417,012	278,008	625,518
Otite moyenne/Angine	1,533	15,130,710	1,290,786	1,244,796	1,459,416	1,335,243	1,172,745	1,194,207	1,165,080	1,506,939	1,235,598	1,211,070	1,385,832	928,998
Measles	904	2,754,488	403,184	546,920	772,016	517,088	250,408	72,320	55,144	25,312	18,080	47,008	24,408	22,600
Tetanus (other than neonatal)	8,955	599,985	98,505	71,640	26,865	107,460	26,865	8,955	35,820	80,595	35,820	71,640	26,865	8,955
Neonatal tetanus	8,322	1,098,504	74,898	58,254	33,288	66,576	74,898	133,152	99,864	183,084	108,186	116,508	108,186	41,610
Cough of 15 days or more	217	461,125	39,928	47,523	33,635	35,371	43,617	27,776	39,277	38,626	29,512	34,069	48,391	43,400
Cough of less than 15 days	1,014	31,367,076	3,106,896	2,781,402	2,503,566	1,855,620	1,733,940	1,709,604	2,034,084	3,179,904	3,238,716	3,524,664	3,281,304	2,417,376
Trauma	416	8,428,576	654,784	584,896	726,336	837,824	791,648	713,440	671,840	697,216	624,000	654,784	789,984	681,824
Genital Ulcers	1,887	2,226,660	198,135	181,152	207,570	162,282	149,073	209,457	175,491	213,231	139,638	183,039	203,796	203,796
Urétrite Purulente (hommes)	1,254	2,738,736	258,324	226,974	231,990	242,022	248,292	249,546	220,704	211,926	199,386	200,640	231,990	216,942
Worms	106	355,312	28,514	28,726	29,362	29,786	28,090	26,606	29,680	33,920	29,574	30,528	34,238	26,394
Total Drug Cost		**240,673,517**	**13,975,753**	**15,164,185**	**16,413,354**	**15,146,730**	**12,492,838**	**11,470,412**	**13,484,964**	**17,247,199**	**14,356,590**	**14,924,358**	**15,031,774**	**11,959,118**
Number of health centers included		58	56	56	55	60	59	61	61	62	60	58	60	53
Average health center drug cost		4,119,946	249,567	270,789	298,425	252,445	211,743	188,040	221,065	278,181	239,276	257,317	250,530	225,644

Source: Rapport Mensuels d'Activités MSPAS/DSIS et Project Survie d'Enfant au Tchad

Notes: Drug treatment costs per health problem were calculated using the HSFP&M Drug Pricing Module ©

Table A5-4: Projected Net Financial Position of the Average Health Center in Moyen Chari After Expenditures on Drugs Priced at Prefectoral Pharmacy Break-Even Prices Based on a Sales Volume Equal to the Demand of 15 Health Centers

No.	Health Problem	TOTAL			JAN			FEB			MAR		
		Total Projected Revenues	Total Estimated Drug Costs	Balance	Total Revenues	Drug Costs	Balance	Total Revenues	Drug Costs	Balance	Recettes Totals	Drug Costs	Balance
1	Asthma	1,228,725	1,738,362	-509,637	121,514	171,914	-50,400	108,683	153,762	-45,079	98,117	138,813	-40,696
2	Other Problems	60,514,054	969,107	59,544,947	4,858,606	77,808	4,780,798	4,888,058	78,280	4,809,778	4,992,564	79,954	4,912,610
3	Post-Partum Complications	901,125	947,263	-46,138	47,250	49,669	-2,419	52,875	55,582	-2,707	45,000	47,304	-2,304
4	Conjunctivitus	6,829,875	2,370,632	4,459,243	444,279	154,208	290,071	496,172	172,220	323,952	602,690	209,192	393,498
5	Pre-natal consultations (a)	47,839,500	55,748,964	-7,909,464									
6	Diarrhea	9,688,950	10,270,260	-581,310	919,208	974,358	-55,150	681,234	722,106	-40,872	736,151	780,318	-44,167
7	Douleurs musculaires/Cephalées	24,496,425	1,737,120	22,759,305	1,757,966	124,663	1,633,303	1,921,927	136,290	1,785,637	2,070,686	146,839	1,923,847
8	Dysentry	5,734,800	13,787,262	-8,052,462	506,901	1,218,663	-711,762	395,938	951,891	-555,953	485,045	1,166,117	-681,072
9	Fevers	32,360,625	32,454,700	-94,075	1,767,961	1,773,100	-5,139	1,655,238	1,660,050	-4,812	1,535,735	1,540,200	-4,465
10	Hematurie	1,117,575	259,904	857,671	73,581	17,112	56,469	97,042	22,568	74,474	79,980	18,600	61,380
11	Hypertension	5,666,625	13,257,384	-7,590,759									
12	Skin infections	9,974,475	5,895,324	4,079,151	760,008	449,196	310,812	632,779	373,998	258,781	691,759	408,858	282,901
13	Urinary infections	9,033,975	20,596,758	-11,562,783	653,270	1,489,404	-836,134	635,732	1,449,420	-813,688	768,360	1,751,799	-983,439
14	Malnutrition	129,375	49,862	79,513	3,023	1,165	1,858	4,232	1,631	2,601	1,814	699	1,115
15	Miningitis	249,750	15,429,444	-15,179,694	21,375	1,320,538	-1,299,163	58,500	3,614,104	-3,555,604	66,375	4,100,618	-4,034,243
16	Otite moyenne/Angine	8,018,325	15,130,710	-7,112,385	684,035	1,290,786	-606,751	659,663	1,244,796	-585,133	773,399	1,459,416	-686,017
17	Measles	1,868,625	2,754,488	-885,863	273,517	403,184	-129,667	371,027	546,920	-175,893	523,731	772,016	-248,285
18	Tetanus (other than neonatal)	69,300	599,985	-530,685	11,378	98,505	-87,127	8,275	71,640	-63,365	3,103	26,865	-23,762
19	Neonatal tetanus	59,400	1,098,504	-1,039,104	4,050	74,898	-70,848	3,150	58,254	-55,104	1,800	33,288	-31,488
20	Cough of 15 days or more	2,254,950	461,125	1,793,825	195,252	39,928	155,324	232,393	47,523	184,870	164,479	33,635	130,844
21	Cough of less than 15 days	23,354,775	31,367,076	-8,012,301	2,313,281	3,106,896	-793,615	2,070,930	2,781,402	-710,472	1,864,063	2,503,566	-639,503
22	Trauma	20,256,975	8,428,576	11,828,399	1,573,687	654,784	918,903	1,405,721	584,896	820,825	1,745,653	726,336	1,019,317
23	Genital Ulcers	1,314,000	2,226,660	-912,660	116,924	198,135	-81,211	106,901	181,152	-74,251	122,492	207,570	-85,078
24	Uretrite Purulente (hommes)	2,457,000	2,738,736	-281,736	231,750	258,324	-26,574	203,625	226,974	-23,349	208,125	231,990	-23,865
25	Worms	3,424,050	355,312	3,068,738	274,782	28,514	246,268	276,825	28,726	248,099	282,954	29,362	253,592
	Total	**278,843,254**	**240,673,517**	**38,169,737**	**17,613,598**	**13,975,753**	**3,637,845**	**16,966,920**	**15,164,185**	**1,802,735**	**17,864,075**	**16,413,354**	**1,450,721**
	Number of health centers included			58			56			56			55
	Average total per health center	4,773,351	4,119,946	653,405	314,529	249,567	64,962	302,981	270,789	32,192	324,801	298 425	26,377

Table A5-4 Continued

No.	APR			MAY			JUN			JUL			AUG		
	Total Revenues	Drug Costs	Balance	Total Revenues	Drug Costs	Balance	Total Revenues	Drug Costs	Balance	Total Revenues	Drug Costs	Balance	Total Revenues	Drug Costs	Balance
1	72,455	102,508	-30,053	67,927	96,101	-28,174	67,172	95,033	-27,861	80,003	113,186	-33,183	124,533	176,185	-51,652
2	5,080,919	81,369	4,999,550	4,774,050	76,454	4,697,596	4,527,034	72,499	4,454,535	5,052,418	80,912	4,971,506	5,779,214	92,552	5,686,662
3	45,000	47,304	-2,304	68,625	72,139	-3,514	69,750	73,321	-3,571	56,250	59,130	-2,880	100,125	105,251	-5,126
4	799,337	277,448	521,889	828,470	287,560	540,910	659,135	228,784	430,351	513,470	178,224	335,246	542,603	188,336	354,267
5															
6	1,122,532	1,189,881	-67,349	1,357,238	1,438,668	-81,430	856,445	907,830	-51,385	805,452	853,776	-48,324	862,330	914,067	-51,737
7	1,754,708	124,432	1,630,276	1,882,837	133,518	1,749,319	1,868,721	132,517	1,736,204	2,337,802	165,781	2,172,021	2,660,294	188,650	2,471,644
8	449,739	1,081,235	-631,496	638,881	1,535,960	-897,079	465,711	1,119,634	-653,923	448,899	1,079,214	-630,315	429,563	1,032,731	-603,168
9	1,392,501	1,396,550	-4,049	1,361,143	1,365,100	-3,957	2,104,432	2,110,550	-6,118	3,823,235	3,834,350	-11,115	5,371,384	5,387,300	-15,616
10	107,706	25,048	82,658	102,373	23,808	78,565	129,033	30,008	99,025	78,913	18,352	60,561	95,975	22,320	73,655
11															
12	709,453	419,316	290,137	827,414	489,036	338,378	936,107	553,278	382,829	835,840	494,016	341,824	1,063,337	628,476	434,861
13	731,092	1,666,833	-935,741	830,836	1,894,242	-1,063,406	696,018	1,586,865	-890,847	784,801	1,789,284	-1,004,483	931,676	2,124,150	-1,192,474
14	2,418	932	1,486	12,091	4,660	7,431	16,928	6,524	10,404	35,669	13,747	21,922	20,555	7,922	12,633
15	57,375	3,544,602	-3,487,227	9,000	556,016	-547,016	3,375	208,506	-205,131	4,500	278,008	-273,508	3,375	208,506	-205,131
16	707,595	1,335,243	-627,648	621,481	1,172,745	-551,264	632,855	1,194,207	-561,352	617,419	1,165,080	-547,661	798,583	1,506,939	-708,356
17	350,789	517,088	-166,299	169,875	250,408	-80,533	49,061	72,320	-23,259	37,409	55,144	-17,735	17,171	25,312	-8,141
18	12,412	107,460	-95,048	3,103	26,865	-23,762	1,034	8,955	-7,921	4,138	35,820	-31,682	9,309	80,595	-71,286
19	3,600	66,576	-62,976	4,050	74,898	-70,848	7,200	133,152	-125,952	5,400	99,864	-94,464	9,900	183,084	-173,184
20	172,968	35,371	137,597	213,292	43,617	169,675	135,827	27,776	108,051	192,068	39,277	152,791	188,886	38,626	150,260
21	1,381,627	1,855,620	-473,993	1,291,029	1,733,940	-442,911	1,272,908	1,709,604	-436,696	1,514,504	2,034,084	-519,580	2,367,640	3,179,904	-812,264
22	2,013,600	837,824	1,175,776	1,902,622	791,648	1,110,974	1,714,660	713,440	1,001,220	1,614,679	671,840	942,839	1,675,667	697,216	978,451
23	95,766	162,282	-66,516	87,972	149,073	-61,101	123,605	209,457	-85,852	103,561	175,491	-71,930	125,832	213,231	-87,399
24	217,125	242,022	-24,897	222,750	248,292	-25,542	223,875	249,546	-25,671	198,000	220,704	-22,704	190,125	211,926	-21,801
25	287,040	29,786	257,254	270,696	28,090	242,606	256,395	26,606	229,789	286,018	29,680	256,338	326,878	33,920	292,958
Total	**17,567,757**	**15,146,730**	**2,421,027**	**17,547,755**	**12,492,838**	**5,054,917**	**16,817,281**	**11,470,412**	**5,346,869**	**19,430,448**	**13,484,964**	**5,945,484**	**23,695,255**	**17,247,199**	**6,448,056**
Number of health centers included			60			59			61			61			62
Average total per health center	292,796	252,445	40,350	297,420	211,743	85,677	275,693	188,040	87,654	318,532	221,065	97,467	382,182	278,181	104,001

Table A5-4 Continued

	SEP			OCT			NOV			DEC		
No.	Total Revenues	Drug Costs	Balance	Total Revenues	Drug Costs	Balance	Total Revenues	Drug Costs	Balance	Total Revenues	Drug Costs	Balance
1	126,798	179,389	-52,591	138,118	195,406	-57,288	128,306	181,524	-53,218	95,097	134,542	-39,445
2	5,041,967	80,745	4,961,222	5,189,226	83,103	5,106,123	5,826,716	93,312	5,733,404	4,503,283	72,118	4,431,165
3	78,750	82,782	-4,032	95,625	100,521	-4,896	109,125	114,712	-5,587	132,750	139,547	-6,797
4	485,247	168,428	316,819	549,886	190,864	359,022	565,362	196,236	369,126	343,223	119,132	224,091
5												
6	598,858	634,788	-35,930	520,405	551,628	-31,223	612,587	649,341	-36,754	616,510	653,499	-36,989
7	2,158,638	153,076	2,005,562	2,243,334	159,082	2,084,252	2,021,824	143,374	1,878,450	1,817,687	128,898	1,688,789
8	356,428	856,904	-500,476	441,332	1,061,025	-619,693	509,424	1,224,726	-715,302	606,937	1,459,162	-852,225
9	4,045,290	4,057,050	-11,760	3,792,724	3,803,750	-11,026	3,435,911	3,445,900	-9,989	2,074,765	2,080,800	-6,032
10	63,983	14,880	49,103	70,382	16,368	54,014	94,909	22,072	72,837	123,701	28,768	94,933
11												
12	852,692	503,976	348,716	938,635	554,772	383,863	1,015,311	600,090	415,221	711,139	420,312	290,827
13	738,765	1,684,326	-945,561	751,917	1,714,314	-962,397	852,759	1,944,222	-1,091,463	658,750	1,501,899	-843,149
14	9,672	3,728	5,944	6,651	2,563	4,088	8,463	3,262	5,201	7,860	3,029	4,831
15	4,500	278,008	-273,508	6,750	417,012	-410,262	4,500	278,008	-273,508	10,125	625,518	-615,393
16	654,789	1,235,598	-580,809	641,791	1,211,070	-569,279	734,403	1,385,832	-651,429	492,311	928,998	-436,687
17	12,265	18,080	-5,815	31,890	47,008	-15,118	16,558	24,408	-7,850	15,332	22,600	-7,268
18	4,138	35,820	-31,682	8,275	71,640	-63,365	3,103	26,865	-23,762	1,034	8,955	-7,921
19	5,850	108,186	-102,336	6,300	116,508	-110,208	5,850	108,186	-102,336	2,250	41,610	-39,360
20	144,317	29,512	114,805	166,601	34,069	132,532	236,637	48,391	188,246	212,231	43,400	168,831
21	2,411,430	3,238,716	-827,286	2,624,336	3,524,664	-900,328	2,443,139	3,281,304	-838,165	1,799,890	2,417,376	-617,486
22	1,499,702	624,000	875,702	1,573,687	654,784	918,903	1,898,623	789,984	1,108,639	1,638,674	681,824	956,850
23	82,403	139,638	-57,235	108,015	183,039	-75,024	120,265	203,796	-83,531	120,265	203,796	-83,531
24	178,875	199,386	-20,511	180,000	200,640	-20,640	208,125	231,990	-23,865	194,625	216,942	-22,317
25	284,997	29,574	255,423	294,190	30,528	263,662	329,943	34,238	295,705	254,352	26,394	227,958
Total	**19,840,354**	**14,356,590**	**5,483,764**	**20,380,070**	**14,924,358**	**5,455,712**	**21,181,843**	**15,031,774**	**6,150,069**	**16,432,794**	**11,959,118**	**4,473,676**
Number of health centers included			60			58			60			53
Average total per health center	330,673	239,276	91,396	351,381	257,317	94,064	353,031	250,530	102,501	310,053	225,644	84,409

Annex 6: The Derivation of a Public Sector Break-Even Pricing Rule for Pharmaceuticals Products that Satisfies Financial Sustainability and Needs-Based Distributive Equity Objectives

Public health sector pharmaceutical pricing rules that satisfy needs-based distributional equity concerns and financial sustainability can be derived by solving a constrained health planner's problem which maximizes the collective health of individuals in society subject to a requirement that the public pharmaceutical supplier (e.g., Ministry of Health Medical Supplies Division or Drug Stores) neither generate profits, nor incur deficits.

For expositional clarity, we consider here the simplified case of a single public pharmaceutical supplier that provides (and prices) two pharmaceutical products (z_1, and z_2). In order to ensure a balanced pharmaceutical supply budget, the supplier employs a break-even pricing strategy that ensures that the following zero-profit target or constraint is satisfied:

$$[1] \qquad p_1 \sum_{h=1}^{H} z_1 + p_2 \sum_{h=1}^{H} z_2 - C\left(\sum_{h=1}^{H} z_1, \sum_{h=1}^{H} z_2\right) + S = \pi = 0$$

where p_1 and p_2 are the sale prices of pharmaceutical products z_1 and z_2 respectively, C is the total recurrent cost (including annualized capital investment costs) of supplying the pharmaceutical products, S is the public subsidy (i.e., government expenditures on the supply of pharmaceuticals), and π is the profit target of the supplier which, in this case, is set equal to zero so that no financial surpluses or deficits are generated. When equation [1] is fully binding, it assures that the cost of supplying pharmaceutical products is completely covered by the government subsidy plus the user-derived revenues from the sale of the products to all H consumers.

If it is further assumed that the government stipulates that pharmaceutical pricing should promote needs-based distributive equity objectives (i.e., that the burden of pharmaceutical pricing falls more heavily on individuals deemed by health providers to be in less need of care, or what is the same, that the distribution of public subsidization of pharmaceutical consumption is pro-needy), then health planners must set prices which are consistent with maximizing the aggregate health of its population (Schwabe, 1993). In the model, the distributive equity concerns of the government are expressed in the following social welfare function:

$$[2] \qquad \mathbf{H} = \sum_{i=1}^{H} H\left[h^i\left(z_1(p_1,p_2), z_2(p_1,p_2)\right)\right]$$

where **H** represents the aggregate health of society (a proxy for societal welfare), H is the individual's contribution to aggregate societal health or welfare,[1] and $h^i(z_1(p_1,p_2), z_2(p_1,p_2))$ is the health status of the ith individual produced by the use of the two pharmaceutical products whose consumption are a function of their prices.[2]

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1 Note that H does not have a superscript for each individual. This reflects the principle of anonymity which dictates that individuals with equal health states (i.e., $h^i = h^j$), are given equal weight in the determination of social welfare. It is called the anonymity principle because individual identities (e.g., their sex, age, ethnicity, etc.) do not matter in the determination of social weights. In the context of this model, anonymity is equivalent to the public finance principle of horizontal equity which states that equals (i.e., those with equal incomes) should be treated equally.

2 For simplicity, it is assumed that H and h are both concave, H is monotonically increasing in its arguments, and that $\partial h^i / \partial z_k > 0$ at $\mathbf{z} = 0$. The monotonicity assumption with respect to H captures the public health view that societal welfare increases (or, at least, does not decrease) ceteris paribus, when the health status of any given individual increases. The concavity assumption with respect to H is a necessary condition for attaining an optimal solution to the health planner problem and reflects a bias towards equalizing health outcomes among individuals in society. As with all other goods, the concavity of $h^i(z_1, z_2)$ with respect to either z_1 or z_2 indicates that the use of health care inputs is subject to diminishing marginal productivity. In addition, note that the objective function does not include other health and non-health consumption goods.

When equations [1] and [2] are combined, the government's health planner becomes one of maximizing the following Lagrangean:

$$\text{[3]} \quad \begin{aligned} L = &\sum_h H\left[h^i\left(z_1(p_1,p_2),z_2(p_1,p_2)\right)\right] + \\ &\lambda\left[p_1\sum_h z_1^h + p_2\sum_h z_2^h - C\left(\sum_h z_1^h, \sum_h z_2^h\right) + S - \pi\right] \end{aligned}$$

which yields the following first order necessary condition for the attainment of a social optimum:

$$\text{[4]} \quad \begin{aligned} &\sum_h \frac{\partial H}{\partial h^i}\left[\left(\frac{\partial h^i}{\partial z_1}\times\frac{\partial z_1}{\partial p_1}\right)+\left(\frac{\partial h^i}{\partial z_2}\times\frac{\partial z_2}{\partial p_1}\right)\right]+ \\ &\lambda\left[p_1\sum_h\frac{\partial z_1}{\partial p_1}+\sum_h z_1 + p_2\sum_h\frac{\partial z_2}{\partial p_1} - C_1'\sum_h\frac{\partial z_1}{\partial p_1} - C_2'\sum_h\frac{\partial z_2}{\partial p_1}\right]=0 \end{aligned}$$

In order to help interpret this first order condition, it is helpful to define

$$\text{[5]} \quad \frac{\partial H}{\partial h^i}\Big/\lambda = \beta^{h^i},$$

and

Consequently, the problem is one of determining the allocation of a fixed quantity of pharmaceutical products within the economy, rather than examining the appropriate mix of health and non-health consumption. Moreover, the social welfare function makes explicit an assumption that is often implicit in health policy analyses -- namely, that health is a merit good whose consumption is valued by society independently of its contribution to individual welfare (i.e., individual utilities do not enter the objective function). Accordingly, maximizing the collective health of all individuals in society is the sine qua non for maximizing societal welfare. Finally, the social welfare function has embedded in it the public health view that societal welfare can only be maximized when the distribution of health care consumption is based on professional evaluations of health need, rather than on individual's assessments of their own welfare.

[6] $$\frac{\partial h^i}{\partial z_1} = MP_1^i,$$

where β^{h^i} is the weight society places on the health of the ith individual valued in terms of public outlays on pharmaceutical supply, and MP_1^h is the marginal productivity of pharmaceutical product z_1 on the health of the ith individual. By substituting for these two terms, and by rearranging equation [4], the first order necessary conditions can be re-expressed as follows:

[7] $$\sum_h \beta^{h^i}\left[\left(MP_1^i \times \frac{\partial z_1}{\partial p_1}\right)+\left(MP_2^i \times \frac{\partial z_2}{\partial p_1}\right)\right]-\sum_h z_1 = -\left(p_1 - C_1'\right)\sum_h \frac{\partial z_1}{\partial p_1} - \left(p_2 - C_2'\right)\sum_h \frac{\partial z_2}{\partial p_1}$$

When the right hand side of [7] is muliplied by p_1/p_1, by z_1/z_1, and by z_2/z_2, the first order conditions become:

[8]

$$\sum_h \beta^{h^i}\left[\left(MP_1^i \times \frac{\partial z_1}{\partial p_1}\right)+\left(MP_2^i \times \frac{\partial z_2}{\partial p_1}\right)\right]-\sum_h z_1 = \left(\frac{p_1 - C_1'}{p_1}\right)\sum_h\left[\left(-\frac{\partial z_1}{\partial p_1}\frac{p_1}{z_1}\right)\times z_1^h\right]+\left(\frac{p_2 - C_2'}{p_1}\right)\sum_h\left[\left(-\frac{\partial z_2}{\partial p_1}\frac{p_1}{z_2}\right)\times z_2^h\right]$$

where $-\left(\partial z_1/\partial p_1\right)\left(p_1/z_1\right) = \varepsilon_{11}^h$ is the own price elasticity of demand for pharmaceutical product 1, and $-\left(\partial z_2/\partial p_1\right)\left(p_1/z_2\right) = \varepsilon_2^h$ is the cross-price elasticity of demand for product 2 with respect to a change in the price of product 1.

Finally, it is helpful to make the further simplifying assumption that the demand for product 1 is independent of the price of product 2 (i.e., that $\varepsilon_2^h = 0$) in order to be able to focus on the direct effects of an increase in p_1.

$$[9] \qquad \left(\frac{p_1 - C_1'}{p_1}\right) = \frac{\sum_h \left[\beta^{h^i} \times \left(MP_1^i \times \frac{\partial z_1}{\partial p_1}\right)\right] - \sum_h z_1^h}{\sum_h \left(\varepsilon_{11}^h \times z_1^h\right)}$$

Equation [9] is a pharmaceutical pricing rule which incorporates the needs-based public health distributive equity concern that the burden of pharmaceutical pricing should fall less heavily on individuals deemed to be in the greatest need of consuming publicly supplied care. More specifically, it reveals that the twin objectives of financial sustainability and needs-based equity can be achieved if pharmaceutical price levels are set in proportion to the price-induced change in social benefits (the numerator of equation [9]), and inversely to their own price elasticity of demand (the denominator of equation [9]).

The denominator of [9] indicates that the more elastic the demand for a given pharmaceutical product (i.e., the greater ε_{11}^h), the lower the break-even price should be.

The needs-based equity component of the pricing rule is contained in the term $\sum_h \left[\beta^{h^i} \times \left(MP_1^i \times \frac{\partial z_1}{\partial p_1}\right)\right]$ which reflects the weight society places on the health of each individual, β^{h^i}, and the marginal health gains or losses (MP_1^i) resulting from a price-induced change in the utilization of pharmaceutical product z_1, $\left(\partial z_1 / \partial p_1\right)$. More specifically, this term reveals that if society places greater weight on the treatment of individuals in greater need of care, then, holding the individual's ability to benefit from drug consumption constant, drugs used to treat the neediest patients should have a lower break-even price <u>relative to their marginal cost</u> than drugs used to treat less needy patients.[3]

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[3] This result can be readily derived from the social welfare function specified in equation [2]. Because of the concacity of H, if $h_1 < h_2$ (i.e., individual 1 is less healthy or more needy than individual 2), then $\partial H / \partial h_1 > \partial H / \partial h_2$. Since $\left(\partial z_1 / \partial p_1\right)$ is negative, the

Finally, when the weight society places on the health of its population is held constant, equation [9] reveals that break-even prices should be set inversely to a drugs effectiveness. In other words, prices for more effective drugs should be set lower than for less effective drugs relative to their marginal cost. Need-based equity will thus be improved if the most effective drugs are subsidized either through direct public expenditures (S), or through a cross-subsidization arrangement where the revenues lost by lowering the price of more effective drugs are recouped by increasing the break-even price charged for less effective drugs.

To summarize, a pharmaceutical pricing rule that satisfies financial sustainability and needs-based distributive equity concerns requires pharmaceutical prices to be set at a level that are:

1. inversely proportional to the price elasticity of demand for the product;
2. inversely proportional to the aggregate level of health need of the patients treated by the drug; and,
3. inversely proportional to the treatment efficacy of the product.

---

more needy the drug recipients are, the greater $\sum_h \beta^{h^i}$ becomes, thus increasing the absolute value of the numerator of equation [9], which requires p_1 to fall to make the absolute value of the left hand side of equation [2] increase.