

AFFORDABILITY, COST-EFFECTIVENESS AND EFFICIENCY OF PRIMARY HEALTH CARE: THE BAMAKO INITIATIVE EXPERIENCE IN BENIN AND GUINEA

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SUMMARY

Since 1986 two West African countries, Benin and Guinea, have been actively reorganizing their peripheral health systems according to strategies subsequently called the "Bamako Initiative". Two preceding articles described the strategies implemented and the increased effectiveness of primary health care (PHC) witnessed over a period of six years. This article presents an analysis of cost and coverage data from biannual monitoring sessions between 1988 and 1993 in approximately 200 health centres in Benin and 214 in Guinea.

In order to assess affordability, the total and per capita recurrent costs for operational health centres are analysed and then compared. The cost analysis reveals a mean total cost per health centre per year of slightly over US\$11,000 in Benin and nearly US\$9,000 in Guinea. The median cost per capita per year is approximately US\$1.0 in Benin and between US\$0.60 and US\$0.80 in Guinea. Comparisons of these costs between regions, health centres and over time (as coverage levels evolved) show very little variation in either country.

Cost-effectiveness is estimated by allocating these costs to immunization, antenatal and curative care and comparing them to the coverage achieved with these interventions. First, the cost-effectiveness of the Bamako Initiative (BI) system as a whole is analysed. The cost per fully vaccinated child is calculated at US\$10.9 in Benin and US\$8.8 in Guinea. The cost per woman receiving at least three antenatal visits is US\$7 in Benin and US\$4.7 in Guinea. For curative care, cost per full treatment is US\$1.6 in Benin and half this amount in Guinea. Cost-effectiveness is variable between regions, health centres and over time. An analysis of the characteristics of the most and least cost-effective centres reveals that these differences in cost-effectiveness are mainly caused by the coverage levels achieved, since total costs are relatively stable.

Finally the efficiency of drug management and prescriptions as well as of outreach for the expanded programme of immunizations (EPI) is estimated by relating specific drug and outreach costs to the number of beneficiaries. The average cost of drugs per treatment is around US\$0.5 in Benin and around US\$0.3 in Guinea. Cost analysis of outreach activities undertaken for EPI in Guinea revealed a similar average cost per child completely vaccinated for health centres with different intensities of outreach (approximately US\$10) and an additional cost per child vaccinated attributable to outreach of US\$1-2. ©1997 by John Wiley & Sons, Ltd.

INTERNATIONAL JOURNAL OF HEALTH PLANNING AND
MANAGEMENT 12: 000-000, 1997

No. of Figures: 5, No. of Tables: 10, No. of References: 22

CCC 0749-6753/97/S10S81-29\$17.50

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INTRODUCTION

Since 1986 Benin and Guinea have taken on the task of reorganizing their peripheral health systems. The objective is to improve health systems performance despite their former decline due to inefficient management and economic crisis. In these two countries, national programmes revitalized the existing health centre network in order to improve the effectiveness and efficiency of health services, while ensuring sustainability and establishing equity mechanisms.¹ This revitalization was based on a set of strategies that later became known as the “Bamako Initiative”.²⁻⁴

Six years after the initiation of these strategies in Benin and Guinea, basic preventive and curative health services are functional again. An integrated minimum care package of preventive and curative activities is offered at the periphery including EPI and antenatal care (ANC). Geographical access, as well as continuity and quality of care has been improved.

These two countries are now among the best performers for immunization coverage in west and central Africa (85% for DPT3 by the first birthday in 1994 in Benin and 75% in Guinea).^{5,6}

These achievements took place in a context of severely constrained resources in these two very poor countries (Benin's GNP is US\$310, and Guinea's is US\$300). In 1986, both public and private resources were scarce in Benin and Guinea. In Benin for example, the government health budget came to only US\$2.50 per capita per year. This was topped up by US\$3 per person per year of household health expenditures (as measured in surveys⁷).

In this context, to ensure sustainable universal access to most essential care for the majority of the population, and to offer the best services at an affordable price, strong attention needed to be given to minimizing the costs of the preventive and curative care delivered.

In revitalizing the health systems of both countries, the BI programmes took increased efficiency rather than reduced costs as their priority. One of the main aims of such a revitalization was to maximize the outputs in terms of coverage of the population with essential care while optimizing the use of available resources.

Strategies were accordingly designed to improve the three main dimensions of efficiency:

- allocative efficiency (choice of the most cost-effective interventions in health) was improved by focusing on a minimum package of health care activities known to have a maximum impact on health status at low cost (EPI, oral rehydration therapy, control of acute respiratory infections, malaria treatment, etc.).
- technical efficiency was improved by systematically minimizing the resources used for an optimal quality output: clear job descriptions were designed; flow charts for curative care were established;
- cost efficiency (lowest unit cost of resources used for a given output) was also improved by e.g. the selection of low cost procurement systems of

essential generic drugs, management tools, vaccines and essential equipment.

The BI programmes initiated by the Ministries of Health in Benin and Guinea, built on the experience of pilot projects (Pahou project, GTZ and Swiss Cooperation projects in Benin). They also learned from their own experience, through a regularly conducted monitoring process at the periphery.

This article on the Benin and Guinea experience examines the results obtained by the BI programmes of Benin and Guinea in terms of affordability, cost-effectiveness and efficiency of PHC. First, it assesses the level of local operating costs incurred by BI programmes at health centre level on a national scale, the variation of these costs between regions and health centres, over time, and in function of the coverage achieved.

Next, the cost-effectiveness of the different interventions provided by the health centres is analysed for the national BI systems as a whole, by region and over time. In order to understand the underlying factors determining the cost-effectiveness of these programmes, key characteristics of the most cost-effective and least cost-effective centres are compared. Finally the efficiency of drug management and prescriptions as well as of outreach for EPI is estimated by relating specific drug and outreach costs to the number of beneficiaries.

METHODOLOGY AND DATA

Indicators

For affordability, this analysis examines the local operating costs of health centres offering a basic package of essential health care. Average local operating costs per health centre per year and average local operating costs of health centre per capita per year are presented for both countries.

Local operating costs include salary costs for the health personnel in health centres, incentives and performance bonuses to these personnel, essential drugs, vaccines, operating costs for cold chain and outreach activities, maintenance costs for buildings and equipment, as well as depreciation of equipment and transport. Costs for direct district support to health centres such as supervision and monitoring costs (for gas and per diems) are also taken into account including ongoing refresher training. However, salaries and other functioning costs of district level are not included. Costs to initiate the programme, including training activities as well as depreciation of buildings and costs incurred at central and provincial level such as costs of salaries in the Ministry of Health are not included.

Beyond the straightforward examination of overall operating costs per health centre or per capita, specific costs were allocated to individual programme components and activities in order to obtain overall costs per intervention. This allows comparisons of costs to coverage levels achieved with these interventions.

This analysis thus attempts to relate the costs incurred to the performance of the system. Some cost-effectiveness aspects such as the cost per target fully covered by an intervention are examined. The impact and cost of EPI in African countries has been often assessed.⁸ Simple ratios between drug costs and number of patients treated, or between the costs of vaccinations and the number of children completely vaccinated are also presented in many studies.⁹ However, the costs of integrated PHC services providing a minimum care package in relation to a set of operational objectives, such as coverage are rarely studied. The total cost of three interventions (immunizations, antenatal and curative care) is related to the number of target units (children, women, or patients) effectively covered by them, giving a final cost per target-unit covered.

For efficiency, the average costs of drugs per full treatment and the cost of outreach per additional child vaccinated are estimated.

Data sources

The cost analysis is based on collection of real cost data when available and estimations when necessary. Methods to determine the costs of each input are described in Tables 1a and 1b.

Real costs data were obtained from regular monitoring sessions at the periphery. Monitoring sessions were conducted every six months in each health centre in both countries with the participation of the health staff, the district medical officer and representatives of the community. Regular assessment of the evolution of different costs (drugs, transport, supplies, salaries, cold chain, maintenance, replacement of equipment) and simple indicators such as the ratio between drug costs and number of patients treated are calculated during these sessions.

In Benin, the stability of the FCFA between 1988 and 1993 kept the unit cost of drugs, vaccines, and depreciation constant. Salaries were frozen over the period analysed. In Guinea, on the other hand, salaries in Guinean Franc (GF) were increased following a devaluation of the local currency in 1990. The costs of petrol, drugs and depreciation of equipment also increased regularly due to currency depreciation and inflation.

Coverage data are used as a measure of effectiveness. During local monitoring sessions, in addition to cost data, coverage data are collected in each health centre. Indicators used to measure these determinants are displayed in a previous article of this series.⁶ Estimates of the target population are based on regularly updated local census data.

All the monitoring data were entered at central level into Reflex[®] in Benin, and Lotus[®] in Guinea, from the reports sent by health centres every six months. Data were transferred into EpiInfo[®] for the purpose of this analysis.

Analysis

The health centre networks include about 400 health centres in Benin, and 350 in Guinea. Under the leadership of the Ministry of Health, all health

centres in Benin were reorganized, 200 with UNICEF assistance (from which data are presented here) and the others with support of other agencies. In Guinea, 256 health centres were reorganized by 1994. This analysis presents the costs (affordability), cost-effectiveness and efficiency data for about 200 health

Table 1a: Health centre operating costs in Benin (in FCFA).

Type of Cost	Amount per year
Salaries	calculated in function of average salary × number of staff members (includes benefits)
Incentives	real, calculated in function of EPI, ANC, curative care utilization
Drugs + management tools	real consumption × cost of replacement of drugs/tools
Vaccines	total amount for the country, distributed among the health centres in function of their target population and EPI coverage rate
Immunization material	18 000 if population < 10 000 30 000 if population > 10 000
Cold chain maintenance	48 000 (based on a consumption of 40 litres kerosene per month)
Outreach strategy	in function of improvements in access and of density of population in different regions
Maintenance health centre	60 000 if population < 10 000 120 000 if population ≥ 10 000
Supervision, monitoring	156 000: average cost for gasoline, per diem
Equipment depreciation	\$2400: motorbike, refrigerator, MCH material

Table 1b: Health centre operating costs in Guinea (in GF).

Type of Cost	Amount per year
Salaries	average salary* × number of personnel
Incentives	1989: staff number × 15 000 1990–93: real
Drugs + management tools	real consumption† × cost of replacement of drugs/tools
Vaccines	total amount for the country, distributed among the health centres in function of their target population and EPI coverage rate
Immunization material	100 000
Cold chain maintenance‡	based on a consumption of 40 litres kerosene per month
Outreach strategy§	– in function of improvements in access and of density of population – real costs as of 1992
Maintenance health centre	100 000
Supervision, monitoring	US\$550
Equipment depreciation¶	US\$2400: motorbike, refrigerator, equipment

*Salaries: including salary increase in 1991.

†Drugs: depreciation of GF included.

‡Kerosene cold chain: inflation included.

§Petrol outreach: inflation included.

¶Depreciation: taking into account depreciation of the GF.

centres in Benin and 214 in Guinea included in the national BI programmes up to 1993.

As interventions were offered as a fully integrated package, the analysis of cost-effectiveness required a specific approach, different from the one used in the costing of vertical programmes. Costs must be clearly and easily attributed to specific interventions. For this purpose a methodology developed by the Department of International Health at the Johns Hopkins University was used. The functional analysis methodology¹⁰ permits the detailed costing of various service packages. This methodology groups health activities and interventions into "functions" which act as links between health needs, health services and health resources. These functions represent activities that have similar goals or service target units.

The cost analysis of the Benin and Guinea data is based on allocation between the three key functions for health centres. These functions are: EPI (including both childhood vaccinations and tetanus toxoid), antenatal care (ANC) and curative care. Deliveries and chronic disease treatment (tuberculosis) are included in the curative care intervention as they essentially require a reactive response from the health centre staff whereas EPI and ANC are more actively promoted. The distribution of costs used for the purpose of this paper was developed and field-tested in Benin in 1983 (Pahou Development Project). It is based on work sampling conducted by Miller,¹¹ and was adapted for use by the national programme.

Costs are allocated somewhat differently in the two countries. Since 1988 in Guinea outreach strategies were conducted for both ANC and EPI. The costs of outreach were accordingly divided between the two interventions. In Benin, outreach costs were attributed only to EPI until 1992 when ANC was included in outreach activities. The proportion of time allocated to different interventions was estimated to be about the same in the two countries. Table 2 describes the allocation procedures used.

Analysis of costs and affordability. Three analyses are presented:

- the average operating costs per health centre for each country, broken down by cost item for the two countries in 1993.
- the variation of these costs between regions and in function of the size of the health centre (as one possible explanation of variation between regions).
- the evolution of these operating costs between 1989 and 1993, i.e. as coverage levels evolved.

Cost-effectiveness of key interventions. Three analyses are presented:

- the analysis of the costs in relationship to coverage as a reflection of the cost-effectiveness. Average health centre cost per target covered for EPI,

Table 2: Allocation of local costs for three interventions: EPI, ANC and curative care in Benin and Guinea.

Type of costs	Benin			Guinea		
	EPI	ANC	Curative	EPI	ANC	Curative
Salaries	30%	20%	50%	30%	20%	50%
Incentives	according to coverage			33%	33%	33%
Drugs + management tools	—	malaria prophylaxis + iron supplement	100%-ANC		malaria prophylaxis + iron supplement	100%-ANC
Vaccines	100%			100%		
Maintenance of cold chain	100%			100%		
Cold chain functioning	100%			100%		
Outreach strategy	100% up to 1992 50% in 1993	50% in 1993		50%	50%	
Supervision, monitoring	33%	33%	33%	33%	33%	33%
Maintenance/ other costs	33%	33%	33%	33%	33%	33%
Equipment depreciation	84%	8%	8%	60%	30%	10%

ANC and curative care in 1993 will be shown. Total costs for all health centres and for each intervention divided by the total number of targets covered, as a reflection of the cost-effectiveness of the entire system, will also be shown.*

- the variation of the overall cost-effectiveness between regions.
- the evolution of cost-effectiveness over time between 1989 and 1993. For this longitudinal analysis, we used the median cost per target covered.

Efficiency of outreach for EPI and of drug use. Three analyses are presented:

- the comparison of the cost of outreach and cost per target covered for EPI between health centres with different levels of outreach. This helps to assess the impact of the outreach strategy on the cost-effectiveness of EPI.
- an estimate for Guinea of the additional cost per child vaccinated through the outreach strategy to reflect the efficiency of outreach.
- the average drug cost per curative treatment as well as its variation between health centres in the two countries, reflecting the efficiency of drug use.

*If the number of health centres is n and $Cepix$ = Cost of EPI in health centre x , and if $Tepix$ = number of Targets (children under one) fully vaccinated, then average cost of EPI = $(Cepi1 + Cepi2 + \dots + Cepin) / (Tepi1 + Tepi2 + \dots + Tepin)$.

Determinants of costs and cost-effectiveness. Health centres with the most cost-effective interventions and health centres with the least cost-effective interventions are compared according to their performance in order to identify characteristics which differentiate them. For this purpose, two subsets of health centres have been considered according to their performance in 1993. The group of "best performing centres" includes the 25% of health centres with the lowest cost per target (i.e. highest cost-effectiveness). The group of "worst performing centres" includes the 25% of health centres with the highest cost per target (i.e. lowest cost-effectiveness). This grouping was completed for two interventions: EPI and curative care. The analysis of ANC data, yielding results very similar to those of EPI, is not presented here.

First, the best and worst health centres are compared in terms of their structural characteristics: region, size of the total target population and of the population living within 5 km etc. They are also compared in terms of total costs; different cost items, especially the costs of outreach; and of efficiency in drug use. Finally, they are compared in terms of the coverage achieved.

Subsequently, the evolution of the cost-effectiveness between 1989 and 1993 of a cohort of "best performing centres" in 1993 is compared to that of a cohort of "worst performing centres".

RESULTS

Health centre local operating costs

Total costs per centre and breakdown of cost items. The average operating costs per year and per health centre in Benin in 1993 amounted to US\$11,327 and cost per capita is slightly under US\$1.0. These costs reflect the operating costs of an average health centre, in which the number of first curative care visits per episode is 0.24 per capita per year, the proportion of pregnant women benefiting from at least three antenatal visits is 43% and the proportion of children under one fully immunized is 58%.

As shown in Figure 1, salaries are the main component of these costs (53% for salaries + additional staff). Other fixed costs are equipment depreciation (11%), health centre maintenance, cold chain (4%) and supervision and monitoring (4%). These fixed costs amount to 72% of total costs. The costs of drugs and management tools represent 15% of total costs. The cost of outreach is quite low, near US\$130 (less than 2%) per health centre per year. The remaining 11% are attributed to vaccines and incentives to health staff.

In Guinea, the mean cost per health centre per year in 1993 amounts to US\$8989. The average cost per capita, is between US\$0.6 and 0.8. These costs correspond to a curative care performance of 0.34 first curative visits per capita per year. Antenatal care reaches 55% of pregnant women with at least three visits. For EPI, 63% of children are fully immunized before the age of one. Salary and incentive costs are lower than in Benin. This difference is mainly due to the depreciation of the Guinean Franc in recent years vis-à-vis the US\$.

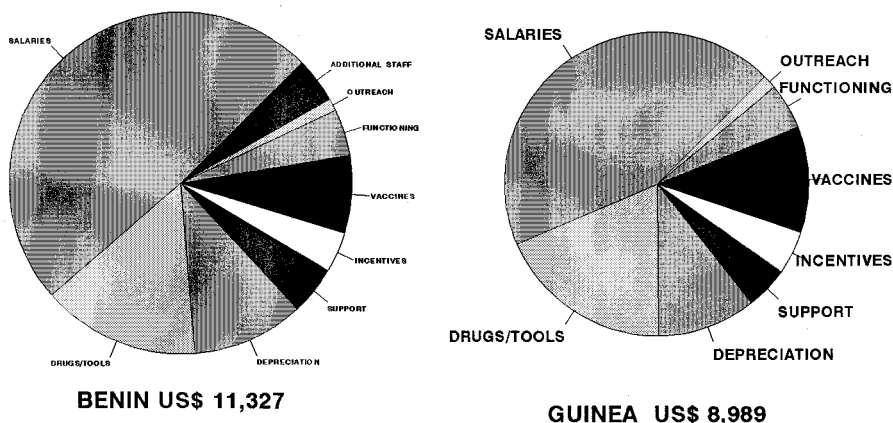


Fig. 1. Average local operating costs per year per health centre 1993.

Salaries represent 44% of the total costs, costs of investment 11%, monitoring and supervision 5%, and health centre maintenance and running costs plus cold chain 5%. Drugs and management tools account for 19% of total costs. Outreach costs (1%) are similar to Benin (\$133 per year) (Figure 1). Real costs of outreach when obtainable, are usually lower than estimated costs based on access and population density. Vaccines and incentives account for the remainder (15%).

Variation of average costs between regions and influence of the size of the health centre population on costs. Annual operating costs of health centres are lower in the northern regions of Benin (Borgou and Atakora) where target areas are less populated. However, the breakdown between different cost items is comparable between regions.

The breakdown between different cost items is also quite similar between regions in Guinea. The total costs per health centre in Moyenne Guinée due to fewer staff and lower drug consumption (associated with lower utilization of curative care in this region as compared to Guinée Forestière).

Total local operating costs increased somewhat with the size of the target population. In Benin (Figure 2a), salary costs accounted for most of the difference, reflecting the severe understaffing of the "small" health centres in the sparsely populated north of the country. In Guinea (Figure 2b), the same increase was also linked to an increase in drug and vaccine costs used in much larger quantities in large centres.

However, the median cost per capita decreased with the size of the target population. This essentially reflects a gain in efficiency in larger centres due to economies of scale (fixed costs being divided by a larger number of users). This improved efficiency exists despite increases in variable costs and lower rates of utilization of curative services in larger health centres.

Evolution of operating costs, 1989–1993. In Benin, costs and coverage data are available for each year for at least 75% of the health centres between 1989 and 1993. Average operating costs per health centre and cost per capita were rather similar throughout the evolution of the BI programme (Figure 3a). Salaries

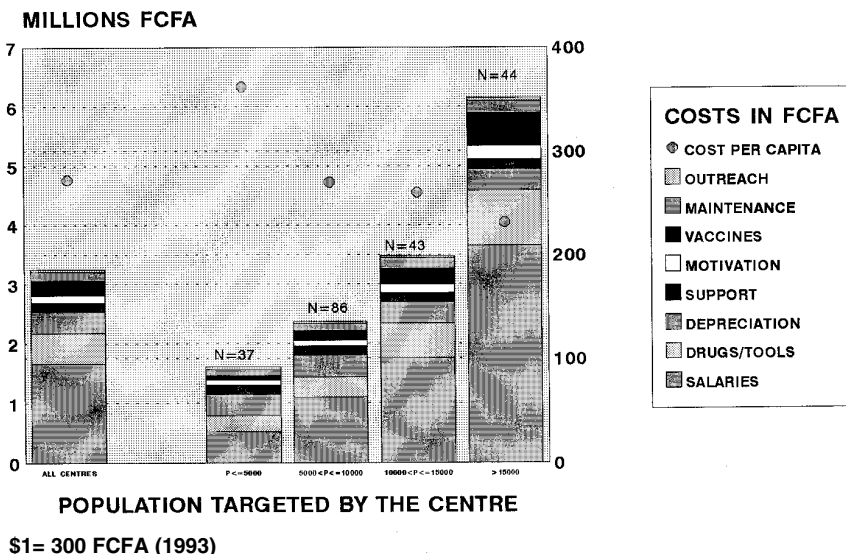


Fig. 2a. Total costs (mean) per year per health centre and cost per capita per year (median) in function of the size of the centre, Benin 1993. (US\$1 = 300 FCFA [1993].)

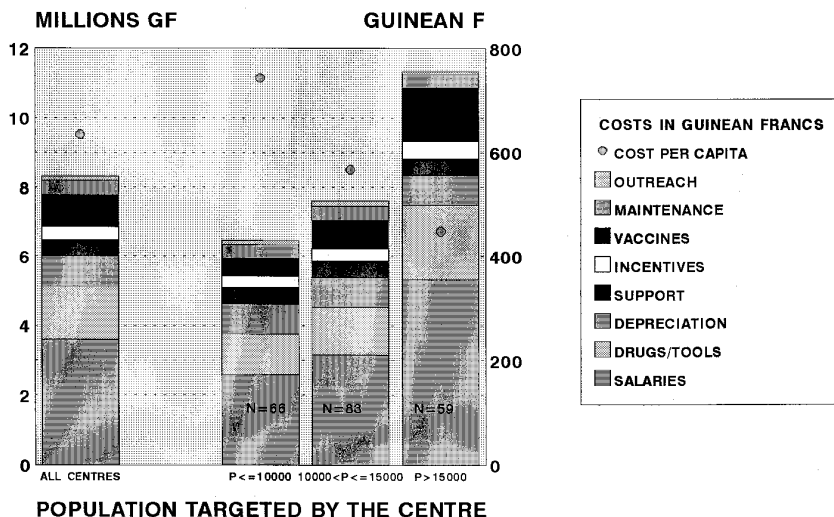


Fig. 2b. Total costs (mean) per year per health centre and cost per capita per year (median) in function of the size of the centre, Guinea 1993. (US\$1 = 913 GF [1993].)

were practically stable. As a result, fixed costs only increased slightly with the hiring of a few additional auxiliary staff.

UNIPAC procurement and UNICEF distribution support kept drug prices stable over most of the period concerned. Coverage with curative care

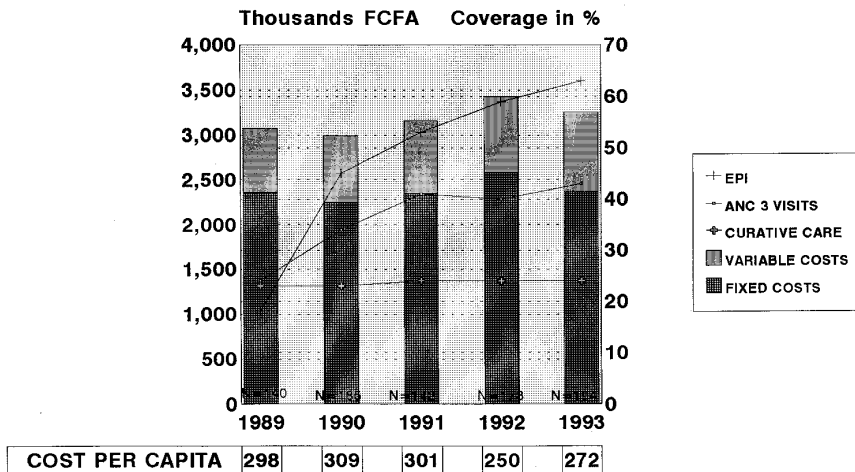


Fig. 3a. Evolution of average operating costs per year per health centre in FCFA (US\$1 = 300 FCFA) and coverage with 3 main interventions (EPI, antenatal care, curative care), Benin 1988–1993. (EPI: % of children less than one fully immunized. ANC: % of pregnant women having benefited from 3 antenatal visits. CURATIVE CARE: number of first visit per 100 inhabitants.)

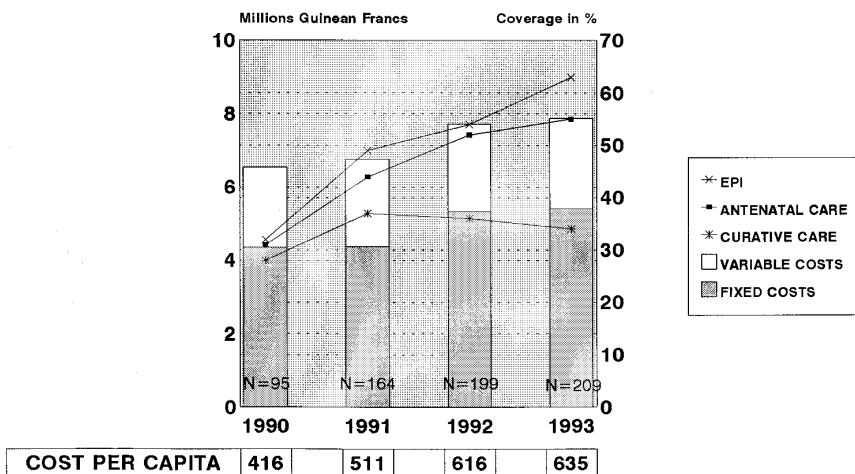


Fig. 3b. Evolution of average operating costs per health centre per year in Guinean Francs (1989 US\$1 = 440 FG; 1993 US\$ = 913 FG) and coverage with 3 main interventions (EPI, ANC, curative care), Guinea 1990–1993. (EPI: % of children less than one fully immunized. ANC: % of pregnant women having benefited from 3 antenatal visits. CURATIVE CARE: number of first visit per 100 inhabitants.)

Table 3: Average local operating costs per health centre and cost per local inhabitant in Benin and Guinea per year, 1993 (US\$).

	Benin		Guinea	
	Variation between regions	National average	Variation between regions	National average
Number of health centres	21–50	200	44–67	209
Salaries	4295–7034	5544	2920–4845	3952
Drugs/tools	1171–2315	1680	1257–2291	1677
Depreciation (equipment and transport)	1200	1200	945	945
Support	520	520	405	405
Incentives	252–536	430	354–493	420
Vaccines	652–1068	842	858–1242	1019
Functioning of cold chain/maintenance	432–570	493	385–608	438
Outreach	94–152	131	79–303	133
Additional staff	163–651	487	—	—
Total operating costs per health centre per year	9087–13 916	11 327	7223–10 159	8989
Cost per capita	0.90–1.05	0.9	0.6–0.82	0.7
Number of first curative visit per capita per year (mean)	0.21–0.36	0.24	0.26–0.50	0.34
% of pregnant women having benefited from at least 3 antenatal visits	21%–61%	43%	36%–65%	55%
% of children less than one fully immunized	45%–69%	58%	58%–68%	63%

remained around 0.24 first visit per capita per year. Coverage with preventive care increased over the same period. Variable costs (drugs and management tools, vaccines, incentives) increased only slightly despite the increase in vaccine costs.

In 1993, the average operating cost of health centres, with an average preventive care coverage of 58% for EPI and 43% for ANC, are not much higher than they were in 1989 where preventive care coverages were only respectively 18% for EPI and 24% for ANC.

In Guinea, health centres were included progressively in the BI programme. Between 1989 and 1993, the programme grew from 18 to 214 health centres. The average operating cost per health centre per year has increased along the evolution of the programme (Figure 3b). The steep increase of the cost per capita is explained by the fact that health centres included as of 1991 had smaller target populations. Salary increases following the devaluation and depreciation of the GF explains the progression of the fixed costs in local

currency. The local currency devalued by more than 100% between 1988 and 1993. In real terms these costs decreased variable costs (drugs and management tools, vaccines) also increased with the depreciation of the GF. However, the proportion of variable costs compared to total operating costs increased slightly over time reflecting an increase in coverage with the three main interventions.

Variation of cost per intervention in function of coverage. In Benin, the average local operating costs of each intervention are not much higher in centres with very high coverage than in those with poor coverage (Table 4a). This suggests major gains in cost-effectiveness with the increase in coverage. The findings reflect the fact that costs of the preventive interventions are mainly fixed and that increasing coverage does generate only small amounts of additional costs. In addition, centres with low coverage are often centres with low baseline access, requiring more intensive outreach and therefore additional petrol costs.

In Guinea (Table 4b), on the other hand, local operating costs were higher in centres with better coverage.

ESTIMATES OF COST-EFFECTIVENESS: COST PER TARGET FULLY COVERED

Cost per EPI target covered in 1993

For the overall BI programme the cost per child fully immunized before the age of one amounts to US\$10.9 (3 266 F CFA) in Benin (for 200 health centres) and US\$8.8 (8 065 FG) in Guinea (for 209 health centres). The cost difference between Guinea and Benin can be explained by much lower salary costs in Guinea and the depreciation of the GF which makes all local costs (such as incentives, costs of supervision and monitoring) appear lower in US\$ terms.*

Cost per ANC target covered in 1993. The cost per woman benefiting from at least three antenatal visits is estimated at US\$7.0 (2 088 F CFA) in Benin and US\$4.7 (4 360 GF) in Guinea. These women received a full prophylaxis for malaria and anaemia.

Cost per curative care target covered in 1993. For curative care, the cost per full treatment in Benin is US\$1.6 (495 F CFA). The average cost per full treatment in Guinea is US\$0.8 (713 GF), about half that in Benin. This is accounted for by the difference in salary and incentive costs.

Variation of cost-effectiveness between regions and health centres. In Benin (Table 5) the median cost per fully vaccinated child among 200 health centres is US\$7.0 and the mean is US\$9.6. Seventy-five per cent of health centers display a cost per vaccinated child lower than US\$11. The last quarter of centres has a

*One US\$ was worth 440 FG in 1987, 672 in 1991, 850 in 1992, 913 in 1993 and 967 in 1994.

Table 4a: Average cost per intervention per health centre in function of coverage, Benin 1993, in FCFA.

Interventions		Coverage of the target population with the intervention				KW Test* <i>p</i>
		0–25%	25–50%	50–75%	>75%	
Cost of EPI	Number of centres	<i>N</i> = 27	<i>N</i> = 49	<i>N</i> = 53	<i>N</i> = 72	
	Total/year per capita	658 750 44	474 749 49	552 233 50	455 778 53	NS† <0.001
Cost of ANC	Number of centres	<i>N</i> = 66	<i>N</i> = 48	<i>N</i> = 43	<i>N</i> = 34	
	Total/year per capita	223 426 18	248 980 20	230 527 23	266 022 27	NS <0.001
Cost of curative care	Number of centres	<i>N</i> = 111	<i>N</i> = 68	<i>N</i> = 23	<i>N</i> = 8	
	Total/year per capita	671 378 50	647 649 67	634 647 86	405 957 120	NS <0.001

*Kruskal–Wallis analysis of variance. †NS not statistically significant.

EPI adequate coverage: % of children completely vaccinated before their first birthday observing intervals and minimum age.

ANC adequate coverage: % of pregnant women having at least 3 antenatal visits with required schedule.

Curative care utilization: % of new patients registered.

very high cost per child immunized. These centres are responsible for raising the average cost for the country to US\$10.9. The median cost per pregnant woman having benefited from three antenatal visits for all centres is US\$6.8, while the mean is US\$13.0. For 75% of the health centres, the cost of antenatal care is less than US\$12 per woman receiving full coverage. The cost of a full curative treatment varies between a minimum of US\$0.5 and a maximum of US\$14.

Regional differences account for a large part of this variation. In the south (Atlantique, Oueme, Mono) and centre (Zou), the costs per target covered in health centres are on average lower for EPI and antenatal care ($p < 0.01$) than in the north (Borgou, Atakora).

In Guinea, the median cost per fully vaccinated child is slightly under US\$10, while the mean is US\$15. For 50% of the health centres, this cost lies between US\$7.4 and US\$27.4, a larger range of variation than in Benin. Cost per woman receiving full antenatal care lies between US\$4.1 and US\$9.2 for 50% of the health centres. The average cost per full curative treatment varies between a minimum of US\$0.3 and a maximum of US\$9.4.

The coastal and forest regions have significantly lower costs per target covered than the upper and central regions. This can be explained by their good results in terms of coverage, even though the two former regions had significantly higher total costs than the latter.

Table 4b: Average cost per intervention per health centre in function of coverage, Guinea, 1993, in GF.

Interventions		Coverage of the target population with the intervention				KW Test* <i>p</i>
		0–25%	25–50%	50–75%	>75%	
Cost of EPI	Number of centres	<i>N</i> = 20	<i>N</i> = 43	<i>N</i> = 69	<i>N</i> = 73	
	Total/year per capita	1080 275 95	1202 160 111	1495 029 120	1938 433 148	<0.001 <0.001
Cost of ANC	Number of centres	<i>N</i> = 35	<i>N</i> = 69	<i>N</i> = 56	<i>N</i> = 45	
	Total/year per capita	546 575 47	719 204 57	779 665 66	1024 141 84	<0.001 <0.001
Cost of curative care	Number of centres	<i>N</i> = 75	<i>N</i> = 90	<i>N</i> = 31	<i>N</i> = 10	
	Total/year per capita	1151 173 82	1667 617 129	2126 332 187	2497 996 281	<0.001 <0.001

*Kruskal–Wallis analysis of variance.

EPI effective coverage: lower of:

– target population received DPT3 at the right age and before first birthday.

– target population received measles vaccine at correct age and before first birthday with vaccines stored at a correct temperature.

ANC effective coverage: % of pregnant women having made at least 3 antenatal visits with one made during the 9th month and effectively followed up: height, pregnancy history and 3 months Fe/folic acid.

Curative care effective coverage: % of first visits registered that received treatments, paid correct for and treated according to flow charts.

Table 5: Average and median costs per covered target, Benin and Guinea, 1993.

	Benin		Guinea	
	Regional variations	National average	Regional variations	National average
Number of centres	19–44	187	44–67	209
EPI cost per child fully vaccinated				
Mean	\$6–\$15	\$9.2	\$12–\$17	\$9.2
median	\$5–\$10	\$6.7	\$8.5–\$11	\$6.7
ANC cost per woman having 3 visits				
Mean	\$5.5–\$22.5	\$13	\$5.9–\$15.5	\$13
median	\$5.1–\$11	\$6.8	\$4.5–\$8	\$6.8
Cost per full curative treatment				
Mean	\$1.5–\$2.8	\$2	\$0.8–\$1	\$2
median	\$1.4–\$1.9	\$1.5	\$0.7–\$0.9	\$1.5

Evolution of cost-effectiveness over time. Over time in Benin (Figure 4a), the cost per target covered for EPI and ANC diminished considerably and significantly between 1988 and 1993. The increase in EPI and antenatal care coverage thus greatly improved the cost-effectiveness of the system. The cost per full curative treatment remained stable over time as did curative care utilization.

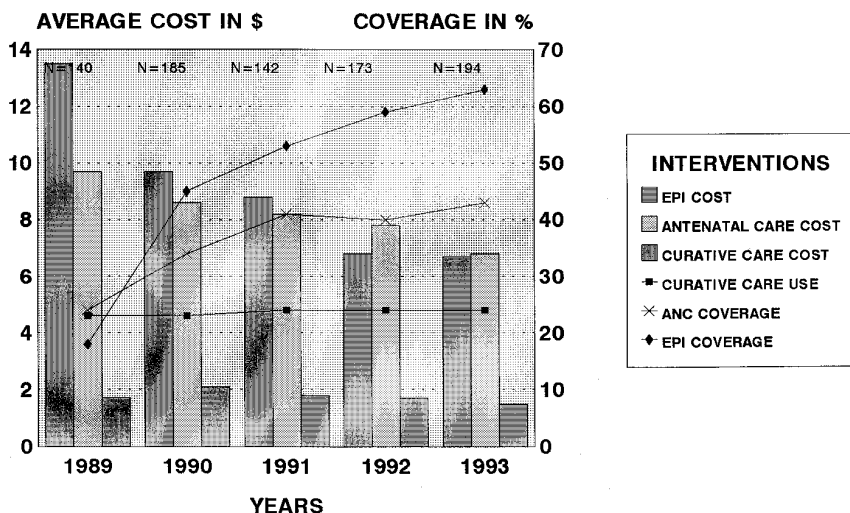


Fig. 4a. Evolution of average cost (median) per person effectively covered, Benin 1989–1993. (EPI: % children fully vaccinated before 1 (BCG, DPT3, measles). ANC: % women with 3 prenatal visits (chloroquine + iron). Curative care: % of new patients.)

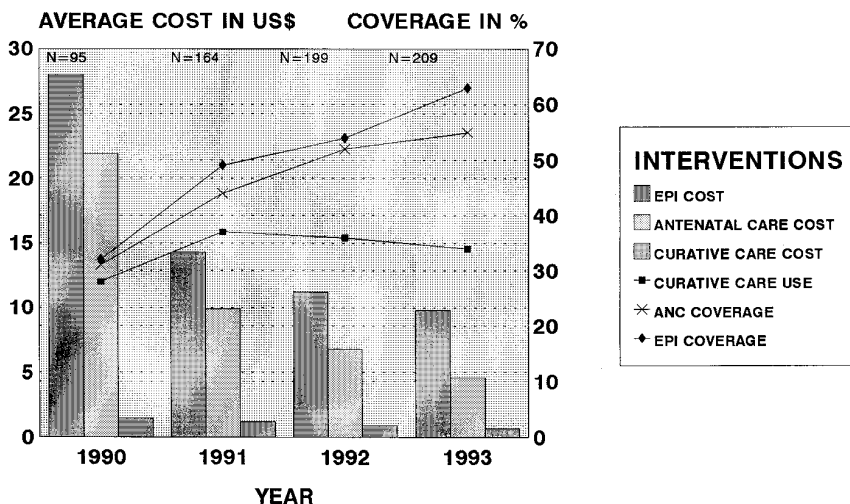


Fig. 4b: Evolution of average cost per person effectively covered, Guinea 1989–1993. (EPI: % of children fully vaccinated before 1 year. PNC: % of pregnant women with 3 prenatal visits (+ chloroquine and iron). Curative care: number of first visits per 100 inhabitants.)

In the same way in Guinea (Figure 4b), the cost per target covered (EPI and ANC) decreased over time. The steep decrease is partially due to the depreciation of the local currency. However, this decrease is also observed if cost per target is examined in GF. EPI and ANC reflect major gains in efficiency due to important increases in coverage. For curative care, the cost per target covered, that decreases in US\$, has in fact increased in GF reflecting the increased cost of drugs.

Efficiency of EPI outreach and of drug use

Cost-effectiveness of EPI outreach. As seen above, the recurrent cost of outreach is very low on average in both countries (less than US\$200 per health centre per year), whether calculated theoretically, or when real figures are available. However, this cost varies logically in function of intensity of outreach sessions. Health centres with different levels of outreach are compared for 1991 in both countries. In 1991 there was a large number of centres not implementing outreach despite low access. They can be compared with centres engaging in outreach activities. In 1993, almost all health centres in Guinea and a large majority in Benin were implementing this strategy.

In Benin, the cost of outreach varied from US\$120 in centres where 25% or less of access was due to outreach, to more than \$1000 in the nine centres where outreach enhanced access by more than 50% (Table 6a). The average cost per child fully vaccinated remains the same for health centres without outreach and centres with outreach enhancing access by 25% or less. The cost per child vaccinated then increases for further levels of outreach but remains reasonable due to increased coverage related to improved access.

In Guinea (Table 6b) on the other hand, the cost per vaccinated child is lower in health centres with high level of outreach. This illustrates the good performance of the outreach strategy in terms of cost-effectiveness.

Efficiency of outreach. The additional cost per child vaccinated through the outreach reflects the efficiency of outreach. Although it is impossible to determine exactly which children are fully vaccinated due to outreach activities, the figure was roughly estimated for Guinea in 1991. Since 33% of children were fully immunized in the centres with no outreach where baseline access is 46%, we assumed that approximately 2/3 of the children with access to fixed health centres are effectively covered by those health centres. Additional EPI coverage has been attributed to outreach. Calculating the average number of children per health centre immunized through outreach every six months for each of the above groups of health centres and dividing by the cost of outreach, reveals an additional cost per child immunized through outreach of less than US\$1 in the group that increased access by less than 25% and US\$1.5 in the group that increased access by more than 50%.

Efficiency of drug use. The combination of the supply of essential generic drugs and of diagnostic and therapeutic flowcharts resulted in very cheap prescriptions.

Both in Benin and in Guinea average costs of drugs remained well below US\$1, even in the most "expensive" health centres. These average costs did not increase significantly over time as can be seen in Table 8. In Guinea the effect of the devaluation was in fact artificially counterbalanced by a temporary price freeze of the drugs sold to the health centres by the BI project.

Table 6a: Impact of outreach on cost-effectiveness of EPI: cost per child fully vaccinated in function of level of outreach, Benin 1991.

	<i>p</i>	No outreach	Outreach improves access by 0–25%	Outreach improves access by 25%–50%	Outreach improves access by more than 50%
Number of centres		98	43	23	9
Cost per child vaccinated	<i>p</i> < 0.05	M: US\$12 m*: US\$9	M: US\$11 m: US\$9	M: US\$15 m: US\$13	M: US\$22 m: US\$14
Cost of outreach every six months/hc	<i>p</i> < 0.05	0	US\$61	US\$283	US\$508
EPI effective coverage (mean)		55%	63%	53%	49%
Accessibility to EPI (mean) [†]		94%	93%	97%	99%
Baseline accessibility (mean) [†]		94%	80%	60%	38%

* M = mean. m = median.

[†] baseline accessibility = accessibility to health centre.

accessibility to EPI = accessibility to health centre or to outreach sessions (less than 2 km to an outreach post in which there is an outreach session every 2 months).

Table 6b: Impact of outreach on cost-effectiveness of EPI: cost per child fully vaccinated in function of level of outreach, Guinea 1991.

	No outreach	Outreach improves access by 0–25%	Outreach improves access by 25–50%	Outreach improves access by more than 50%
Number of health centres	36	35	60	40
Cost of child fully vaccinated	M: US\$21 m: US\$15	US\$15 US\$9.5	US\$11 US\$9	US\$12 US\$8
Cost of outreach every six months	0	US\$26	US\$75	US\$147
EPI effective coverage	33%	48%	53%	58%
Accessibility to EPI	46%	63%	76%	90%
Baseline accessibility	46%	50%	37%	26%
Number additional children effectively covered by outreach/ every six months	0	30	70	100
Outreach cost/child additional covered	0	< \$1	\$1	\$1.5

Table 7: Average cost of drugs per curative case, Benin 1993 and Guinea 1992 in US.

	Benin		Guinea	
	Regional variation	National average	Regional variation	National average
Number of health centres	17–50	206	41–63	199
Cost of drugs per case	0.44–0.65	0.49	0.26–0.30	0.56
Drug costs at 25 percentile	0.31–0.47	0.35	0.22–0.24	0.23
Drug costs at 75 percentile	0.48–0.86	0.56	0.29–0.35	0.32

Determinants of cost-effectiveness

We will first look at the determinants of cost-effectiveness by relating costs and coverage and then by looking at the evolution of these two parameters over time.

Costs per target covered. For two interventions, EPI and curative care, a comparison was conducted between health centres with lowest “best” and highest “worst” average cost per target unit effectively covered in 1993. Results for ANC were similar to those of EPI and have thus not been included here.

Comparison of costs between “best” and “worst” performing centres in terms of average cost for target unit

□ *For EPI*

In Benin (Table 9a) total average operating costs per health centre and per capita were somewhat higher in the health centres for which cost-effectiveness of EPI was best. Intervention costs of EPI are similar in the two groups. Therefore low cost-effectiveness in the poorest performing group as measured by cost per target fully covered cannot be explained by higher costs in these centres. The size of the target population of health centres also does not affect the efficiency of EPI.

In Guinea (Table 9b) the health centres with most cost-effective EPI interventions have on average significantly higher operating costs than centres with least cost-effective EPI. Per capita costs are slightly lower in best

Table 8: Evolution of average drug cost per case in two cohorts of health centres, Benin and Guinea 1989–1993.

Cohort	1989	1990	1991	1991	1992	1993
Benin (cohort of 96 centres)	134 FCFA	126	122	134	131	145
Guinea (cohort of 80 centres)	not available	212 GF	268	233	213	not available

Table 9a: Comparison of most cost-effective health centres (centres with low cost per target) and less cost-effective centres (centres with high cost per target) for EPI and curative care.

	Status of health centres regarding cost-effectiveness of EPI			Status of Health centres regarding cost-effectiveness of curative care		
	Best <US\$ 4.8	Worst >US\$11.2	KW	Best <US\$ 1.2	Worst >US\$ 2.1	KW
Benin 1993						
Number of health centres	47	47		52	53	
Total costs every six months per health centre (mean)	\$ 5815	\$ 5203	$p < 0.05$	\$ 3854	\$ 6236	$p < 0.0$
Cost per capita	\$ 0.99	\$ 0.94	$p < 0.05$	\$ 1.11	\$ 0.8	$p < 0.01$
Cost per intervention	\$ 1836	\$ 1845	NS	\$ 1674	\$ 2576	$p < 0.0$
Average cost per target (mean)	\$ 3.99	\$ 18.6	$p < 0.001$	\$ 0.92	\$ 3.9	$p < 0.01$
Average drug cost per case				106	187	
Adequate coverage (mean)	93%	30%	$p < 0.00$			
Utilization (mean)	109%	47%	$p < 0.001$	54	11	$p < 0.01$
Accessibility (mean)	97%	93%	NS	86	80	
Availability (mean)	99%	97%	NS			
Target population (mean)	12 244	13 438	NS	7343	16 715	$p < 0.01$

performing centres as compared to worst performing because centres with low cost per child fully immunized have a significantly larger population on average.

□ *For curative care*

In Benin health centres with most cost-effective curative care (lowest cost per full curative treatment) have lower operating costs but significantly smaller target populations than health centres with least cost-effective curative care.

In Guinea for curative care the size of the population targeted by the centre is not very different in health centres with high cost-effectiveness and centres with low cost-effectiveness.

Comparison of coverage between “best” and “worst” health centres

□ *For EPI*

In Benin, availability of resources and accessibility to EPI are quite similar between health centres with the best and worst cost-effectiveness ratio.

Table 9b: Comparison of most cost-effective health centres (centres with low cost per target) and less cost-effective centres (centres with high cost per target) for EPI and curative care.

Guinea 1993	Status of health centres regarding cost-effectiveness of EPI			Status of health centres regarding cost-effectiveness of curative care		
	Best <US\$7.4	Worst US\$134	KW	Best <US\$0.66	Worst >US\$ 1	KW
Number of health centres	52	52		51	51	
Total costs every six months per health centre (mean)	\$ 5739	\$ 3506	$p < 0.001$	\$ 4428	\$ 3990	NS
Cost per capita (mean)	\$ 0.57	\$ 0.73	$p < 0.001$	\$ 0.67	\$ 0.7	NS
Cost per intervention	\$ 2244	\$ 1747	$p < 0.001$	\$ 1722	\$ 1493	NS
Average cost per target (mean)	\$ 6.1	\$ 33	$p < 0.01$	\$ 0.56	\$ 1.5	$p < 0.001$
Adequate coverage (mean)	85%	30%		43%	18%	
Utilization (mean)	92%	47%		48%	21%	
Accessibility (mean)	77%	57%		39%	36%	
Availability (mean)	92%	92%		95%	97%	
Target population (mean)	19 774	10 325	$p < 0.001$	13 994	12 381	NS

However, utilization and adequate coverage (fully vaccinated) are quite different between the two groups. Best performing health centres have on average a significantly higher coverage than worst performing centres.

In Guinea, beyond the size of health centres, the most important difference between the two groups is accessibility to the services. Centres with worst cost-effectiveness display on average lower accessibility and consequently lower utilization and coverage.

□ *For curative care*

In Benin, centres with a large population and lower access are in general less effective in raising curative care utilization and therefore have a lower cost-effectiveness. In Guinea, utilization of curative care appears as the major factor influencing cost-effectiveness of curative care.

Evolution of coverage and cost. In both countries, the number of centres already functioning during the first year under study is highest in the group of 1993

best performing centres. This points to the importance of the time factor in improving the cost-effectiveness of interventions. We therefore studied the evolution over time of the cost for target covered. Out of the cohort of 96 health centres having been functioning since 1989 in Benin and 80 centres

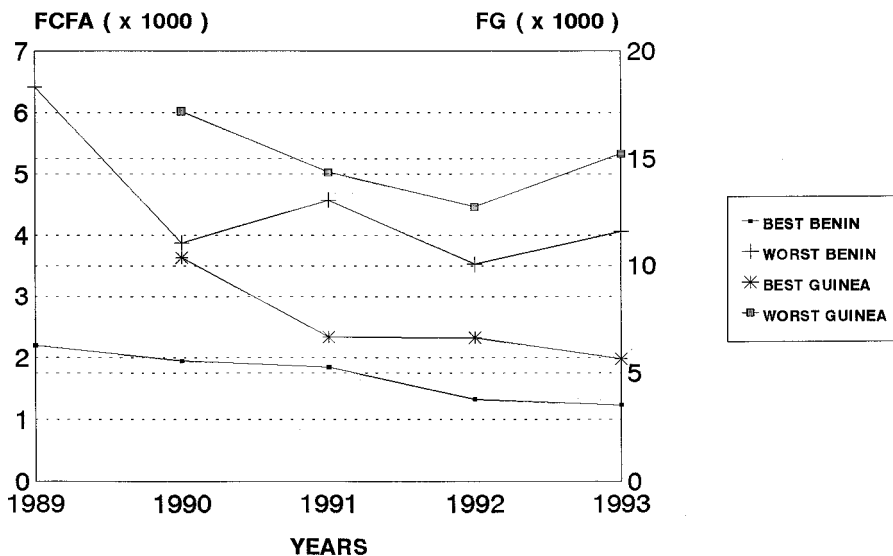


Fig. 5a. Evolution of median cost per fully immunized EPI target for best and worst centres, Benin 1989–1993 (FCFA) and Guinea 1990–1993 (GF).

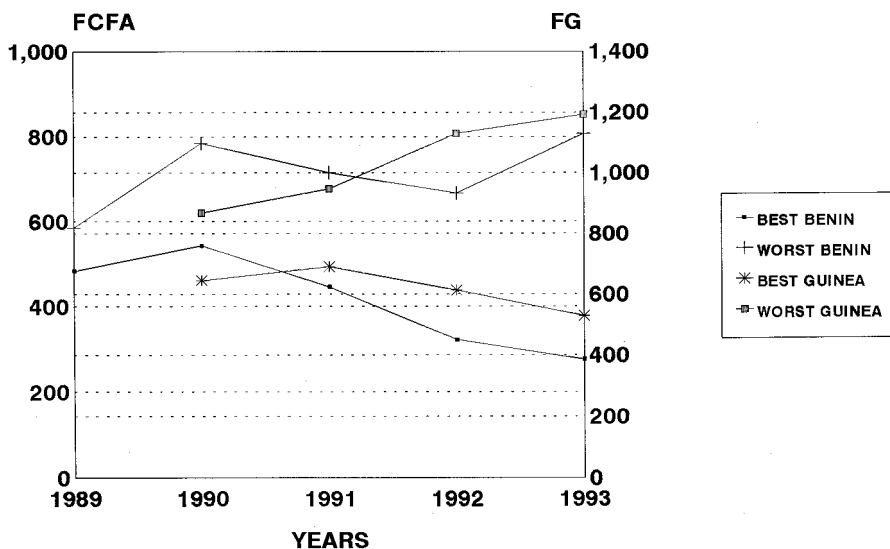


Fig. 5b. Evolution of median cost per curative case for best and worst centres, Benin 1989–1993 (FCFA) and Guinea 1990–1993 (GF).

having been functioning since 1990 in Guinea, two groups corresponding to the first and last quartile of the distribution of the cost-effectiveness ratios in 1993 were defined.

During the first year of the observation period and in both countries, the cost per child fully vaccinated is already lower in the best performing group of centres, some of them already functioning for one year. This cost continues to decrease overtime in all centres (Figure 5a) and there is a continuing difference between the two groups.

For curative care, the cost is initially similar in best and worst performing groups in both countries. Cost per curative case increases over time in the worst group but decreases in the best quartile over a period of 5 years (Figure 5b).

DISCUSSION

The findings

Affordability. In 1993 in the national BI programmes of Benin and Guinea, the average operating cost per health centre was around US\$10 000. In both countries, the cost per capita is slightly under US\$1 per capita per year. This average cost represents the local costs of a health centre providing a minimum health care package of services to the population. The health centres achieve on average about 0.3 first curative visits per capita per year, cover about half of pregnant women with antenatal care and fully immunize more than 60% of children under one.

The costs are significantly lower in Guinea than in Benin due to lower salaries and lower incentives (in Guinea, incentives are fixed and have not been increased since 1989 despite a high inflation rate). Both countries show relatively little variation in costs between regions.

Over a period of five years (1989–1993), average operating costs of health centres remained relatively stable. Meanwhile preventive coverage increased dramatically in both countries and curative care coverage remained stable in Benin and rose slightly in Guinea. Fixed costs (salaries, depreciation of material and transport etc.) represent the majority of local operating costs. Variable costs increased only slightly.

Strategies chosen for EPI from the beginning of the programme are responsible for the stability of the costs of this intervention. After the initial implementation of outreach for EPI at the beginning of the programme, further increases in coverage did not raise costs further. The cost of vaccines increase only slightly with increasing coverage. From the very beginning of the programme the national strategy in both countries was to open a vial of each antigen every weekday (if at least one child came to the health centre) and for each outreach session. This explains the high initial vaccine consumption and its later stabilization, as vaccines were better used with increased utilization and adequate coverage. For curative care, both utilization and costs remained stable over time.

Cost-effectiveness. Dramatic increases in coverage for EPI associated with slight increases in costs have allowed improvements in cost-effectiveness of preventive care over time in both countries. Increased utilization and continuity related to stable availability and access explain the gains in cost-effectiveness over time. The cost per target covered is relatively low. This cost does not include the support costs at central level. However, if central level costs are included, the cost per child fully immunized remains under US\$10. For curative care, the cost per full treatment in Benin is US\$1.65, similar to that in the Pahou pilot project.

Regular monitoring of costs has allowed inter-centre and inter-region comparisons and detection of centres which display higher costs than others (such as high drug cost per case or high cost of outreach). Centres with costs deviating significantly from average were thoroughly supervised and corrective actions implemented.

In both countries, cost-effectiveness of the interventions is essentially linked to the capacity of the health centres to achieve high effective coverage. Variations in the total costs of the interventions have a negligible effect. In Guinea, best performing centres in terms of cost-effectiveness are centres with a higher access on average which explains higher utilization and coverage with the services.⁶ In general, the most cost-effective health centres are those which manage to increase coverage rather than those which reduce costs drastically. Differences in cost effectiveness between best and worst performing centres remain high because of continuing differences in coverage performance.

Efficiency. Outreach proved a very cost-effective and efficient strategy for EPI coverage, even in areas with dispersed population requiring extensive outreach efforts.

The rationalization of drug procurement and use in the context of the BI has led to very low average drug costs per full treatment (approximately US\$0.5) with relatively little variation between health centres.

Validity of data

Cost and coverage data used in this analysis were extracted from routine data collected through the biannual monitoring process in both countries. The quality of data collected routinely is therefore carefully examined. In practice, some problems were detected for the five years period used for this study. For example, manipulations of coverage data were detected in some health centres during the supervision process.

In a study conducted in Benin, it was shown that the monitoring data were in general accurate enough to base decisions upon their analysis.¹² A comparison was made, for the purpose of this study, between monitoring coverage data and survey data. The results were presented and discussed in an earlier article. A centre by centre comparison was not possible but comparisons by region showed reasonably good agreement.⁶

Real cost data correspond to financial monitoring established every six months by health centres. They are carefully checked during supervision activities. The combined cost of salaries and cost of incentives reflect the costs incurred by the system for rewarding the work of the health personnel. However, these costs are to some extent artificial. Low incentive levels have led health care providers to undermine the system for increased personal benefits. An external evaluation conducted in 1992 found that in some health centres in Guinea, unofficial rates were even three times as high as the official ones.¹³ A study conducted in Guinée Forestière¹⁴ has shown that the amount paid by users is on average 50% higher than the official price. Solutions to this problem are currently being examined by the managers of the programme.

Comparison with other African countries

Other studies of local operating costs of functional health centres have been carried out in African countries. The Kasongo project team launched the challenge of PHC for less than US\$1 per capita per year.¹⁵ In 1994, the World Bank¹⁶ estimated the cost of a minimum care package at health centre level for low income countries at US\$4.6 per capita per year, including public health programmes (EPI+; information, education and communication; school health; alcohol and tobacco abuse prevention; and AIDS prevention) and clinical services (for integrated child care; tuberculosis chemotherapy; antenatal and delivery care; family planning; STD treatment; basic curative services). According to the World Bank, this amount could cover the health centre system running costs, including support costs.

Data presented in Table 10 were collected in BI programmes in seven countries with large scale programmes, and reflect the costs of average

Table 10: Health centre operating costs per capita and per year within the Bamako Initiative in some African countries, 1989–1990 (US\$).

Country (ref)	Population per centre	Total cost per capita in \$	Governmental salary per capita	Other operating costs per capita	Drug cost per capita
Benin	11 000	1.0	0.49	0.36	0.15
Guinea	13 600	0.7	0.31	0.26	0.13
Guinea-Bissau ¹⁷	7800	0.6	0.26	0.13	0.22
Mali ¹⁸	(rural) 10 000	1.3	0.45	0.45	0.40
	(urban) 15 000	2.5	0.86	0.83	0.81
Senegal ^{19*}	9000	1.11	0.61	0.25	0.25
Zaire ²⁰	5500	0.28	0.15	0.03	0.10
Cameroon ²¹	4600				0.10

*Data based on analysis of three health centres in BI project in Matam and Podor districts: most health centres in these two districts with a total population of 400 000 are implementing similar community financing systems in 1991/1992.

government health centres in West and Central Africa. The evidence shows that integrated PHC of acceptable quality can be delivered by health centres for around US\$1 to 2 per person per year (local operating costs). This figure is lower than the World Bank estimates but consistent with the results of this study. This is not surprising as the World Bank cost estimates per health centre include two parts. On the one hand the costs of the “more basic” components of the minimum care package as offered in Benin and Guinea, are based on cost data from real integrated PHC programmes. On the other hand, the costs of health/nutrition promotion and communicable disease control have been calculated by attributing the costs of national programmes for these problems to health centres. This adds another US\$2 per capita per year, which is a significant overestimate compared to fully integrated programmes, as demonstrated by a recent cost analysis of the Guinea-Bissau BI programme that has integrated these components at a much lower cost (Table 10). Over half of this amount is accounted for by salaries. Without depreciation and vaccine costs, the remaining—non salary—local operating costs amount to less than half a dollar per person per year.

It is difficult to compare this cost-effectiveness data with other contexts since data from this study depends on the allocation of fixed common costs to the different interventions. Since in the context of Benin and Guinea three main interventions were offered, adding any additional intervention such as family planning or health promotion would very likely result in immediate gains of cost-effectiveness through economies of scope.

Figures of cost-effectiveness in the literature were found essentially for EPI. Former publications have shown that routine services through fixed facilities had lower cost per fully immunized child than immunization campaigns, with comparable and better sustained results.

Figures of cost-effectiveness of Benin and Guinea are in the lower range of the figures available for other West African countries. Figures of cost-effectiveness must however be compared with caution. In systems offering an integrated package they depend on the mode of allocation of common costs, in particular of salaries which represent the largest cost item.

CONCLUSION

Over six years of implementation, the BI programmes in Benin and Guinea have demonstrated their ability to raise preventive and curative coverage with key primary health care interventions while keeping the costs of the health system low. By implementing low cost strategies and rationalizing resource management, costs of a functioning health system have remained affordable, within the limits of existing expenditures on health by both the Ministry of Health and households. Along with the findings of smaller scale projects, this large scale experience confirms that a full minimum care package can be offered for less than US\$2 per capita per year. Summary indicators of cost-effectiveness also show improvement over time in the two countries studied.

This experience also confirms that the additional costs of obtaining high EPI coverage are minimal with an integrated approach, once the strategies to raise coverage are in place. Increased coverage for EPI and ANC over time certainly play a major role in explaining the improvements in cost-effectiveness in both Benin and Guinea.

Several challenges remain for the future. The devaluation of the FCFA in 1994 means that drug costs have doubled in FCFA terms. Keeping the cost of the system to a minimum has been the key prerequisite to the implementation of a cofinancing scheme where fees are affordable for the users. The results of the implementation of the cost sharing scheme are presented in the next article.²²

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