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COST AND FINANCING OF EPI

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Other technical reports in this series are available from REACH and include the following:
Computerized EPI Information Systems (CEIS)
Urban EPI
Missed Opportunities for Immunization
Acceptability of Immunization
Neonatal Tetanus

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ACRONYMS

A.I.D.	(United States) Agency for International Development
ANE	Asia/Near East Bureau of A.I.D.
ARI	Acute Respiratory Infection
CIE	Centre International de l'Enfance (International Children's Center, Paris, France)
CMC	Christian Medical College of Vellore, India
EPI	Expanded Program on Immunization
FIC	Fully Immunized Child
GDP	Gross Domestic Product
PAHO	Pan American Health Organization
REACH	Resources for Child Health
UCI	Universal Childhood Immunization
UNICEF	United Nations Children's Fund
WHO	World Health Organization

EXECUTIVE SUMMARY

This is one of a series of technical papers prepared as part of an internal assessment of the activities carried out by the Resources for Child Health (REACH) Project. It concerns the cost and financing of national immunization programs.

The World Health Organization led the field in the development of the Expanded Program on Immunization (EPI) *Costing Guidelines* in 1979. Subsequent field studies have used these guidelines as a reference for costing methodologies. The Pan American Health Organization, the United Nations Children's Fund, and other institutions have created manuals and conducted cost and cost-effectiveness studies of EPI since the early 1980s.

The role of the REACH Project in this field has been to further understand the costs and financing patterns of EPI and to promote policy dialogue concerning sustainability of programs. Under the REACH Project, 10 additional cost-effectiveness studies have been undertaken. The results from these and earlier studies have been reviewed and analyzed by REACH, which found that the cost per fully immunized child is near $15 and that governments are financing 55% of routine immunization programs. These figures were used by REACH to predict the total EPI annual cost ($104 million) of achieving Universal Childhood Immunization (UCI) by the year 2000.

Donors have encouraged program managers and EPI staff to use tools for cost and cost-effectiveness analysis for program management. The hope is to integrate cost evaluation into ongoing monitoring and evaluation activities and to create demand for using financial and economic information in the EPI. Cost-effectiveness studies have been conducted primarily, however, to satisfy the interest of donor organizations. Although many studies attempt to identify areas where EPI management can be improved using study results, the actual use of study results has been limited.

At a recent meeting in Paris at the International Children's Center, the use and utility of cost-effectiveness studies were discussed among EPI program managers, donor representatives and technical agencies. The major finding of this meeting was that the usefulness of cost and cost-effectiveness studies has been limited by the lack of coordination in study design with the EPI and a focus on non-priority operational issues of the EPI. In the future, it will be important to conduct economic and financial studies in such a way as to orient study objectives toward the management priorities of country programs, and to integrate cost evaluations into ongoing routine evaluations and monitoring of the EPI.

This paper highlights some of the salient lessons learned from five years of the REACH Project as well as outlines priorities for donors in the future.

INTRODUCTION

This paper concerns the cost and financing of national immunization programs. It first describes the extent of knowledge of the Expanded Program on Immunization (EPI) costs prior to the inception of the Resources for Child Health (REACH) Project. REACH activities are reviewed in the following section, and the lessons learned from REACH studies and activities are also summarized. The paper concludes with a discussion on the financial sustainability of immunization programs.

ROLE OF COST AND FINANCING STUDIES OF THE EPI

Economic evaluations of health programs, such as cost-benefit and cost-effectiveness studies, have been conducted since the 1960s (Mills, 1985). Both techniques are applied to health to aid resource allocation decisions between programs in situations where resources are limited. Cost-benefit analysis expedites comparisons among several health programs with differing objectives; whereas, cost-effectiveness analysis is concerned with comparisons of different ways of achieving the same objective. For cost-benefit analysis, both cost and benefits are measured in monetary terms. In the case where improved health status is difficult to measure and quantify in dollar terms, cost-effectiveness analysis is a more useful and understandable tool. As such, economic evaluations of the EPI have primarily utilized cost-effectiveness methodology.

Table 1 provides an illustration of some of the types of evaluations which can be conducted using economic and financial analysis, as well as their potential uses. Cost and cost-effectiveness analysis can be used for planning and budgeting, management and budget execution, and evaluation of health programs. Cost and cost-effectiveness analysis can specifically help decision-makers to choose among alternative strategies, plan program financing and lobby for additional public sector or donor resources, determine future costs and annual resource requirements, and improve management and efficiency of service delivery.

The first cost-effectiveness studies of immunization programs were conducted in the late 1970s and early 1980s to investigate program costs (Barnum et al., 1980; Creese et al., 1982; Creese, 1984; Makinen, 1980; Ponnighaus, 1980; Shepard et al., 1987; WHO, 1981; WHO, 1982a, b). At the 1984 Bellagio Conference on immunizing the world's children, the results of these early cost-effectiveness studies were used to convince donor organizations of the cost-worthiness of the EPI so that they would contribute to the worldwide effort to improve immunization coverage. The results of these initial studies suggested that it cost between $5 and $15 to fully immunize a child (Bellagio Conference Report, 1984). Since EPI was thought to be one of the most cost-effective means of reducing childhood deaths and illness, the first purpose of cost-effectiveness studies of EPI was to seek additional financial support for the program from donor organizations.

With the advent of acceleration programs and strategies for increasing immunization coverage at any cost, cost-effectiveness studies shifted focus to examine the cost-efficiency of different types of EPI strategies (Berman, 1987; Brenzel, 1986; Brenzel, 1987a, b; Brenzel et al., 1987; Brenzel et al., 1988; Brenzel, 1989; Creese et al., 1987a, b; de Champeaux, 1987; Hartman et al., 1986; Qualls, 1985; Robertson, 1985; Robertson et al., 1985a, b; Shepard et al., 1987; Turner, 1987). While in theory, choices about which strategy to pursue could be determined on the basis

Table 1
Uses and Objectives of Cost and Cost-effectiveness Studies of EPI

PURPOSE	OBJECTIVE	TYPE OF ANALYSIS	CLIENT
Planning	1. To choose among alternative strategies	CE Study	Donor MOH Manager
	2. To plan future financing of the program	Cost Study	Donor MOH Manager
	3. To determine future costs of expanding the program	Cost Study	Donor MOH Manager
	4. To lobby more effectively for resources from donors or ministries of health	CE Study Cost Study	MOH Manager Donor
Management	1. To describe the type, quantity and distribution of resources for a program	Cost Study	Manager Donor
	2. To estimate annual resource requirements	Cost Study	Manager Donor
	3. To monitor expenditures and resource use over time	Cost Study	Manager
	4. To improve management and efficiency	Cost Study	Manager
Evaluation	1. To determine the least costly strategy for achieving desired health objectives	CE Study	Donor MOH Manager
	2. To assess methods to maximize health gains given a level of resources	CE Study	Donor MOH Manager

CE = Cost-effectiveness MOH = Ministry of Health

NB: This table presents the role of cost and cost-effectiveness studies for planning, management and evaluation of health programs. It must be noted that other types of studies and analyses may also serve these objectives.

of cost-effectiveness studies, in practice, cost-effectiveness study results were used to reveal how donor resources were being used by the EPI and to justify continued donor support to country programs.

Studies which compare the cost-effectiveness of different strategies rarely result in different resource allocation patterns from one mode of operation to another. Immunization strategies may not always represent true alternatives, since choices cannot always be made among them. For instance, mobile strategies may serve a remote population, while routine strategies are designed for urban dwellers (Brenzel, 1986; Brenzel et al., 1990).

The costing part of cost-effectiveness analysis helped extend the role of cost-effectiveness studies to examine efficiency issues. Cost evaluation identified areas where costs could be reduced through better management and monitoring. Program managers and EPI staff have been encouraged by the World Health Organization (WHO), the United Nations Children's Fund (UNICEF) and the United States Agency for International Development (A.I.D.) to use tools for cost and cost-effectiveness analysis for program management. The hope is to integrate cost evaluation into ongoing monitoring and evaluation activities and to create demand for using financial and economic information in the EPI.

Recently, cost-effectiveness studies have been used to evaluate programs using alternative technologies, such as injectable polio vaccine and solar cold chain equipment. These studies aim to determine the cost implications of new technologies for the EPI: an area which will become of greater importance as new vaccines and equipment are developed for the program (de Chapeaux, 1987; Brenzel et al., draft).

The results of cost-effectiveness studies showing the expense of fully immunizing a child through different strategies have been useful in discussions about long-term financing and sustainability of EPI.

CONTRIBUTIONS MADE BY OTHER ORGANIZATIONS

Prior to the establishment of the REACH Project in 1985, significant efforts had been made in this technical area by other agencies and academic institutions which continue to play a vital role in the present time. WHO pioneered work in the area of costing and financing of immunization programs in the late 1970s through development of the *EPI Costing Guidelines*. This methodology was designed as a training tool to assist program managers in making cost-effective decisions.

In 1985, the Pan American Health Organization (PAHO) instituted a coordinated system for planning and financing EPI in Latin America through the establishment of Inter-Agency Coordinating Committees at country level. Each country drafts a National Plan of Action which states program objectives, total resources required to attain each objective and the funding source, whether government or external sources. A preliminary analysis demonstrated that the total cost of the National Plans of Action in Latin America (1985) was $450 million: 85% from national funds and 15% from external sources (EPI, 1987). The proportion of external funds varied from a low of 4% in Brazil to a high of 48% in Bolivia. The data suggest that external funding will be necessary beyond 1991 to sustain pre-acceleration immunization coverage levels.

(Accelerated immunization coverage began in 1985.) The financial analysis framework is being promoted by WHO for use in other regions for financial planning. REACH contributed to the development of this framework in 1987.

In 1988, WHO developed a simplified, computerized costing model, EPICost, for use by program managers. (This model was similar to the one developed by Creese in 1979, though it emphasized unit cost rather than cost-effectiveness analysis.) To date, EPICost has been distributed and used in more than 20 countries. WHO and UNICEF are in the process of developing manuals on costing of primary health care programs. (WHO, draft) The WHO manual is aimed toward ministry of health personnel, whereas the UNICEF framework was developed for its field staff. These manuals and methods are a potential source of information for EPI managers and technical experts conducting economic evaluations.

In addition to WHO, UNICEF, and REACH field work, unit cost and cost-effectiveness studies of EPI have been conducted since 1985 by other agencies, institutions, and individuals. (Staff at the Centers for Disease Control conducted studies in Lesotho and Swaziland. Medecins sans Frontieres/Belgium has undertaken studies in Peru, Guatemala, and Bolivia. Other studies have been conducted in Thailand, Burkina Faso, Tanzania, Gabon, and Zaire.) In addition, several reviews of the literature contributed to knowledge regarding immunization program costs (Creese, 1986; Haaga, 1986; Mills, 1985).

In 1987, at a meeting of African countries in Mali, the "Bamako Initiative" was launched as a mechanism to reorganize the health system to "ensure universal, permanent accessibility to maternal and child health services" (International Children's Center, 1990). This Initiative has significant support from UNICEF and has been implemented most extensively in Guinea and Benin. Under this strategy, primary health care is to be financed through the sale of pharmaceuticals on a revolving fund basis: revenues generated by the sale of pharmaceuticals will be used to cover the cost of replacing drug stocks as well as cover some operating costs of health facilities, such as personnel and maintenance. The Initiative requires local community participation in the management of the revolving funds and continuous feedback of financial information from health centers to other levels in the health system.

Studies have found that 57% of operating costs for primary health care were financed in Benin and 51% of costs were covered in Guinea (International Children's Centre, 1990). These studies also found large variations in cost recovery rates (the ratio of receipts to total operating cost of facilities) among health facilities. For Benin, facilities could cover between 70% and 380% of total costs, with the latter facilities making considerable surpluses. In Guinea, between 30% and 120% of operating costs were covered through sale of pharmaceuticals. (Total operating costs excluded the costs of salaries in these two cases.) These encouraging results demonstrate potential for financing some of the operating costs of EPI through this mechanism. It is significant, however, that in Benin, 38% of the population studied were unable to afford fees charged for drugs (International Children's Centre, 1990).

CONTRIBUTIONS OF THE REACH PROJECT

Since the mid-1980s, the EPI has received tremendous financial and technical support from donor agencies to help achieve coverage goals. In 1989, nearly $200 million was invested in the

EPI by multinational and bilateral organizations, in addition to private voluntary and national agencies (Day, 1990). This figure does not include government contributions to the program (Day, 1990). The REACH Project has played a critical role in providing information to A.I.D. and other donors about the cost-effectiveness of alternative immunization strategies and the economic implications of global objectives. Results from REACH field studies have generated questions about sustainability of child survival activities currently designed and implemented in countries faced with declining resources for health programs.

Cost-effectiveness Studies

Through the initiative and experience of REACH staff and the interest in cost issues of the Evaluation Section of UNICEF in New York, the first cost-effectiveness study of an immunization campaign in Cameroon was conducted by REACH in 1987. Since that time, nine studies on the cost and cost-effectiveness of EPI were performed by REACH in collaboration with UNICEF, WHO, and various ministries of health. These studies can be divided into three categories: 1) studies comparing strategies, 2) national cost assessments, and 3) management studies. REACH studies in Senegal, Haiti, Ecuador, Sudan, and India compare the costs and outcomes of fixed facility, mobile team, and campaign strategies. These studies showed that mobile teams were more cost-effective than facilities. However, the number of mobile team evaluations (two) is too small to provide conclusive evidence, and the range in cost-effectiveness was larger for mobile team strategies. It is concluded that fixed facility approaches tend to be more economical. While campaigns were typically the least cost-effective, one campaign in Mauritania had better results than a mobile team strategy.

Facility-based studies permit a more in-depth analysis of resource use and result in specific management recommendations. REACH conducted two such studies in Sudan and India. These studies show a wide range of operating costs, health worker productivity, and program effectiveness among the sample of facilities and mobile teams.

REACH's work has contributed to improved quality of cost and cost-effectiveness analysis by enumerating the range of EPI inputs and by linking coverage and epidemiological survey results to cost analysis. The focus of REACH studies has been increasingly toward providing answers to EPI managers' priorities and operational problems. As a consequence of the increased availability of evidence on EPI costs and financing from REACH and other field studies, awareness and interest in considering economic criteria in planning and implementation of EPI strategies has increased.

Manuals and Guidelines

Over a two-year period, REACH developed a methodology for costing primary health care projects: *Asia/Near East (ANE) Bureau Guidance for Costing of Primary Health Care Projects, 1989* (A.I.D., ANE Bureau, 1988). This manual, which attempts to capture the best aspects of other manuals of its kind, outlines a method similar to that used by the World Bank (which uses CosTab to estimate health program budgets). As part of a field test in the Philippines, this manual was used for a cost-effectiveness analysis of EPI and acute respiratory infection programs. In addition, methods for estimating incremental resource requirements for neonatal tetanus control strategies were developed and used in a WHO workshop in Zimbabwe. These methods examined the incremental costs of changing the target populations from pregnant

women to those of childbearing age for tetanus toxoid immunization. This methodology was adapted for similar workshops in Senegal and Benin. While participants found it difficult to perform a cost analysis in a workshop format, the REACH manual did contribute to raising awareness of economic consequences of alternative immunization coverage.

Analytic Activities

A REACH analysis of 28 cost and cost-effectiveness studies of the EPI as part of the Immunization Sustainability Study *(Review of Cost and Cost-effectiveness Studies of the EPI: 1979-1987)* concluded the following:

- The average cost per fully immunized child (FIC) is approximately $15, with a range from $4 to $19. The cost per FIC varies only slightly according to the particular strategy or region under consideration. Routine services through fixed facilities have the lowest cost per FIC, on average ($11.26). Immunization campaigns have a higher cost per FIC, i.e., $15.62. (Table 2 summarizes these findings.)

- Personnel costs represent the most significant cost category for all strategies, approximately 40% of total cost. (See Table 3.) Supervision and management are the second highest category, followed by transportation and capital costs. The importance of vaccine costs varies by strategy: 5% for mobile and campaign strategies compared to 12% for the fixed-facility strategy. This difference is explained by the relative proportion of other types of costs specific to each strategy.

- Several factors have been identified which influence the cost-effectiveness of a national program or strategy. First, low coverage rates for full immunization result in less cost-effective programs. Second, the size of the population affects total resource use and cost. Third, the number and type of personnel, as well as their productivity, affect both the cost and effectiveness of EPI. Finally, the type and durability of materials and supplies, as well as the appropriateness of technology, affect program costs.

- A large degree of inefficiency has been found in the delivery of immunization services, primarily as a result of two factors. First, inputs into the program are often inappropriate and not cost-effective themselves. An example is a vehicle imported on the basis of the country of its origin rather than because of its appropriateness for the terrain of the country where it is being sent. Second, distribution of resources does not always match the need for them. Equipment, supplies, and finances still remain in central headquarters or urban areas and are not proportionally distributed among the target population.

- The contributions of national governments to immunization programs, which cover approximately 50% of total program costs, are lower than previously estimated. (At the 1984 Bellagio Conference on immunizing the world's children, an estimate of 80% government financing was made.) For immunizations through routine strategies (fixed facilities), the proportion of government contribution is greatest (55% of the total); this proportion diminishes to 44% for campaign strategies and 31% for mobile teams. (See Table 4.)

TABLE 2
Comparison of Cost-effectiveness Studies of the EPI by Strategy

COUNTRY	STRATEGY	COST 1987 $	NO. FIC	COST/FIC 1987 $
Burkina Faso (1987)[1]	Facility	$26,707	5,977	$4.47
Tanzania (1988)[2]	Facility	$4,571,000	700,000	$6.53
Mauritania (1985)[3]	Facility	$88,698	12,297	$7.21
Philippines (1988)[4]	Facility	$17,036,583	1,233,147	$13.82
The Gambia (1982)[5]	Facility	$442,222	26,791	$16.51
Turkey (1988)[6]	Facility	$15,265,676	803,568	$19.00
Mean (n=6)		$6,241,373	463,630	$11.26
Mauritania (1985)[3]	Campaign	$207,652	25,50	$8.14
Cameroon (1987)[7]	Campaign	$4,905,427	255,000	$19.24
Senegal (1987)[8]	Campaign	$3,678,669	188,864	$19.48
Mean (n=3)		$2,920,311	156,457	$15.62
Burkina Faso (1987)[1]	Mobile	$16,512	2,325	$7.10
Mauritania (1985)[3]	Mobile	$290,313	20,604	$14.09
Mean (n=2)		$158,476	11,465	$10.60

[1]de Champeaux A. Evaluation du programme elargi de vaccination, province de la Sissili. Centre Muraz, Burkina Faso: OCCGE, 1937, Unite de Vaccinologie, November 1987.

[2]Ministry of Health, Tanzania-DANIDA Review Team. Joint review report on EPI in Tanzania. September 1987, selected appendices.

[3]Brenzel L. Cost-effectiveness of alternative immunization strategies in the Islamic Republic of Mauritania. New York: UNICEF, 1986.

[4]Turner P. Excerpts from an A.I.D. project proposal for A.I.D./Manila, 1988.

[5]Robertson RL, Foster SO, Hall HF, Williams PJ. Cost-effectiveness of immunization in The Gambia. Journal of Tropical Medicine and Hygiene 1985b; 88:343-51.

[6]Brenzel L, Cobangolu N, Yemenicioghu N. Cost analysis of the national immunization and CDD programs in the Republic of Turkey, Arlington, VA: REACH, March 1988.

[7]Brenzel L. Cost-effectiveness of immunization strategies in the Republic of Cameroon. Arlington, VA: REACH, August 1987.

[8]Brenzel L, Claquin P, McLellan I, Stansfield S. Rapid assessment of Senegal's acceleration phase. Arlington, VA: REACH, November 1987.

TABLE 3

Percentage Comparison of Cost Profiles by Strategy

COST CATEGORY	1984[1] Bellagio	1986[2] Review	FIXED	CAMPAIGN (based on current figures)	MOB
Salaries	45	38/39	45	35/39	50
Supervision	unknown	20	20	14/20	19.5[3]
Vaccines	14	10/12	12	5	5
Transport	11	8/9	10	6/12	14
Other	13	5/7	5	6	8.5[3]
Capital	17	14/16	16	5	8.5[3]

Figures represent median values of proportion of total cost, and therefore column totals do not sum to 100%.

[1] From presentation by Dr. R.H. Henderson, Bellagio Conference, 1984.
[2] From Creese, 1986.
[3] Mean values only.

Source: Brenzel L. The cost of EPI: a review of cost and cost-effectiveness studies 1979-1987. Arlington, VA: REACH, May 1989, p. 42.

TABLE 4

Sources of Financing for the EPI

Country	Ministry of Health	Donors
Routine Strategies		
Turkey (1988)	96.5%	3.5%
Mauritania (1986)	41.0%	59.0%
Philippines (1988)	84.0%	16.0%
Tanzania (1988)	35.0%	65.0%
Burkina Faso (1987)	27.0%	73.0%
Average	56.7%	43.3%
Campaigns		
Mauritania (1986)	15.0%	85.0%
Cameroon (1987)	87.0%	13.0%
Senegal (1987)	29.0%	71.0%
Average	43.7%	56.3%
Mobile Teams		
Mauritania (1986)	31.0%	69.0%

Source: Brenzel L. The cost of EPI: a review of cost and cost-effectiveness studies 1979-1987. Arlington, VA: REACH, May 1989, p. 50.

- Government contributions to the EPI tend to be in the form of salaries for health workers, building depreciation costs, and, in some instances, vaccine and transport costs. However, EPI costs which require foreign exchange, such as vaccines, syringes, cold chain equipment, and vehicles, are being borne mostly by international organizations and outside donor agencies. Governments with lower gross national product per capita appear to make less of a contribution to the EPI from government resources.

- The implementation of the EPI cannot occur without the continued, high financial commitment by international donor organizations. Given current public sector allocation patterns to primary health care and EPI in particular, assuring adequate financing of EPI will require some combination of 1) reallocation of resources from curative to preventive programs, 2) reallocation of funds to the health sector from other sectors, and 3) improved efficiency of service delivery or financing of immunization by individuals.

- Preliminary evidence suggests that the average cost per FIC decreases with increasing coverage levels. (See Figure 1.) However, the data are too limited to draw definitive conclusions.

These conclusions are pertinent to EPI in the 1980s. However, new initiatives, such as eradication efforts, and constantly evolving technologies are likely to affect the profile of EPI costs in the future. To estimate future EPI costs, REACH undertook a major study funded by the Program and Policy Coordination Bureau of A.I.D. entitled the Immunization Sustainability Study.

Using an average figure of $15 per FIC, it is estimated that in the year 2000, 80% full coverage in 50 developing countries will cost approximately $1.5 billion (Immunization Sustainability Study, Vol II, 1990). When the costs of EPI are compared with projected government health expenditures and total national resources under high economic growth conditions determined by the World Bank (1988), a small group of countries, most notably those in Latin America and oil-exporting countries, could finance all costs of full immunization coverage with less than 0.1% of the gross domestic product (GDP) (Immunization Sustainability Study, Vol. II, 1990). Most of these countries are currently not financing EPI to this extent. At the other extreme is a set of countries in sub-Saharan Africa and Asia that will need to allocate more than two to three percent of their GDP to finance full immunization. In these countries, EPI (in the year 2000 with 80% coverage) would represent nearly one-fifth of total health expenditures. (See Figure 2.)

Figure 3 shows the number of years required to achieve 80% coverage with 0.1% of GDP by country. In some countries (under these assumptions), allocating less than 0.1% would result in immediate full coverage (theoretically); whereas, some countries would need more than 100 years to reach 80% of infants less than one year of age fully immunized if economic conditions do not improve. In the most economically depressed countries, the cost per FIC would have to be less than $5 for the country to afford 80% coverage levels with 0.1% of GDP. The difference between $15 and $5 is the level of subsidy per child donors should expect to provide on an annual basis.

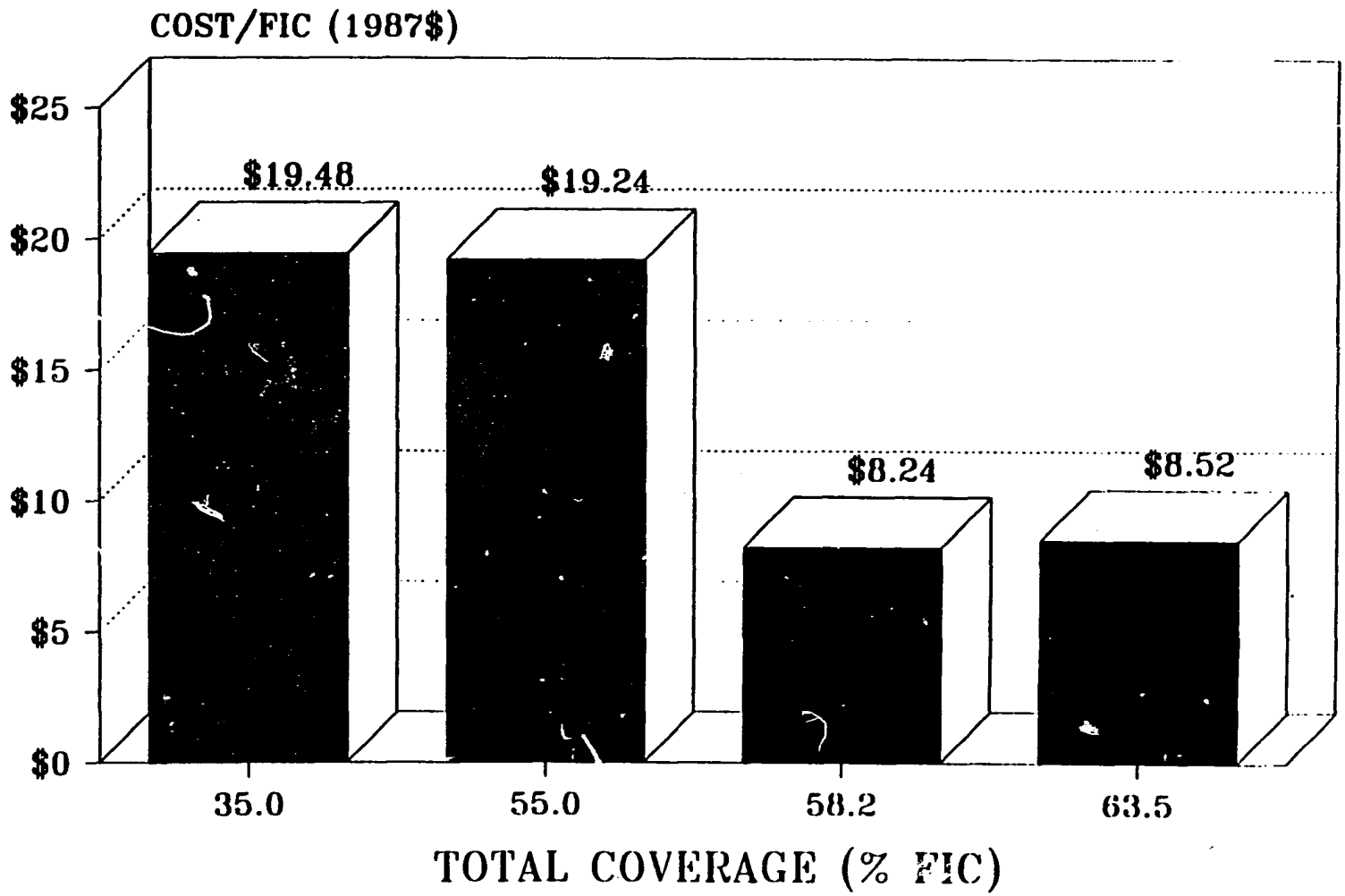
These results imply that some countries that currently receive donor assistance could "afford" the cost of EPI. These countries should be encouraged to allocate more resources toward immunization and primary care programs. On the other hand, there are some countries for which EPI represents a formidable cost and which could not provide services at 80% coverage using national resources. For these countries, donor organizations must be willing to continue financing EPI.

Dissemination of information

In collaboration with the International Children's Center (CIE) in Paris, France, the REACH Project organized three meetings on the role of economic and financial studies for the EPI. The first workshop, held in December 1987, afforded an opportunity for economists and epidemiologists to discuss methods for unit cost and cost-effectiveness analysis (Brenzel, 1987c). The second symposium, held in June 1989, brought together technical experts, donor organizations, and EPI managers to discuss results of cost and cost-effectiveness evaluations and their application to program management. At a third meeting, which took place in June 1990,

FIGURE 1

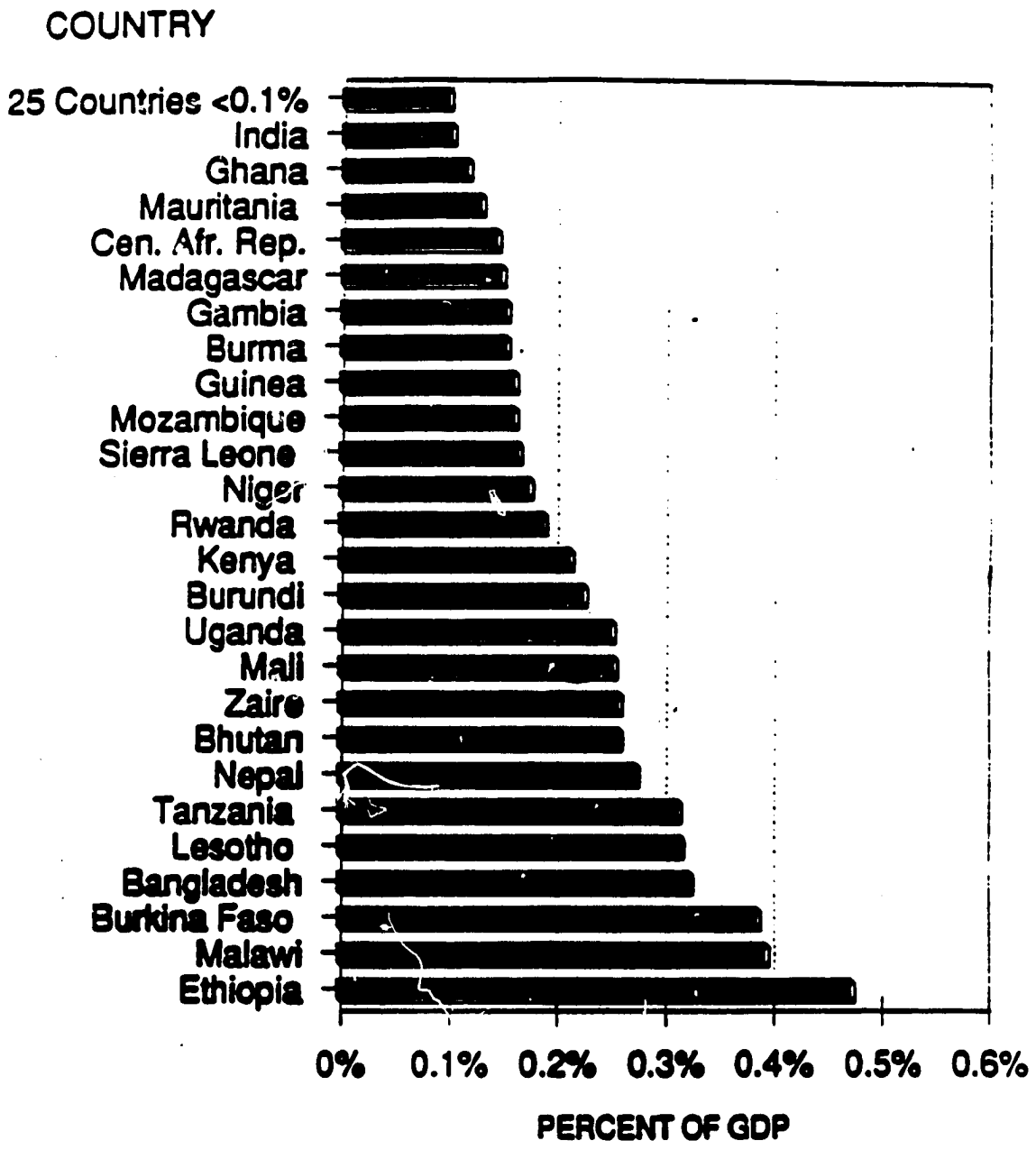
COMPARISON COST/FIC WITH TOTAL COVERAGE RATE FOR CAMPAIGNS



Senegal (1987) Cameroon (1987) Mauritania (1987) Ecuador (1985)

FIGURE 2

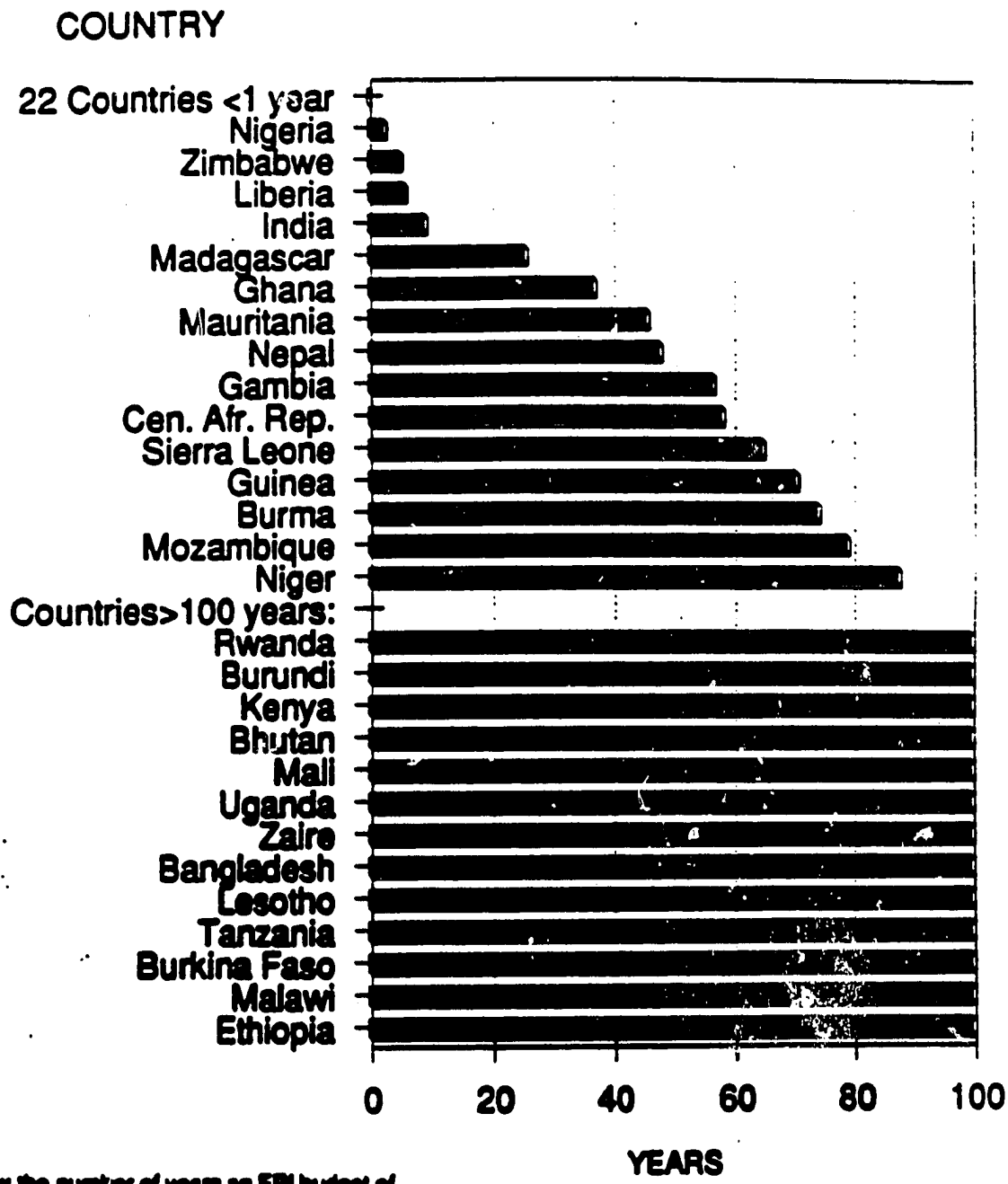
TOTAL EPI COST AS % OF GDP
80% COVERAGE
HIGH GROWTH SCENARIO - YEAR 2000*



* EPI expenditure at 0.1% of GDP;
Cost per FIC = $15

FIGURE 3

NUMBER OF YEARS FROM 1990 TO ATTAIN 80% COVERAGE HIGH GROWTH SCENARIO



These projections show the number of years an EPI budget of 0.1% GDP needs to meet the cost of immunizing 80% of the target population @ $15/FIC with the GDP growth rates of each scenario. As the GDP growth rate increases, the number of years required for 80% coverage goes down.

EPI managers and technical experts identified why the application of study results has been limited and described strategies that can be used to redress this situation. It was found that EPI managers were often not employed for guidance in study design nor consulted in determining study objectives, and these factors contributed to the lack of follow-up and non-implementation of study recommendations. Difficulty in interpreting study results and the novelty of economic jargon also limited the usefulness of cost-effectiveness studies.

INITIAL LIMITATIONS ON REACH WORK

There have been relatively few constraints to REACH work in the area of cost and financing of EPI. At the outset of the REACH Project in 1985, cost and cost-effectiveness studies of EPI were being conducted using a wide variety of methods and serving different objectives. By highlighting the strengths and limitations of different studies and developing and using better methods to evaluate program impact, REACH has helped to promote more consistent methodologies. As a result, there is now a growing awareness that emphasis needs to be placed on collecting and analyzing cost information for routine monitoring and evaluation, rather than conducting one-time cost-effectiveness evaluations.

Data analysis and computer skills were often insufficient to allow for full participation of counterparts in these aspects of cost-effectiveness studies. The time available to complete studies also hindered in-depth training in analysis. In some countries, counterparts had never used a computer prior to the cost-effectiveness study, and it was not felt that the time period for the study would allow for sufficient computer skill-building.

Finally, there is evidence to suggest that study results and recommendations are rarely put into practice by the EPI. As mentioned earlier, the impetus for studies in the early to mid-1980s was to justify donor funding. Therefore, at that time, economic studies aimed to satisfy the needs of donors rather than program managers. Initially, this placed a constraint on the wider applicability of REACH studies for management. Over time, the needs and priorities of EPI staff have been woven into the objectives of studies, and there has been less pressure to conduct cost-effectiveness analysis solely for the purpose of donor interests.

LONG-TERM IMPACT OF REACH WORK

Most of the cost-effectiveness studies done by REACH on EPI between 1985 and 1990 were conducted as one-time evaluations upon the request of A.I.D., WHO, or UNICEF. REACH consultants completed their field work and debriefed the EPI, ministry of health, and donors on the implications of the results. However, REACH studies have had a long-term impact on training of counterparts and in promoting policy dialogue among donor and technical organizations and ministries of health.

Training of EPI staff in data collection, processing, and analysis has taken place, most notably in Haiti, Sudan, and India. In Haiti, the Deputy Director of EPI, in collaboration with a REACH staff member, developed the objectives of the study. Once data were collected, analysis was done with the assistance of REACH as part of a training exercise. As a consequence, the Haiti EPI staff member will be able to conduct a similar study on her own.

In Sudan, EPI staff members from the accounting and finance office were involved in identifying study objectives, drafting and translating questionnaires, and data collection. Training in analysis was constrained by the limited time available to process data and write a draft report. However, EPI staff participated in meetings with the EPI directors and ministry of health personnel and have been able to use the results of the study to support policy and program changes in the EPI.

In working with the Department of Virology at the Christian Medical College (CMC) of Vellore, India, REACH's contribution in developing survey research and analysis skills has been significant. CMC staff have been involved in every stage of the cost-effectiveness study: design, questionnaire development, sample selection, data collection, data analysis, and report writing. CMC staff will be able to conduct the cost-effectiveness survey of health facilities with little outside assistance in the future.

Finally, REACH and A.I.D. efforts to promote rational resource allocation and cost efficiency in service delivery are shared priorities by other donor organizations and governments. REACH studies have helped to provoke discussions at international and country level about the sustainability and long-term financing of EPI.

FINANCIAL SUSTAINABILITY OF EPI

The analytic and policy work conducted under REACH contributed to discussions on the sustainability of immunization programs. REACH documented that the average cost per fully immunized child was higher than expected ($15), and that universal immunization will require substantial financial outlays in the future. The REACH Project also highlighted that governments are financing 55% of the total program costs (for fixed facility strategies): a figure which was lower than predicted in 1984 (at the Bellagio Conference) when it was estimated that 80% of total EPI costs would be borne by governments. Given declining health budgets in developing countries and growing indebtedness, the ability of some governments, particularly in Africa, to assume greater proportions of total immunization program costs will be limited.

Sustainability has become a popular phrase within the international donor community. Sustainability of EPI has been defined in several ways, though the most common definition centers around conditions which permit the indefinite continuation of the program itself, usually linked to a transfer of financial responsibility from donors to national governments.

With immunization programs, continuous immunization activity is necessary to reduce the burden of childhood disease, unless diseases are eradicated. Each newborn population must receive the required complement of immunization for full protection. The EPI will be constantly evolving and integrating new vaccines and technologies. Therefore, it is incumbent to assure both a high demand for immunization services and adequate financing of immunization activities.

Donor-designed and funded programs in the health sector often are not adopted by governments once outside funding is withdrawn. Often, costly strategies are implemented in developing countries, and governments cannot afford to assume full financial responsibility. In addition, donor resources may be substituted for scarce government funds, and over a period

of time, it may be bureaucratically difficult to alter resource allocation patterns at the national level. Thus, the process toward sustaining immunization program activities will require either creating favorable conditions under which government resources can be used to finance the EPI or assuring continued donor support.

Another factor precluding government financing is that preferences and priorities of governments may not be reflected in the design of the program or strategy. While this is a political issue, immunization strategies to control childhood diseases need to increasingly incorporate the priorities and preferences of the countries implementing them. As governments become more accountable for providing basic health services to their populations and thereby remove the need for externally generated programs, donors need to redefine their role as secondary developers of policy and programs.

In addition, the time horizon in which immunization targets and goals are planned and implemented has significant implications for the types of strategies which will be used to achieve those goals, and consequently the ability of governments and donors to continue financing such strategies. Tradeoffs exist between reaching timed targets and sustaining benefits. Sustaining immunization programs will require a long-term, committed effort wherein donor organizations and governments become partners in assuring long-term financial viability of the EPI. In addition, planning the sustainability and financing of EPI needs to be placed within the larger picture of overall economic development of countries. The capacity of governments to commit resources to EPI will depend upon current financing strategies and policies for primary and curative health care activities, as well as potential for economic growth.

LESSONS LEARNED UNDER REACH

The major lessons learned under the REACH Project from both field and analytic work include the following:

1. The results of cost-effectiveness studies have been used sparingly at country level for policy and program management decisions. Often, the process by which cost-effectiveness studies have been undertaken prevents the adoption of study recommendations by the EPI. For instance, economic terminology and methods are foreign to EPI managers and staff, and outside experts conduct studies as an external evaluation of the program. The objectives and goals of studies do not always reflect problem issues and priorities of EPI management, and recommendations are not formulated into practical steps in every case. The lack of follow-up, once a study has been completed, almost ensures that the study will go unused.

2. While initial cost-effectiveness results sparked discussion about sustainability of the EPI, gaps exist in knowledge of future costs at increasing coverage levels, with changing technologies, and under eradication versus control strategies. This information is important to predict future EPI costs and plan long-term financing of the program.

3. Field work has highlighted the need for better financial management and monitoring of donor and country resources. During data collection for cost-effectiveness studies, the incompleteness of financial records by both governments and donor organizations has been revealed.

4. Financing of immunization programs is not yet integrated institutionally into some country programs, and the capacity to absorb resources for immunization varies across countries. Few if any countries have specific budget line items for EPI or primary health care in general. Resources for the program, thus, cannot be earmarked under these types of conditions.

5. An analysis of inefficiencies in service delivery within country programs can highlight areas where resources can be translated into more cost-effective programs. Variability in costs, productivity, and immunization activity across facilities can be used as a means of determining a standard model of service delivery to identify which facilities are more costly to operate or less productive than average (management by exception).

6. There is a growing consensus among technical experts in this field that the focus and objective of cost evaluations should be toward aiding financial decisions and assisting in financial planning and management. The role of cost-effectiveness analysis to help choose among alternative strategies has never been realized fully in the EPI, because strategies do not represent true alternatives and cannot or should not be changed from a technical point of view. Cost-effectiveness analysis has justified investments and provided an opportunity to collect and analyze information on program or strategy costs.

PRIORITIES FOR THE FUTURE

The post-1990 period should focus on strengthening country capacity to become more self-sufficient in financing immunization programs, as well as increasing general understanding of the economic consequences of EPI strategies.

1. The EPI is an expanding and evolving program that will incorporate new vaccines, cold chain, and injection technology, and that will reach wider target groups. Program costs are likely to be affected by technological change, and this will have implications for the affordability and sustainability of EPI. Therefore, additional efforts should be made to investigate the cost implications of technological change.

2. Currently, some countries can afford to finance larger portions of recurrent and capital costs but still rely on donor financing of the program. Reasons why country financing is not forthcoming need to be identified, and incentives by which countries can begin to assume greater shares of program financing need to be developed.

3. Evidence suggests that there is considerable waste and inefficiency in service delivery of EPI that sound financial management of country programs could strengthen and improve.

4. The use of previous economic and financial studies of EPI for policy or management decisions has been limited. Managers need to be consulted on how financing information can be of assistance and how study findings can be utilized.

5. Sustained high coverage does not appear affordable to many countries at the present time. Given worsening economic conditions and persistent economic debt, continued donor support will be needed to ensure the permanence of the EPI and its achievements, and to prevent recurrence of disease pre-1980 levels. However, efforts need to be made to encourage

support will be needed to ensure the permanence of the EPI and its achievements, and to prevent recurrence of disease pre-1980 levels. However, efforts need to be made to encourage greater allocation of government resources to preventive health programs.

6. Current costing methodologies need to be simplified to be used by field staff without jeopardizing reliability of results. Training in the use of the methodology, collection of cost information and interpretation of results should become priorities in the near future.

7. More information needs to be assembled on the cost recovery potential of different schemes for financing EPI. The role of the private sector in providing or financing EPI needs to be reviewed.

GLOSSARY OF TERMS

Budget: A yearly account that estimates how much money goes in and comes out of the national government or of a household. This budget may or may not be equivalent to the amount of money spent at the end of the year.

Cost: A cost refers to the value of resources used to deliver immunization services. In this report, the terms cost, full cost, resource cost, and full resource cost are synonymous.

Cost-benefit analysis: A technique that compares the costs and benefits of programs by placing all benefits in monetary terms. The common unit of analysis becomes a dollar, and different types of programs can be compared, such as EPI and adult education. The purpose for comparison is to determine how to allocate scarce resources.

Cost category: A name given to classify a wide variety of program inputs into similar groups such as personnel, transportation, media, and equipment.

Cost-effectiveness analysis: A technique that compares alternative strategies for achieving the same health outcome to determine how to allocate scarce resources. The ratio between the total cost and effectiveness of a program is the cost-effectiveness ratio.

Cost profile: A ratio of the value of each cost category (i.e., personnel) to the total cost of an EPI. This analysis results in a series of proportions that are unique for each immunization strategy or program. Cost profiles can be compared among strategies and programs to identify useful differences between them.

Economies of scale: This term refers to a comparison between the average cost of providing additional units of output. If fewer costs are required to produce one more immunized child than before, there are economies of scale. If the same level of costs are required to immunize one more child than before, there are constant returns to scale. If additional resources are required to immunize an additional child, there are diseconomies of scale. Economies of scale can be represented by a U-shaped curve. For immunization programs, it is generally thought that it will cost increasingly more on average to reach the last 10 to 20 percent of the population, so there will be diseconomies of scale. This theoretical concept has yet to be proven.

Externalities: This term describes the benefits or disadvantages of an immunization program which are unforeseen and have a "cost" to society. An example of a positive externality is that of retraining of health workers during a campaign, who then are better skilled to handle other tasks. An example of a negative externality arises when a strategy prevents the delivery of other preventive health programs because it requires the full attention of administrative and health staff.

Expenditure: Money that is actually spent from a budget. Expenditures can be different than costs. For example, a cost analysis will include the value of donated radio broadcast time, but these figures do not represent actual money transfers for the EPI.

Financial analysis: An evaluation of who is paying for immunizations and how much money is being spent.

Financing: How something is paid for. When individual patients give donations to health centers, they are financing some part of the delivery of services.

Fixed costs: Fixed costs refer to those which are required for providing a service but which do not vary as the volume of services delivered changes. For example, for an immunization program, a vehicle is required for supervision and outreach services, but the cost of the vehicle does not change with each additional child immunized.

Fully immunized child: In these studies, a fully immunized child refers to a child who has received at least one dose of Bacillus Calmette-Guerin tuberculosis vaccine, one dose of measles, three doses of oral polio, and three doses of diphtheria/pertussis/tetanus vaccine. Children who have received most but not all of the doses mentioned above are not considered fully immunized.

Incremental cost: The cost of adding a new product or service into an already existing system. Incremental cost analysis can be used to determine the cost of adding a periodic campaign to a routine, fixed-facility immunization strategy.

Investment costs: Investment costs are the value of resources which last over more than one year and which provide the infrastructure for the EPI. For example, initial training, building and vehicle costs represent investment costs for immunization programs.

Margin (on the margin): This terminology refers to the comparison of costs and benefits of different programs, where the additional dollar cost of producing one additional dollar of benefit is compared. The program with the lowest cost per dollar of benefit is considered to result in the most efficient use of resources in economic terms.

Marginal cost: This is the additional cost to provide one additional immunization in a program. A marginal cost analysis could be used to determine how much more an EPI would cost at higher coverage levels.

Opportunity cost: An opportunity cost is a measure of the economic value lost in one sector of society by using resources to undertake one activity rather than another. For instance, investing in four-wheel drive vehicles could represent the opportunity cost of capital, as the money used to purchase the vehicles could have been put into a bank or used for purchase of another investment.

Recurrent cost: Recurrent costs are equal to the value of resources used within a given time period e.g., a year) to provide immunization services. For instance, vaccine costs occur every day of an immunization program and are therefore a recurrent cost of that program.

Resource: The inputs which are used to provide or deliver immunization services. Resources consist of labor, materials, and money.

Sensitivity analysis: An analysis which alters key assumptions made in a cost-effectiveness study to test whether the changes from the original assumptions result in large variations in cost-effectiveness ratios. If large differences occur, then the cost study is said to be sensitive to changes in assumptions.

Total cost: The total cost of an EPI is equal to the sum of the value of all resources used. Total costs can be divided into recurrent and capital costs. Also, fixed costs plus variable costs equal total cost.

Variable cost: Variable costs are those which depend upon the volume of services provided. The cost of vaccines is a variable cost because each child receives an injection and incurs a cost for the EPI.

REFERENCES

Agency for International Development, Asia/Near East Bureau. ANE Bureau guidance for costing of health service delivery projects. Arlington, VA: REACH, September 1988.

Barnum HN, Tarantola D, Setiady IF. Cost-effectiveness of an immunization program in Indonesia. Bulletin of the World Health Organization 1980; 58(3):499-503.

Bellagio Conference Report. Protecting the world's children: vaccines and immunization within primary health care. New York: Rockefeller Foundation, June 1984.

Berman P, Quinley J. Mass campaign or routine program? A cost-effectiveness comparison of tetanus immunization programs in Aceh. CHIPPS Project, January 1987 (draft).

Brenzel L. Cost-effectiveness of alternative immunization strategies in the Islamic Republic of Mauritania. New York: UNICEF, 1986.

Brenzel L. Cost-effectiveness of immunization strategies in the Republic of Cameroon. Arlington, VA: REACH, August 1987a.

Brenzel L, Claquin P, McLellan I, Stansfield S. Rapid assessment of Senegal's acceleration phase. Arlington, VA: REACH, November 1987.

Brenzel L, Cobangolu N, Yemenicioghu N. Cost analysis of the national immunization and CDD programs in the Republic of Turkey. Arlington, VA: REACH, March 1988.

Brenzel L. Cost-effectiveness of immunization programs: issues and future directions. Presented for discussion at the Technical Advisory Group meeting, REACH Project mimeo, November 1987b.

Brenzel L. The cost of EPI: a review of cost and cost-effectiveness studies 1979-1987. Arlington, VA: REACH, May 1989.

Brenzel L. Trip report on a meeting on the economic evaluation of immunization programs at the International Children's Center held in Paris, December 7-8, 1987. Arlington, VA: REACH, 1987c.

Brenzel L, Balraj V, Claquin P, John J. Protocol for the cost-effectiveness study of the North Arcot District in collaboration with the Christian Medical College of Vellore, India (draft).

Brenzel L et al. Report on the cost-effectiveness of the Expanded Program on Immunization in the Republic of Sudan (Volumes I-V). Arlington, VA: REACH, August 1990.

Creese AL. Cost-effectiveness of potential immunization interventions against diarrhoeal disease. Social Science and Medicine 1986; 23(3):231-40.

Creese AL, Sriyabbaya N, Casabal G, Wiseso G. Cost-effectiveness appraisal of immunization programs. Bulletin of the World Health Organization 1982; 60(4):621-32.

Creese AL. Cost-effectiveness of alternative strategies for poliomyelitis immunization in Brazil. Reviews of Infectious Diseases 1984; 6(suppl 2):S404-7.

Creese AL, Dominiguez-Uga MA. Cost-effectiveness of immunization in Colombia. World Health Forum 1987a; 8.

Creese AL, Dominiguez-Uga MA. Cost-effectiveness of immunization programs in Colombia. Bulletin of the Pan American Health Organization 1987b; 21(4).

Day L. Toward ensuring the financial sustainability of EPI. Discussion paper prepared for WHO Global Advisory Group on the Expanded Programme on Immunization, September 1990.

de Champeaux A. Evaluation du programme elargi de vaccination, province de la Sissili. Centre Muraz, Burkina Faso: OCCGE, Unite de Vaccinologie, November 1987.

Expanded Programme on Immunization in the Americas. National EPI plans of action: preliminary financial analysis. Geneva: World Health Organization, 1987. (WHO/EPI/GAG/87/WP.3).

Expanded Programme on Immunization. Expanded programme on immunization: costing guidelines. Geneva: World Health Organization, 1979. (EPI/GEN/79/5).

Haaga J. Cost-effectiveness and cost-benefit analyses of immunization programs in developing countries. In: Jelliffe D, Jelliffe EFP, eds. Advances in international maternal and child health, vol. 6. New York: Oxford University Press, 1986.

Hartman A, Corrales G, Cross PN, Gavidia RC. The cost-effectiveness and benefits of intensive immunization strategies in Honduras. Presented to the National Council for International Health, annual international health conference, June 12, 1986.

Immunization Sustainability Study, Volume Two. Arlington, VA: REACH, August 1990.

International Children's Center - Paris. The Bamako Initiative: primary health care experience. Children in the Tropics 1990; No. 184/185.

Makinen M. A benefit-cost analysis of measles vaccinations in Yaounde, Cameroon. Department of Economics, University of Delaware, June 1980.

Mills A. Survey and examples of economic evaluation of health programs in developing countries. World Health Statistical Quarterly 1985; 38.

Ministry of Health, Tanzania-DANIDA Review Team. Joint review report on EPI in Tanzania. September 1987, selected appendices.

Ponnighaus JM. The cost/benefit of measles immunization: a study from Southern Zambia. Journal of Tropical Medicine and Hygiene 1980; 83:141-9.

Qualls N. CCCD cost study report, People's Republic of the Congo. June 17 - July 12, 1985.

Robertson RL. Cost of the Combatting Childhood Communicable Diseases (CCCD) Project in Malawi, 1984-1985. Submitted to University Research Corporation, September 1985.

Robertson RL, Qualls N. Cost of the Combatting Childhood Communicable Diseases (CCCD) Project in Swaziland, 1984-1985. Submitted to University Research Corporation, September 1985a.

Robertson RL, Foster SO, Hull HF, Williams PJ. Cost-effectiveness of immunization in The Gambia. Journal of Tropical Medicine and Hygiene 1985b; 88:343-51.

Shepard DS, Robertson RL, Cameron CSM, Saturno P, Pollack M, Manceau J. The cost-effectiveness of immunization strategies in Ecuador. Arlington, VA: REACH, 1987.

Turner P. Excerpts from a cost evaluation of the national EPI in the Philippines, results from a field test of the ANE Bureau guidance for costing of health service delivery projects. Arlington, VA: REACH, 1987.

Turner P. Excerpts from an A.I.D. project proposal for A.I.D./Manila, 1988.

World Health Organization. Estimating the cost of primary health care: a manual for program managers. Geneva: WHO (draft).

World Health Organization. An economic appraisal: Indonesia. Weekly Epidemiologic Review 1981; 13(4).

World Health Organization. Expanded Program on Immunization: cost study. Weekly Epidemiologic Review 1982a; 38(9).

World Health Organization. Expanded Program on Immunization: cost-effectiveness. Weekly Epidemiologic Review 1982b; 22(6).

APPENDIX

REACH Documents on EPI Cost Analysis/Effectiveness

GENERAL

CIE Meeting Report
Pierre Claquin
June 1990

Cost-Effectiveness of Immunization Programs. Issues and Future Directions.
Presented at AMA Hospital, India, December 2, 1988.
Logan Brenzel, Pierre Claquin, Gerald Rosenthal
November 1987

The Costs of EPI: A Review of Cost and Cost-Effectiveness Studies (1979-1987)
Logan Brenzel
September 1990

Draft Strategy for REACH Activities in Costing and Financing of Immunization Programs
Logan Brenzel
September 1988

The Economic Burden of a Sustainable EPI: Implications for Donor Policy
Gerald Rosenthal
February 1990

The Immunization Sustainability Study
Gerald Rosenthal, Koj Evlo, Allison Percy
April 1990

REACH Technical Assessment Report: Cost and Sustainability
Logan Brenzel
September 1990

Sustainability of Immunization Efforts
Outreach
Allison Percy
Spring 1990

Trip Report: Design of PAHO/Donor Financial Control System
Donovan Rudisuhle
March 16-20, 1987

Trip Report on a meeting on the Economic Evaluation of Immunization Programs at the International Children's Center, Paris
Logan Brenzel, Pierre Claquin, Gerald Rosenthal
December 7-8, 1987

BOLIVIA

Expanded Program on Immunization Consultant Services to USAID/Bolivia
Ernesto Guerrero, Judith K. Williams
February 16-20, 1987

CAMEROON

Cost-Effectiveness of Immunization Strategies in the Republic of Cameroon
Logan Brenzel
August 1987

ECUADOR

Comments on the proposed EPI Plan of Action developed at an interagency/GOE meeting, Quito, February 9-13, 1987
Marjorie Pollack
May 12, 1987, memorandum

The Cost-Effectiveness of Immunization Strategies in Ecuador
Donald Shepard, Robert Robertson, Charles Cameron, Pedro Saturno, Marjorie Pollack, Jacques Mandeau
August 10, 1987

Review of the EPI Inter-Agency Meeting, Quito, Ecuador
Marjorie Pollack, Donovan Rudisuhle
February 9-13, 1987

Trip Report: EPI Inter-Agency Meeting, Quito, Ecuador
Donovan P. Rudisuhle
February 7-14, 1987

GUATEMALA

Financial Review of the Guatemala EPI, USAID/Guatemala City
Gerald Rosenthal
March 1-6, 1987

HAITI

Analyse de Cout, Cout-Efficacite des Strategies
Maryse Narcisse
June 4-21, 1990

Formation en Etude de Cout-Efficxacite a REACH/Washington, D.C.
Maryse Narcisse
June 4-10, 1989

Trip Report: Study on Cost and Cost-Effectiveness of the National Vaccination Days in Haiti
Logan Brenzel
August 12-24, 1988

INDIA

REACH Assessment Report: Cost-effectiveness Study, Vellore, Tamil Nadu, India
Allison Percy
September 1990

SENEGAL

Rapid Assessment of Senegal's Acceleration Phase
Logan Brenzel, Pierre Claquin, Iain McLellan, Sally Stansfield
November 1987

SUDAN

Report of the Cost-Effectiveness of the Expanded Program on Immunization in the Republic of Sudan (5 volumes)
Logan Brenzel et al.
June 1989

Study Protocol for the Cost-Effectiveness and Efficiency Study of the EPI in Sudan
Logan Brenzel
1988

Trip Report: Cost and Efficiency Study of the Expanded Program on Immunization in the Sudan
Logan Brenzel
October 20-30, 1988

TURKEY

Cost Analysis of the National Immunization and CDD Programs in the Republic of Turkey
Logan Brenzel
March 1988