

Cost Analysis of the National Vitamin A Supplementation Program in Zambia



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The overall objective of this study is to provide policymakers in Zambia with cost information on vitamin A supplementation – information that may help answer questions concerning the efficiency and sustainability of the campaign approach vis-à-vis other modes of delivering vitamin A supplementation. Specific objectives are to document the Child Health Week and National Immunization Days programs as they presently operate, and to analyze the two programs' cost structures.

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Acronyms

CBOH	Central Board of Health
CHW	Child Health Week
DHB	District Health Board
DHMT	District Health Management Team
GRZ	Government of the Republic of Zambia
EPI	Expanded Program of Immunization
IEC	Information, education, and communication
JICA	Japan International Cooperation Agency
MOH	Ministry of Health
MOST	USAID Micronutrient Program
NFNC	National Food and Nutrition Commission
NGO	Non-governmental organization
NIDs	National Immunization Days
PHO	Provincial Health Office
Sub-NIDs	Sub-National Immunization Days
UCI	Universal Childhood Immunization
UNICEF	United Nations Children’s Fund
USAID	United States Agency for International Development
WHO	World Health Organization

Currency Unit

3,608 kwacha (K) = \$1

Summary

Study Objectives and Methodology

This study was prepared under MOST, the United States Agency for International Development (USAID) Micronutrient Program, in response to a request from Zambia's Central Board of Health (CBOH). Over the years, questions have arisen concerning the efficiency and sustainability of the campaign approach vis-à-vis other modes of delivering vitamin A supplementation. Underlying many of those questions is a central assumption that costs associated with the campaign approach are high and, thus, the national vitamin A supplementation program as it presently operates may not be cost-effective.

The overall objective of this study is to provide policymakers in Zambia with cost information on vitamin A supplementation, information that may help answer some of those questions. Specific objectives are to document the Child Health Week (CHW) and National Immunization Days (NIDs) programs as they presently operate, and to analyze the two programs' cost structure.

The August 2000 NIDs and February 2001 CHW were selected for analysis. The NIDs 2000 campaign was used because critical cost data for NIDs 2001 were unavailable, and the August 2001 CHW was the most recent vitamin A supplementation round when this study began.

Program Description

Objectives

The long-term objective of Zambia's CHW program is to extend the coverage of vitamin A supplementation of children 6 to 59 months of age to at least 80 percent. A related objective is to improve the overall health of those children through provision of other critical health services such as de-worming, immunization, and growth monitoring. The long-term objective of the NIDs program is total eradication of polio.

Beneficiary Population

CHW targets children from 6 to 59 months of age, dividing them into two age groups: 6-11 months and 12-59 months. Each age group receives different doses. In addition to vitamin A capsules, children receive services included in each district's CHW package. Vitamin A supplementation policy is the same for NIDs as for CHW. The NIDs polio vaccine is administered to children 0-5 years old.

Program Structure and Participants

A collaborative effort, the CHW program involves government health-sector agencies and international donor organizations. Government agencies include the Ministry of Health (MOH), CBOH, the National Food and Nutrition Commission (NFNC), provincial health offices (PHO), and District Health Boards (DHBs). NIDs draw upon the same health structure that supports CHW. A major difference between the two programs, however, is that under NIDs the level of

planning required from the districts is minimal because NIDs are much more centrally oriented as a result of their status as a global program.

MOH provides salaries, infrastructure, and vehicles, and also channels financial and technical-assistance resources to local implementing agencies at the provincial and district levels. Cooperating partners provide funding and technical assistance for the procurement of supplies, logistical support to facilitate distribution of packages to the districts and PHOs, orientation of PHOs and district health management teams (DHMTs), and monitoring of CHW and NIDs activities.

DHBs plan the operational strategy for CHW activities and implement NIDs through local fixed and outreach service posts. Other government organizations contribute to CHW and NIDs at the district and provincial levels, especially through contribution of staff and motor vehicles to the local resource pool. Volunteers assist with capsule distribution, as well as with supervision and administration of the CHW and NIDs programs. These volunteers work closely with health workers, as well as traditional and identified opinion leaders, to mobilize guardians of children of up to five-years old, administer vitamin A, and maintain distribution records. In some districts, non-governmental organizations (NGOs) also provide staffing and transport.

Program Activities

CHW

National level. Here, CHW preparation includes organizing funds for district and provincial CHW budgets; producing information, education, and communication (IEC) materials for district and national dissemination; arranging airtime for broadcasting IEC materials; disseminating promotional and advocacy materials through the mass-media; preparing monitoring and evaluation documents; and orienting PHO staff. Preparatory activities are implemented over a period of five months.

Provincial level. At this level preparatory activities include preparing provincial CHW budgets; initiating preparatory activities at the district level; orienting DHMT staff; collaborating with central or national-level agencies; and preparing protocols for monitoring districts during the campaign.

As part of post-CHW activities, mini-surveys are conducted to verify coverage reported by districts, as well as qualitative information presented in supervisory and observation reports. Such surveys are used to gain better understanding of the opportunities and challenges of the CHW strategy and to revise the design of the next CHW campaign as needed.

NIDs

Preparation for NIDs at the national, provincial, and district levels follows a pattern similar to that of CHW. Activities are implemented over a period of five months using resources from the NIDs basket, a pool of resources to which donor organizations contribute. Post-NIDs activities are very similar to those implemented after completion of CHW.

Program Costs

Costing Methodology

The costing methodology used in this study is based upon a combination of two common approaches used in cost analysis: (a) the expenditure approach, whereby accounting or expenditure data are analyzed and assigned to specific program activities, and (b) the ingredients approach, in which all inputs needed to generate a given activity are identified and assigned specific costs.

Cost Categories

Two major categories of costs are estimated: “program-specific” costs and “other” costs, the latter encompassing personnel and capital costs. Total costs consist of program-specific, personnel, and capital costs. The distinction between program-specific, personnel, and capital costs — rather than the usual distinction between capital costs and recurrent costs (including personnel costs) — is used in describing the results presented in this study.

Program-specific costs. These are the costs incurred exclusively for the delivery of vitamin A: expenditures for capsules, supplies, transportation, fuel and vehicle maintenance; for training; for IEC; and for social mobilization. Personnel and capital are shared resources: that is, resources not attributable to a single program or intervention. Since the costs of shared resources would arguably be incurred with or without CHW and NIDs, they are not included in the analysis of program-specific costs.

Program-specific costs are of particular relevance to decision makers and program managers for two reasons. First, since they include resources that MOH must mobilize each year to implement the program, they are a vital determinant of program sustainability. Second, they are critical in comparing the costs of CHW and NIDs with those of other nutritional interventions or in examining

alternative program options, such as integrating vitamin A supplementation into other health-care delivery systems.

Personnel costs. In Zambia, MOH personnel are involved in a variety of activities besides vitamin A supplementation. Personnel costs are therefore shared among many other health interventions and not incurred exclusively for the delivery of CHW and NIDs services. To determine the personnel costs of the vitamin A program, it was necessary to identify all personnel involved in program implementation at every level: planning, distribution, and monitoring and evaluation. The proportion of time each person devoted to the supplementation program was then established. Total personnel costs were derived as the sum of personnel costs at all levels of program implementation.

Capital costs. Such costs are incurred in purchasing goods whose useful operating life exceeds one year: vehicles, buildings, large equipment, computers, and other office assets. Certain expenses of a non-capital nature, such as long-term training, are necessary for setting up a program. Since these expenses are not recurrent and their impact spans several years, they are capitalized to reflect their long-term nature.

Cost Estimates

Estimates by cost category. Total costs for CHW are estimated at about K7.8 billion, or \$2.2 million per year. Program-specific costs represent 39 percent of total costs, about twice as much as capital costs and only slightly lower than personnel costs.

NIDs’ program-specific costs for 2000 are about k4 billion, or \$1.3 million. It is worth noting that average program-specific cost per district per round is 3.5–4 times higher for NIDs than for CHW (\$43,000 and \$11,700, respectively).

Annual CHW Costs			
Cost Item	Amount		
	K Million	Dollars	% of Total Cost
Program-specific costs	3,052	845,973	39
Personnel costs	3,288	911,446	42
Capital costs	1,464	405,688	19
Total Costs	7,804	2,163,107	

NIDs' Costs — 2000 Campaign		
Cost Item	Amount	
	K Million	Dollars
Program-specific costs	4,136	1,304,417

Cost by funding source. The government of the Republic of Zambia (GRZ) provides 57 percent of total costs for CHW and the U.S. Agency for International Development (USAID) 36 percent. Another five percent of total costs comes from the United Nations Children's Fund (UNICEF), and one percent from NGOs.

Of program-specific costs USAID provides 81 percent, with UNICEF contributing 13 percent and GRZ 6 percent. GRZ contributes 96 percent of personnel costs and nearly 80 percent of capital costs. UNICEF contributes 83 percent of program-specific costs for NIDs, and the World Health Organization (WHO) 16 percent.

Average cost per child dosed. As indicated in the table on the following page, the average cost per child dosed twice per year during CHW is K1,726, or \$0.48 — if only program-specific costs are considered. The annual average is K4,414, or \$1.23, if personnel and capital costs are included as well.

Average program-specific cost per child per round of vitamin A supplementation is over six times higher for NIDs than for CHW — \$1.49 and \$0.24, respectively.

Cost-effectiveness. While cost information is needed to assess affordability, cost-effectiveness analysis helps identify interventions that use resources most efficiently. One method commonly used to assess cost-effectiveness of vitamin A relative to other health interventions is to compare cost per death averted for each intervention.

Assuming a 23 percent reduction in mortality rate of children between 6 and 59 months due to the CHW program, cost per death averted in Zambia is estimated at about \$63, if only program-specific costs are considered, and \$162 when all personnel and capital costs are also included.

When measured in terms of cost per death averted, the CHW program compares favorably with malaria chemoprophylaxis, breastfeeding promotion, and measles immunization, and is measurably more cost-effective than most other programs such as cholera immunization and health interventions associated with diarrheal disease.

Annual Cost per Child Dosed During CHW					
Cost Category	Population Dosed	Distribution Costs		Cost per Child	
		K million	\$000	K million	Dollars
Program-specific costs	1,768,000	3,052,269	846	1,726	0.48
Personnel costs		3,288,498	911	1,860	0.52
Capital costs		1,463,721	406	828	0.23
Total Costs		7,804,488	2,163	4,414	1.23

Conclusions

The overall objective of this study is to provide policymakers in Zambia with cost information that may help answer critical policy questions regarding the future of vitamin A supplementation in that country. Results in this study are based upon analysis of the CHW and NIDs programs as they presently operate, and on the two programs' cost structure. Costs were divided into three categories: program-specific, personnel, and capital costs.

Cost per child covered twice per year during CHW is \$0.48 — if only program-specific costs are considered. The annual average is \$1.23, if personnel and capital costs are also included. Average program-specific cost per child per round of vitamin A supplementation is several times higher for NIDs than for CHW. Analysis of cost per death averted suggests that vitamin A supplementation is highly cost-effective relative to other primary health interventions. Such findings suggest that the CHW program in Zambia should receive priority consideration when allocating resources to primary health interventions.

The major purpose of the study is to estimate the cost of vitamin A supplementation through the Child Health Week and National Immunization Days programs in Zambia.

Chapter 1: Introduction

Background

General Background

This study was prepared under MOST. Funded by the Office of Health and Nutrition of the United States Agency for International Development (USAID), MOST is the Agency's flagship project for the promotion of activities to improve the micronutrient status of at-risk populations worldwide.

The major purpose of the study is to estimate the cost of vitamin A supplementation through the Child Health Week (CHW) and National Immunization Days (NIDs) programs in Zambia.

Socioeconomic Setting

A landlocked country, Zambia is bordered by Angola to the west, the Democratic Republic of the Congo to the northwest, Tanzania to the northeast, Malawi to the east, Mozambique to the southeast, Botswana and Zimbabwe to the south, and Namibia to the southwest. The country, which encompasses 752,614 square kilometers (290,585 square miles), occupies a plateau lying 3,000 to 5,000 feet above sea level and boasts a number of lakes and rivers. According to the 2000 population census, about 10 million people live within Zambia's 9 provinces and 72 districts, about half of those inhabiting urban areas.

Although agriculture provides the main livelihood for half the population, Zambia's economy has historically been based upon copper mining. Today, the mining industry accounts for a significant proportion of gross domestic product (GDP), up to 50 percent of government revenues and over 80 percent of Zambia's foreign-exchange earnings.

Annual per capita income is about \$460. It is estimated that up to 80 percent of Zambians are poor, with over 60 percent of the poor living in rural areas. Government expenditure on health relative to total government expenditure has been 8-12 percent in recent years.

Background of the CHW and NIDs Programs

In Zambia the background of CHW differs from that of NIDs, even though they are both based upon a similar implementation model. The long-term objective of the NIDs program is total eradication of polio. The level of planning required from the districts is lower under NIDs because NIDs are more centrally oriented as a result of their status as a global program. More resources are also allocated to NIDs than to CHW.

CHW is a week of intensified activity during which health workers deliver services through outreach and fixed facilities to promote child health. The service package delivered during that week varies across districts according to available human and financial resources within each. However, the CHW service package across the country is driven by a common core service of vitamin A supplementation of children up to five-years old. During CHW, guardians take their charges to the nearest health post or health center for vitamin A supplementation. Other services received include de-worming, health education, immunization, family planning, prenatal care, and growth monitoring.

Vitamin A deficiency in Zambia is a public health problem formally recognized as a common cause of childhood morbidity and mortality, with infant and under-five mortality at 107.5 and 192.3 per thousand live births, respectively. Vitamin A deficiency was first recognized as a public health problem in the early 1960s, when it was described as the major cause of blindness in Luapula Province. The 1980s saw growing interest in defining the extent of the problem in children, and in 1985, the Tropical Disease Research Center conducted a study of 4,275 children 6-72 months of age in the Luapula Valley in conjunction with the National Food and Nutrition Commission (NFNC). Their study revealed that 1.89 percent of those children had xerophthalmia (clinical vitamin A deficiency), while 16.5 percent displayed biochemical levels of severe deficiency (< 10 ug/dl).

A USAID-funded baseline survey conducted in 1997 by NFNC found that 65.7 percent of children had serum retinol levels of ≤ 20 ug/dl, with night-blindness prevalence of up to 6.2 percent in the same cohort. Those prevalence rates placed Zambia in the severe clinical vitamin A deficiency category according to World Health Organization (WHO) population-affected cutoffs. As the study discovered, routine vitamin A supplementation coverage for children was 28.4 percent.

A study on the trends of vitamin A supplementation coverage recommended that a social mobilization approach be used to achieve higher coverage. Initially designated “vitamin A supplementation week,” the campaign activity was designed to occur twice a year. Its key goals were to increase the low vitamin A supplementation coverage among children up to six years of age and to raise awareness about the importance of vitamin A through social mobilization.

In February 1998, the first vitamin A supplementation week was launched — although later renamed CHW to make the focus on the child more explicit. It was also

felt that, instead of limiting activities to a vertical vitamin A supplementation program, the opportunity should be seized to deliver an integrated service that included not only vitamin A capsules but also such other health services as de-worming, health education, immunization, family planning, prenatal care, and growth monitoring. Districts were encouraged to provide an integrated package of services commensurate with their local capacity and need — as long as vitamin A supplementation remained the core activity.

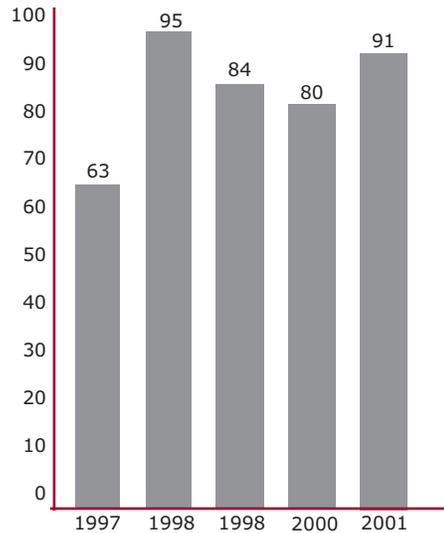
A monitoring system was established to record information on each activity during and after CHW. During CHW, several elements are monitored: quality of training; service provision; capsule administration; and effectiveness of the information, education, and communication (IEC) campaign. The monitoring system also documents client perceptions of the services provided. After CHW, small-scale surveys (“mini-surveys”) verify coverage figures reported by each district.

NIDs are part of a WHO global program. At WHO’s 41st session in May 1988, members committed themselves to the global target of eradicating polio by year 2000. In July 1995, Zambia joined other Organization of African Unity countries at the Heads of State Summit in Cameroon in re-affirming their commitment to the polio-eradication goal.

In approach, NIDs differ very little from CHW. Both follow the campaign model, which involves intensified social mobilization and service delivery over a few days. The pool of resources mobilized for NIDs, however, tends to far surpass that for CHW. Being a global agenda, the NIDs initiative has access to broader international resources and higher levels of commitment.

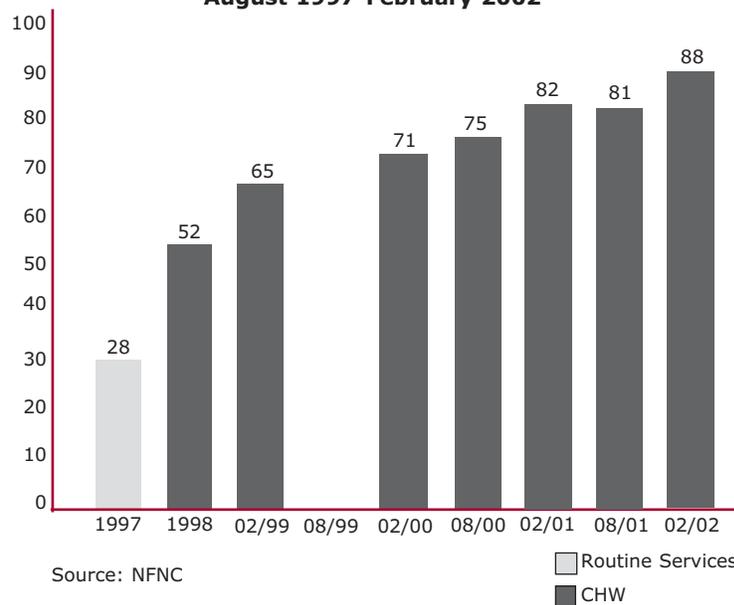
Initially, NIDs were a nationwide undertaking. In view of improved immunization coverage in recent years, however, the program was scaled down to about half the districts (figure 1.1). Since

Figure 1.2 Trends in Vitamin A Supplementation Coverage, NIDs 1997-2001



Sources: MOH 2000 and MOH 2001

Figure 1.3 Trends in Vitamin A Supplementation Coverage, CHW August 1997-February 2002



Source: NFNC

Routine Services
 CHW

Study Objectives

Over the years, questions have arisen concerning the efficiency and sustainability of the campaign approach vis-à-vis the routine mode of delivering Vitamin A supplementation. How disruptive of existing routine systems is the campaign approach?

Are routine services and campaigns mutually exclusive, or should they be viewed

as two complementary avenues for delivering health services? And how sustainable is the campaign mode of delivery versus the routine system?

Underlying many such questions is a central assumption that the costs associated with the campaign approach are high and, for this reason, the national vitamin A supplementation program as it presently operates may not be cost-effective.

The overall objective of this study is to provide policymakers in Zambia with cost information on vitamin A supplementation that may help answer some of these questions. Specific objectives are to document the CHW and NIDs programs as they presently operate and to analyze the two programs' cost structure.

Methodology

Selection of February 2001 CHW Round and August 2000 NIDs

The August 2000 NIDs and February 2001 CHW were selected for analysis. The NIDs 2000 campaign was used because critical cost data for NIDs 2001 were unavailable, and the August 2001 CHW was the most recent vitamin A supplementation round when this study began.

Data-Collection Methodology

The overall goal of the study and its general framework were developed in collaboration with program stakeholders: government agencies, including NFNC; Central Board of Health (CBOH); Universal Childhood Immunization (UCI); and international organizations, including USAID, WHO, and the United Nations Children's Fund (UNICEF).

Field research for the study was initiated in Lusaka in February-March 2002. Part of the data were collected from national-level sources (both primary and secondary) at donor offices and country agencies. A questionnaire was also forwarded to all districts. Because only 9 districts out of 72 responded to the questionnaire, district-level data obtained through the questionnaire were supplemented with data collected through field visits made to 13 additional districts.

In selecting districts several factors were considered, among them rural-urban characteristics, size, topography, and population density.¹ Data for the NIDs campaign were obtained from the Ministry of Health's (MOH's) sub-NIDS 2000 report. Information in that report was supplemented with prices and other data collected by the study team.

1 Districts selected are listed below:

<i>Province</i>	<i>District</i>
Central	Kabwe; Mumbwa
Copperbelt	Ndola; Chililabombwe
Eastern	Chipata; Chadiza; Petauke
Luapula	Mansa; Kawambwa
Lusaka	Lusaka; Kafue
Northern	Mbala; Mpika
Northwestern	Solwezi; Mwinilunga
Southern	Livingstone; Mazabuka; Kalomo; Kazungula; Namwala; Siavonga
Western	Mongu; Senanga

Chapter 2: Program Description

Program Objectives

The long-term objective of Zambia’s CHW program is to provide vitamin A supplementation to at least 80 percent of children 5 to 59 months of age and reduce vitamin A deficiency by one-third. A related objective is to improve the overall health of those children through provision of other critical health services such as de-worming, immunization, and growth monitoring. The long-term objective of the NIDs program is total eradication of polio.

Beneficiary Population

CHW targets children from 6 months to 59 months of age, dividing them into two age groups: 6-11 months and 12-59 months. Different doses are administered to each age group (table 2.1). In addition to vitamin A capsules, children receive other services included in each district’s CHW package. Vitamin A supplementation policy is the same for NIDs as for CHW; the NIDs polio vaccine, however, is administered to children 0-5 years old.

Table 2.1: Vitamin A Supplementation Policy

Age of Child	Dosage	Frequency
6-11 months	100 000 IU	6 months
12-59 months	200 000 IU	6 months

Program Structure and Activities

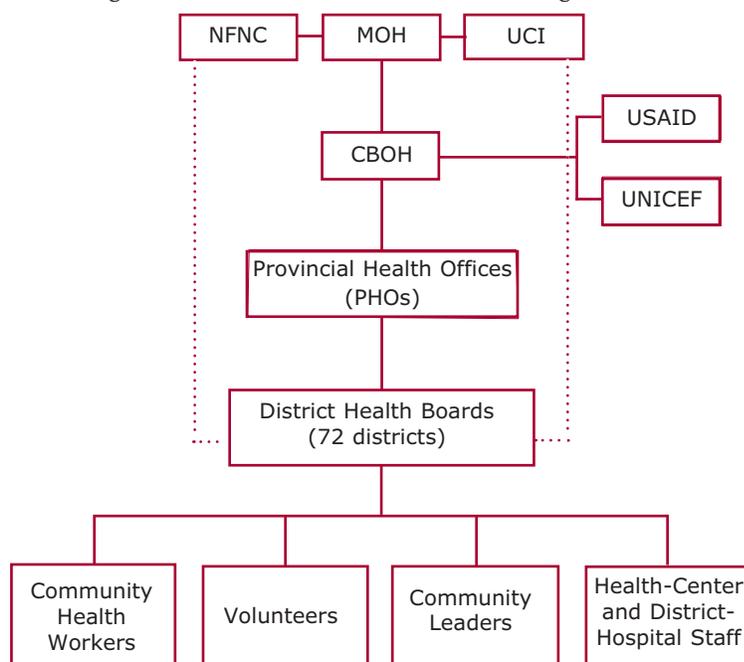
Program Structure and Participants

CHW

Figure 2.1 depicts the operational structure of the CHW program, a collaborative effort involving government health-sector agencies and international donor organizations. Government agencies include MOH, CBOH, NFNC, Provincial Health Offices (PHOs), and District Health Boards (DHBs).

Since formal decentralization in 1995, the health system in Zambia has operated at three levels. MOH is responsible for overall sectoral development, health financing, and international development cooperation. Although the ministry may endorse specific health programs, it is operationally restricted to health policy development and direction, rather than policy implementation.

Figure 2.1: Organizational Structure of the CHW Program



National health policy implementation is the responsibility of CBOH, a parastatal organization delegated with the authority to execute health policy in Zambia on behalf of MOH. PHOs are administrative extensions of CBOH to the provinces, and their responsibility at the provincial level is limited, at least in theory, to providing technical backstopping to DHBs in health programming and execution.

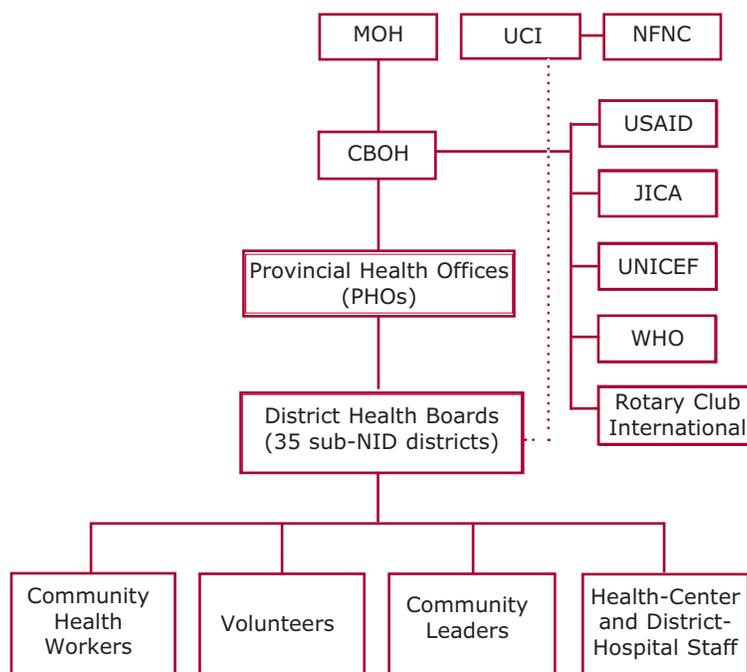
DHBs and their executive District Health Management Teams (DHMTs) are statutory boards set up to provide health services to the local populations, including strategic decision-making, health planning, and management. DHBs operate under a contractual relationship with CBOH, an arrangement under which districts are annually contracted to deliver basic health services to their local populations on behalf of CBOH. Health financing at the district level is provided by CBOH, on behalf of MOH, on the basis of annual contracts and performance reports.

Each district has at least one fixed first-level referral hospital and a network of health centers. In cases where there is no hospital within the district, this function is contracted

to a hospital in a neighboring district. DHBs, through their DHMTs, are responsible for planning and executing CHW. Vitamin A supplementation, the expanded program of immunization (EPI), and the growth monitoring program are the core activities of CHW across Zambia's 72 districts. Other services within the CHW package are locally determined by respective DHMTs according to local priorities and resource availability. The district health structure, down to the community level, is fully engaged in the delivery of services during CHW. Apart from using fixed health centers, outreach activities to serve clients right where they live are intensified during CHW.

As the entity responsible for implementing health-program interventions, CBOH has overall responsibility for coordinating CHW implementation. NFNC, which takes the technical lead on matters related to nutrition in Zambia, provides the secretariat for the program and the national vitamin A (and CHW) resource center. The center's dedicated contract staff is located within NFNC. UCI contributes to the CHW program based upon its status as MOH's body responsible for all child immunization programs in Zambia.

Figure 2.2: Organizational Structure of the NIDs Program



International organizations involved in CHW are USAID (through MOST and the Zambia Health Integrated Project) and UNICEF.

International Cooperation Agency (JICA), and Rotary Club International.

Program Actors and Their Roles

This section describes the specific activities performed by actors listed in the two organizational structures depicted in figures 2.1 and 2.2.

NIDs

Although NIDs draw upon the same health structure supporting CHW (figure 2.2), a major difference between the two programs is the level of planning each requires from the districts. Districts are relatively less involved under NIDs than under CHW because NIDs are much more centrally oriented, owing to their status as a global program. CBOH designs upcoming activities for each NIDs round. Action plans are then forwarded to the districts for implementation under the close supervision of UCI, the health ministry’s logistical and coordination arm in the implementation of the expanded program on immunization.

CBOH

Through UCI, MOH prepares CHW packages for the districts — those packages including IEC materials, vitamin A capsules, de-worming tablets, and similar items. Packages are distributed from the center to PHOs, which forward them to the districts within their geographic area. UCI also contributes to the orientation of PHO staff, who in turn orient DHMTs on CHW requirements for the year.

In providing expert technical input for nutrition programs in Zambia, NFNC supports CBOH in ensuring the success of the vitamin A supplementation component of NIDs. International organizations involved in NIDs are WHO, USAID, UNICEF, Japan

CBOH funds airtime to broadcast the national television and radio campaigns. NFNC serves as a secretariat for CHW activities at the national level and also participates in channeling financial and technical assistance to local implementing agencies at the provincial and district levels.

UCI prepares NIDs packages for the districts, which include IEC materials, vaccines, and vitamin A capsules. UCI also oversees and maintains the national cold-chain for vaccines throughout the country. CBOH coordinates financial resources from donors and sponsors the social mobilization program through the mass media. CBOH also ensures coordination and technical support to districts through the PHOs. NFNC coordinates the procurement and distribution of vitamin A capsules during NIDs.

Cooperating Partners

Cooperating partners provide funding and technical assistance for the procurement of supplies, logistical support to facilitate distribution of packages to the districts and PHOs, orientation of PHO and DHMT staff, and monitoring of CHW and NIDs activities.

USAID has supported the national vitamin A supplementation program and CHW in Zambia since 1999, contributing financial and technical assistance in support of strategic planning, development of technical guidelines and IEC materials, and orientation of program staff at all levels, as well as grants for district expenses. This support has generally been channeled into the local health system through NFNC.

Together with JICA, UNICEF, WHO, and Rotary Club International, USAID supports the NIDs program by contributing to NIDs funds. UNICEF contributions to CHW include procurement of vitamin A capsules; provision of funds for, and participation in, monitoring activities during and after CHW; and support to the distribution of vitamin A capsules and other supplies to PHOs and districts. UNICEF also procures vaccines and vitamin A capsules for NIDs and contributes to NIDs funds. WHO assists with the procurement of vaccines and contributes to the NIDs basket.

DHBs

Through their executing DHMTs, DHBs are the implementing agencies for CHW. DHBs plan the operational strategy for CHW activities, including composition of the CHW package. They are responsible for local deployment of staff; mobilization of local resources; lobbying for local support from other government and non-governmental organizations (NGOs); priority setting; and supervision, monitoring, and coordination of service provision under CHW. DHMTs orient local health staff and volunteers and conduct the social-mobilization campaign at the community level.

The health boards implement NIDs through their local fixed and outreach service posts based upon the operational strategy designed by CBOH and UCI. Districts tend to have established local operational systems that are reactivated for every NIDs campaign.

Other Government Organizations

Other government organizations contribute to CHW and NIDs at the district and provincial levels, especially through contributing staff and motor vehicles to the local resource pool. Involvement of those organizations will often depend on their respective resource capacities and those of the host health office in the province or district.

Volunteers

Volunteers assist with capsule distribution, as well as with supervision and administration of the CHW and NIDs programs. These volunteers come from local communities and other government departments at the district level. Community-based volunteers are in direct contact with caregivers and children, working closely with health workers, as well as traditional and identified opinion leaders, to mobilize guardians of children of up to six-years old, administer vitamin A, and maintain distribution records.

Program Activities at the National and Provincial Levels

CHW Preparation

National level. At this level, CHW activities include organizing funds for district and provincial CHW budgets; producing IEC materials for district and national dissemination; arranging airtime for broadcasting IEC materials; disseminating promotional and advocacy materials through the mass-media; preparing monitoring and evaluation materials; and orienting PHO staff. Preparatory activities are implemented over a period of five months.

Provincial level. Preparatory activities at this level include drawing up provincial CHW budgets; initiating preparatory activities at the district level; orientating DHMT staff; collaborating with central or national-level agencies; and preparing protocols for monitoring districts during the campaign. At this stage of the CHW round, each PHO acts as a catalyst for the implementation of preparatory activities in the districts within its geographic area.

NIDs Preparation

Preparation for NIDs at the national level follows a similar pattern. Activities are implemented over a period of five months using resources from the NIDs basket. Preparation at the provincial level includes initiation of preparatory activities at the district level; orientation of DHMT staff; and close consultation with national authorities.

Procurement and Packaging of Supplies for CHW and NIDs

UCI procures vitamin A capsules for CHW with UNICEF support. In addition to vitamin A capsules, UCI includes any other supplies requested by the districts, such as de-worming tablets, growth monitoring and promotion supplies, and vaccines. During NIDs, NFNC prepares vitamin A capsule requests, while

CBOH prepares requests for vaccines. UNICEF procures the necessary supplies in light of those requests. When supplies arrive in Zambia, they are held at UCI stores where UCI proceeds with re-packing them according to district requirements.

Program Activities at the District Level

CHW Preparation

The preparatory period for CHW, which lasts about three months, encompasses resource mobilization, including budgeting and local mobilization of funds, vehicles, fuel, and other logistical needs from local NGOs and other government organizations; social mobilization and advocacy activities within the district; logistical planning and preparation of distribution posts and assignments of monitoring teams; orientation of health workers and volunteers; and delivery to the distribution posts of vitamin A capsules, other medical supplies, and IEC materials.

NIDs Preparation

District-level preparation includes orientation of health workers and volunteers; cold-chain preparation; and packaging and delivery of vaccines and vitamin A capsules to the distribution or immunization posts. Each district also conducts social mobilization and advocacy activities as part of the preparation effort.

Procuring Vitamin A and Vaccines

Districts receive vitamin A capsules and medical supplies for CHW and NIDs from UCI. These supplies are then channeled to administration posts within each district.

Dispensing Vitamin A and Vaccines

The specific logistical, supervisory, and local monitoring systems for a round of CHW are locally planned by the respective DHMTs, supported by PHO technical staff.

Capsule-distribution teams use all means of transportation available in their respective regions and districts: motor vehicles, motorcycles, and bicycles. In districts where rivers or lakes must be crossed, boats are part of the transport fleet. The DHMT, other government organizations, and local and international NGOs may provide vehicles and fuel and assist with vehicle maintenance.

During CHW, a package of services is provided at health centers and outreach administration or distribution posts in the district. Some of these services are curative, such as de-worming and diarrhea, while others are preventive, such as vitamin A supplementation, immunization, and health education. The CHW service package typically varies from one district to another and, in many cases, from one CHW round to another.

Package features are not determined by epidemiological factors alone; availability of resources at the district level also determines the range of services a DHMT provides at each CHW round. However, since the resource and logistical support system set up by government in collaboration with donor organizations places vitamin A supplementation at the center of the CHW initiative, such supplementation for children 6 to 59 months of age remains the core activity across all districts during CHW.

During CHW, health workers and volunteers, along with supervisors, are assigned to specific distribution points. Children in the target groups are brought to administration posts by their guardians. There, the children receive vitamin A capsules, with each dosing recorded on tally sheets. Mothers are counseled on the importance of vitamin A and other services received, and the next dosing and/or treatment date is also discussed.

Monitoring teams consisting of national, provincial, and district staff carry out systematic or random observations, depending on what they are monitoring. Where necessary, vitamin A capsule administrators are assisted in performing their tasks. At the

end of each day, tally sheets are counted, summary sheets completed, and data compiled. District figures are then checked for accuracy, after which district coverage is calculated and the results forwarded to NFNC.

The overall operational strategy for administration of vaccines and vitamin A by districts during the NIDs campaign is determined at the central level by MOH, CBOH, and UCI. DHMTs decide upon the local mobilization and deployment of human resources (including volunteers) and logistical operations within the district. As in the case of CHW, vaccine and vitamin A capsule supplies to administration posts are transported by all means available in the region and district.

In each district, child immunization and vitamin A supplementation are conducted during NIDs. Health workers administer vaccinations at health centers and designated community-based health posts, whereas vitamin A supplementation is carried out by both health workers and volunteers. Each vaccination and vitamin A supplementation case is recorded on tally sheets.

Monitoring teams consisting of national, provincial, and district staff carry out systematic observations and provide supervision and technical backup. As for CHW, tally sheets are counted and summary sheets completed at the end of each day. District figures are then checked for accuracy, with district coverage calculated and results forwarded to UCI. In August 2000, NIDs were conducted in 35 districts, slightly fewer than half the country's 72 districts.

Post-CHW and -NIDs Activities

For each CHW, DHMTs compile district coverage and expenditure reports. PHOs and DHMTs hold CHW review meetings to discuss lessons learned, with observations during those meetings employed to better plan for the following CHW round. Lessons learned are also shared with representatives from central agencies at the next orientation meeting.

Central agencies and supporting international organizations carry out similar reviews through the Inter-agency Committee on Child Health and the National Vitamin A Task Force. Such reviews are based upon observational reports from the field. Those reports are discussed, taking into account coverage and expenditure reports from the districts and PHOs.

As part of post-CHW activities, mini-surveys take place to verify coverage reported by districts and also qualitative information presented in supervisory and observational reports. Such surveys lead to better understanding of the opportunities and challenges of the CHW strategy and to any needed design revisions for the next CHW campaign. Post-NIDs activities are very similar to those implemented after completion of CHW.

Chapter 3: Program Costs

Methodology²

Costing Methodology

The costing methodology used in this study is based upon a combination of two common approaches used in cost analysis: (a) the expenditure approach, whereby accounting or expenditure data are analyzed and assigned to specific program activities, and (b) the ingredients approach, in which all inputs needed to generate a given activity are identified and assigned specific costs.

Early data-collection efforts, which relied exclusively upon the expenditure methodology, suffered from several shortcomings. First, cost data were in certain instances too aggregated to be useful in evaluating individual program activities. Second, data did not capture the cost of significant inputs, such as labor. Third, data did not properly account for capital inputs such as vehicles, computers, and similar equipment.

Although the first step in the data-collection process for this study was to obtain expenditure data from all participating organizations, those data were then combined with other information from a variety of sources at the central, provincial, and district levels. Within the time allocated to fieldwork for this study, every effort was made to identify all major inputs used at each operational and administrative level and then to estimate the quantity and price of each input for each activity. Such an approach enabled the study team not only to use a more comprehensive approach in analyzing costs, but also to gain better understanding of the structure and functioning of the CHW and NIDs programs in Zambia.

Definitions and Calculation Procedures

Recurrent Costs and Capital Costs

In estimating the annual costs of a program, it is useful to distinguish between recurrent costs (those incurred in purchasing recurrent inputs, or inputs purchased each year) and capital costs (those incurred in purchasing capital inputs, or inputs with a useful lifespan of more than one year). It is important to separate these two cost categories not only because they are estimated differently, but also because the distinction is fundamental to analyzing program sustainability — which is largely a function of recurrent costs.

Recurrent costs. Such costs are incurred to purchase inputs with a lifespan of less than one year that, as their name suggests, must be incurred periodically. Recurrent inputs are usefully grouped into categories such as materials and supplies (e.g., vitamin A capsules, scissors, and educational materials); utilities (e.g., fuel and electricity); and services (e.g., IEC and media campaigns).

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² This section on methodology draws heavily on Rassas et al.

Capital costs. These are incurred in purchasing goods whose useful operating life exceeds a single year: vehicles, buildings, large equipment, and computers and other office assets. Certain expenses of a non-capital nature, such as long-term training, are necessary for setting up a program; because, however, these expenses are not recurrent and have an impact spanning several years, they are capitalized to reflect their long-term nature.

The longer lifespan of capital inputs relative to recurrent inputs is an important consideration in developing accurate annual cost estimates. Since capital costs generally represent a significant proportion of total costs, an expenditure-based approach for estimating annual costs can be misleading. For instance, capital expenditures can be significantly higher in a start-up year than in subsequent years; thus, using expenditure data for a start-up year is likely to overestimate annual costs. Conversely, using expenditure data pertaining to a year that shortly follows the start-up phase may well underestimate “average” or “typical” annual costs.

To develop an annual use of capital assets that would smooth out the varying annual costs over the useful life of capital inputs, the annualization method was used in this analysis.³

Program-specific Costs vs. Other Costs

Two major categories of costs are estimated in this study: “program-specific” costs and “other” costs, the latter including personnel and capital costs. Total costs consist of program-specific, personnel, and capital costs. The distinction between program-specific,

personnel, and capital costs — rather than the usual distinction between capital costs and recurrent costs (including personnel costs) — is used in describing the results presented in this study. The need to distinguish between program-specific, personnel, and capital costs is justified by the importance of each of these cost categories in the vitamin A program.

Personnel Costs

MOH personnel in Zambia are involved in a variety of activities aside from vitamin A supplementation through CHW and NIDs. Personnel costs are therefore shared among many other health interventions and are not incurred exclusively for the delivery of CHW and NIDs services.

To determine personnel costs of the vitamin A program, it was necessary to identify all personnel involved in program implementation at every level: planning, distribution, and monitoring and evaluation. The proportion of time each person devoted to the supplementation program was then established by dividing the number of days spent on the program in a given period by the person’s total working days and multiplying that proportion by the person’s total remuneration⁴ during that period. Total personnel costs of the program for, say, a given district were estimated as the sum of this product for all personnel involved in the supplementation program in that district. Summation over all districts generated total personnel costs at the district level. Total personnel costs were derived as the sum of personnel costs at all levels of program implementation. Percentages of personnel time allocated to the program were obtained from interviews with participants.

3 Straight-line depreciation is the simplest technique to estimate annual capital costs. In the straight-line depreciation approach, capital costs are divided by the estimated useful life of the capital item in years. However, straight-line depreciation underestimates the cost of capital because it does not take into account the time value of money. A more accurate method, referred to as the annualization method, includes both the useful lifespan of the capital item being analyzed and the interest forgone each year. Even though annualization yields a higher cost than other methods of depreciation, it is a more appropriate method, especially in an inflationary economy such as Zambia’s in recent years.

4 Volunteer labor is estimated using rural wage rates.

Program-specific Costs

Such costs are incurred exclusively for the delivery of vitamin A: for example, the costs of capsules, supplies, transportation, fuel and vehicle maintenance, training, IEC, and social mobilization. Personnel and capital are shared resources, as they are not attributable to a single program or intervention. Since the costs of shared resources would arguably be incurred with or without CHW and NIDs, they are not included in the analysis of program-specific costs.

Program-specific costs are of particular relevance to decision makers and program managers for two reasons. First, since they include resources that MOH must mobilize each year to implement the program, they are a vital determinant of program sustainability. Second, they are critical in comparing the costs of CHW and NIDs with those of other nutritional interventions or in examining alternative program options, such as integrating vitamin A supplementation into other health-care-delivery systems.

Program-specific costs were first estimated for the February 2001 CHW. Since CHW consists of two campaigns every year, those costs were doubled to obtain annual estimates. As the NIDS program is carried out once a year, program-specific costs for NIDS were limited to the 2000 campaign. Other costs, including capital costs, were estimated directly on an annual basis.

As explained in the section on data collection (page 5), this analysis is based in part on cost information obtained from interviews with a limited number of program participants in representative geographic areas. More-extensive fieldwork and primary data collection would undoubtedly have provided more-refined estimates. However, more-refined estimates would not have altered the results significantly.

Results

The analysis in this section places more emphasis on CHW. Since vitamin A distribution associated with NIDs is only a temporary arrangement, supplementation through CHW was considered more relevant for decision making. Also, no attempt was made in this study to estimate vitamin A distribution costs separately from the costs of other CHW or NIDs services, such as immunization, deworming, prenatal care, and growth monitoring. Estimating the cost of each of those activities separately would have required far greater resources than available for this study. Thus, the estimates presented in this section do not describe the cost of vitamin A distribution as a discrete activity and should be considered as the cost of an integrated package of services that include vitamin A.

Total Costs

As shown in table 3.1, total costs for CHW are estimated at about K7.8 billion, or \$2.2 million per year. Program-specific costs represent 39 percent of total costs, about twice as much as capital costs and only slightly lower than personnel costs (see also figure 3.1). Capsules and distribution of supplies represent about 17 percent of program-specific costs. IEC, orientation and training, supervision and monitoring, and technical assistance represent the bulk (more than 80 percent) of those costs.

Capital costs represent 19 percent of total costs. Vehicles account for about 60 percent of capital costs, with the rest equally divided between office equipment and long-term training. Personnel costs are 42 percent of total costs. Volunteer labor represents more than 50 percent of those costs, followed by government personnel (44 percent) and personnel from NGOs (3 percent). The cost of volunteer labor represents 22 percent of total costs, higher than the percentage for capital costs (19 percent). Such a large percentage reflects the critical role volunteers play in the CHW program.

Table 3.1: Annual CHW Costs			
Cost Item	Amount		
	K Million	Dollars	% of Total Cost
Program-Specific Cost			
IEC	725	200,871	
Meetings	48	13,431	
Orientation and Training	142	39,304	
Supervision and Monitoring	603	167,224	
Distribution and Supplies	286	79,229	
Capsules	246	68,121	
Technical Assistance	1,002	277,793	
Total Program-Specific Cost	3,052	845,973	39
Personnel Cost			
Government			
MOH	1,329	368,264	17
Other GRZ Institutions	96	26,518	1
NGOs	120	33,299	2
Volunteers	744	483,365	22
Total Personnel Cost	3,288	911,446	42
Capital Cost			
Vehicles	870	241,093	11
Office Equipment	286	79,328	4
Long-term Training	307	85,266	4
Total Capital Cost	1,464	405,688	19
Total Cost	7,804	2,163,107	

Figure 3.1 Program-Specific, Personnel, and Capital Costs as a Percentage of Total Costs for CHW

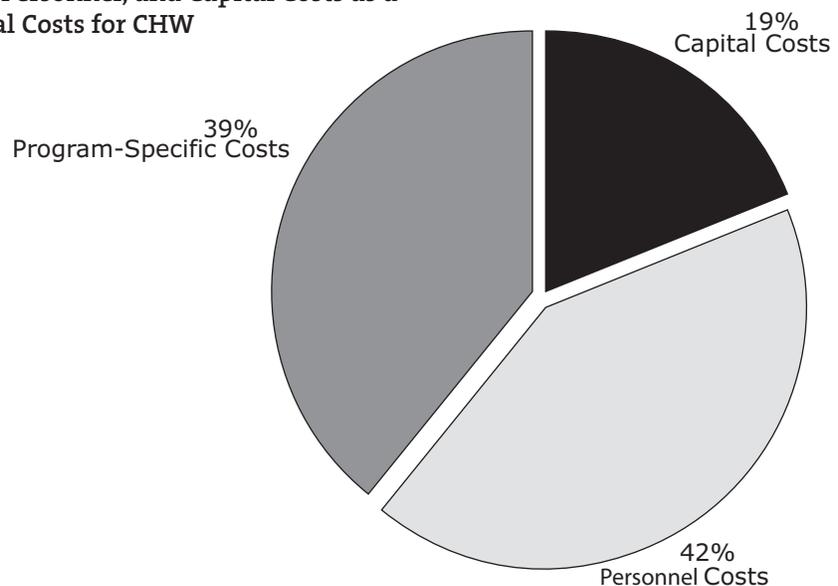


Figure 3.2 Annual Total Cost by Funding Source

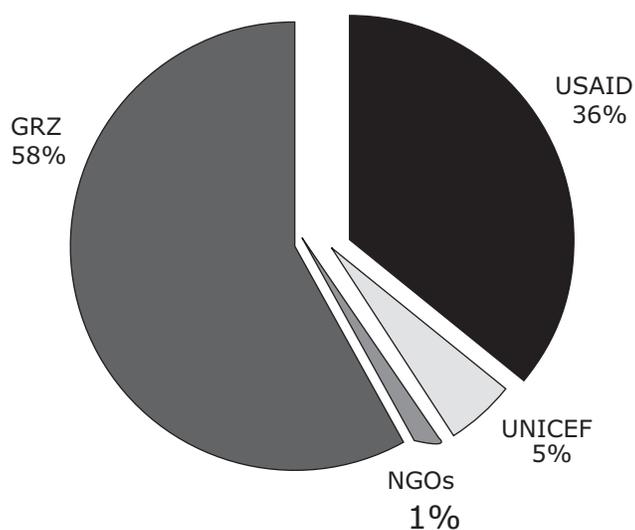


Table 3.2: Program-Specific Costs for NIDs 2000*

Cost Item	Amount	
	K Million	Dollars
Vitamin A, Vaccines, needles, Syringes	1,791	564,700
Cold Chain Spares	133	41,959
IEC	312	98,322
Central-Level Workshops	6	1,923
Provincial Training	158	49,920
District Training	61	19,385
Social Mobilization	301	95,056
Cold-Chain Support Visits	33	10,550
Distribution	75	23,741
District Operational Costs	1,154	363,964
Fuel	12	3,681
Report Writing	7	2,234
Surveys	92	28,982
Total	4,136	1,304,417

* Due to time and resource constraints, personnel and capital costs for NIDs could not be accurately estimated.

Figure 3.3 Annual Program-Specific by Funding Source — CHW

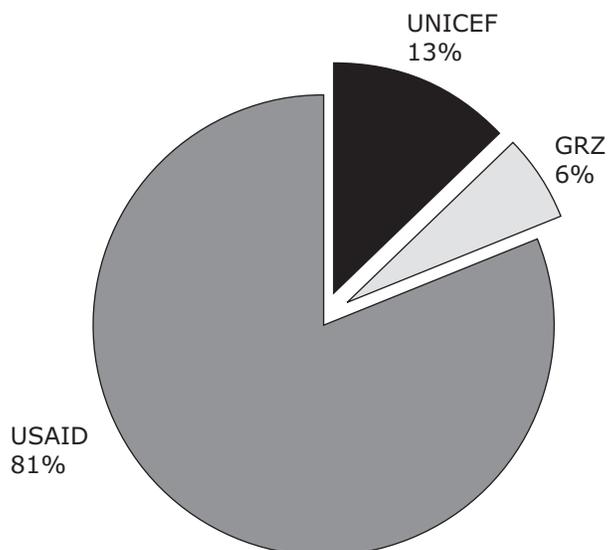
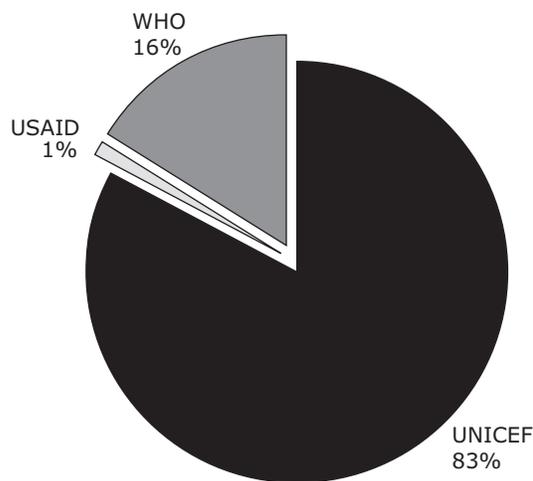


Figure 3.4 Program-Specific Cost by Funding Source — NIDs



As summarized in table 3.2, NIDs program-specific costs for 2000 are about k4 billion or \$1.3 million. A comparison of tables 3.1 and 3.2 reveals that average program-specific cost per district per round is about 3.5–4 times higher for NIDs than for CHW (\$43,000 and \$11,700, respectively).⁵

Cost by Funding Source

Costs by funding source for CHW are described in table 3.3 and figures 3.2 and 3.3. The Government of the Republic of Zambia (GRZ) provides 58 percent of total costs and USAID 36 percent. UNICEF contributes five percent of total costs, and NGOs 1 percent.

USAID provides 81 percent of program-specific costs for CHW, UNICEF 13 percent, and GRZ six percent. GRZ contributes most personnel costs and capital costs.

Program-specific costs by funding source for NIDs are summarized in table 3.4 and figure 3.4. UNICEF contributes 83 percent of program-specific costs, WHO 16 percent, and USAID about one percent.

Average Cost per Child Dosed

As table 3.5 indicates, the average cost per child dosed twice per year during CHW is K1,726, or \$0.48 — if only program-specific costs are considered. The annual average is K4,414, or \$1.23, if personnel and capital costs are also included.⁶

Table 3.3: Annual Cost by Funding Source — CHW

Source	Funding			
	Program-Specific Costs		Total Costs	
	Dollars	Percent	Dollars	Percent
GRZ	50,443	6	1,243,032	58
USAID	686,377	81	789,161	36
UNICEF	109,153	13	109,153	5
NGOs	—	—	21,761	1
Total	845,973		2,163,107	

Table 3.4: Program-Specific Cost by Funding Source — NIDs 2000

Source	Funding	
	Dollars	Percent
GRZ	—	—
UNICEF	1,079,199	83
WHO	213,234	16
USAID	11,984	1
Total	1,304,417	

Table 3.5: Annual Cost per Child Dosed During CHW

Cost Category	Population Dosed	Distribution Costs		Cost per Child	
		K million	\$000	K million	Dollars
Program-specific costs	1,768,000	3,052,269	846	1,726	0.48
Personnel costs		3,288,498	911	1,860	0.52
Capital costs		1,463,721	406	828	0.23
Total Costs		7,804,488	2,163	4,414	1.23

⁵ Computations of average cost per district are based on the fact that the 2000 NIDs program was implemented in 35 districts, and the February 2001 CHW campaign was carried out in all 72 districts.

⁶ Program-specific cost per child dosed during the 2000 NIDs campaign is as follows:

Population Dosed	Cost Category	Distribution Costs		Cost per Child	
		K million	\$000	Kwasha	Dollars
874,435	Program-specific costs	4,136	1,304	4,730	1.49

Comparing the results in this table with those in Table 3.5 reveals that average program-specific cost per child per round of vitamin A supplementation is more than 6 times higher for NIDs than for CHW (\$1.49 and \$0.24, respectively).

Table 3.6 presents annual costs per child dosed with vitamin A in selected countries. Estimated average costs per child dosed in Zambia are lower than those estimated in other countries for which data are available (except Ghana) — despite the fact that the intervention in Zambia included more than just vitamin A. This finding applies to both program-specific and total costs. Two factors account for the cost differential between the Ghana and Zambia programs: first, the capsule-distribution campaign in Zambia is longer (one week in Zambia and three days in Ghana); second, while the Ghana program is limited to vitamin A, CHW in Zambia provides many additional services including de-worming, health education, immunization, family planning, prenatal care, and growth monitoring.

At \$0.67 per child dosed, program-specific costs in Nepal are not disproportionately higher than those in Ghana and Zambia. The similarity may be explained by the fact that the three countries use a campaign approach that has achieved high coverage due to the extensive promotion of the special events surrounding vitamin A distribution.

Cost-effectiveness of the CHW Program

While cost information is needed to assess affordability, cost-effectiveness analysis helps

Table 3.6: Annual Cost per Child Dosed in Selected Countries

Country	Cost (in Y2000 Dollars)	
	Program-Specific	Total
Zambia (1)	.48	1.23
Ghana (2)	.25	.90
Nepal (2)	.67	
Peru (2)	1.42	3.44
Peru (3)	—	1.82
Guatemala (2)	3.25	
Philippines (4)		3.27

Notes —

- (1) Two CHW-linked rounds
- (2) Two free-standing vitamin A campaigns
- (3) Two rounds integrated into routine EPI
- (4) One vitamin A campaign and one NIDs-linked round

Source: Study estimates; Rassas et al.

identify interventions that use resources most efficiently. Cost-effectiveness may be defined as the achievement of maximum provision of goods or services from given quantities of resource inputs. One method commonly used to assess cost-effectiveness of vitamin A relative to other health interventions is to compare cost per death averted for each intervention.

Assuming a 23 percent reduction in mortality rate of children between 6 and 59 months due to the CHW program,⁷ cost per death averted in Zambia is estimated at about \$63, if only program-specific costs are

⁷ This assumption is based on the conclusion in Beaton et al. 1994 — the most widely quoted meta-analysis of vitamin A supplementation on mortality — that vitamin A supplementation resulted in an average reduction of 23 percent. Coverage figures by study ranged from 58 percent to 93 percent, with most over 85 percent. It is also worth noting that the number of deaths averted depends upon the underlying birth and death rates for the population, as well as upon the effectiveness of the program. We have used the most current available estimates of fertility and mortality. In subsequent years as these rates change, so will estimates of deaths averted.

It should, however, be noted that a 23 percent reduction in mortality due to CHW in Zambia may be a conservative assumption for two reasons. First, the CHW program in Zambia is likely to result in a larger reduction in mortality rate than under similar vitamin A programs in other countries because the Zambia program includes several health interventions in addition to vitamin A.

Second, a recent demographic and health survey in Zambia (DHS 2002) shows a 15 percent reduction in under-five mortality rate between 1992-1996 and the period between 1997-98 and 2001-02. Knowledgeable individuals at USAID/Zambia believe that this decline — which reversed an increase in under-five mortality rate between 1987-91 and 1992-96 — was a direct result of the CHW program. The positive impact of the CHW program is indeed likely to be much higher than the 15 percent reflected in the survey because other negative factors are likely to have offset some of the positive effects of CHW during the same period. Nutrition status is the most important of these factors. It is remarkable that the under-five mortality rate declined between the two periods under consideration despite worsening malnutrition (the under-five stunting was 42 percent in 1996 and 47 percent in 2001-02) — suggesting that the impact of CHW has more than offset the negative effects of malnutrition (*continued on next page*).

considered, and \$162 when all personnel and capital costs are also included. Under alternative assumptions, the estimated cost per death averted ranges between \$35 and \$107 for program-specific costs and between \$90 and \$275 for total program costs.⁸

Even when only vitamin A is considered, cost per death averted in Zambia compares

favorably with estimates from other countries. Based upon data for 10 countries in 1998 and 14 countries in 1999, incremental cost per death averted⁹ was estimated at \$72 (with a range of \$36–142) in 1998 and \$64 (with a range of \$32–126) in 1999. Average total cost per death averted was \$310 (with a range of \$157-\$609) in 1998 and \$276 (with a range of \$139-\$540) in 1999. (Ching et al.).¹⁰

.....
 (Footnote 7 continued) The CHW program has also more than offset the increased incidence of malaria and HIV in recent years. The biggest killer of young children in Zambia has been malaria. In 1992-96, about one-quarter of malaria cases failed outpatient treatment due to Chloroquine resistance. More than one-third failed treatment over the following four years. Between the two periods, there was also an increase of about 20 percent in the outpatient consultation rates for malaria (i.e., for febrile illness, presumed to be malaria). Since most in-patient treatment was also done with Chloroquine, in-patient malaria case-fatality increased through the 1990s.

Also, over the period between the last two DHS surveys HIV prevalence in sentinel survey results remained flat, and there were no widespread effective interventions to reduce mother-to-child transmission. So there is no reason to believe that pediatric AIDS cases have declined. Rather, they more likely have increased due to a probable increase in the number of incident pediatric HIV cases through the early 1990s.

8 The following table provides a detailed description of those results.

(a) Reduction in mortality rate under alternative scenarios		35%	30%	23%	15%
(b) Number of births per year *	435,670				
(c) Annual mortality rate for children 6-59 months **	102 deaths per 1000 births				
(d) Number of deaths among children 6-59 months (with CHW program): (b)X(c)/1000	44,634				
(e) Expected number of deaths among children 6-59 months without CHW: (d)/[1-(a)]		68,668	63,763	57,967	52,511
(f) Number of deaths averted (e)-(d)		24,034	19,127	13,332	7,877
(g) Annual program-specific costs	\$845,973				
(h) Annual total costs	\$2,163,107				
(i) Cost per death averted (program-specific cost): (g)/(f)		\$35	\$44	\$63	\$107
(j) Cost per death averted (total cost): (h)/(f)		\$90	\$113	\$162	\$275

Notes —

* Calculations using DHS 2002 and U.S. Bureau of the Census International Database online (midyear 2001 estimates.

** Calculated from data in DHS 2002 as follows:

- Use the following figures for infant mortality rate (IMR) and under-five mortality rate (U5MR): IMR=95 per 1000 births; U5MR=168 per 1000 births.
- Calculate mortality rate for children 12-59 months of age (MR 12-59 months) as the difference between U5MR and IMR: 168-95=73 per 1000 births.
- Calculate mortality rate for children 6-11 months of age (MR 6-11 months) assuming that 69% of infant mortality — most recent estimate in DHS 1996 — occurs before age 6 months: IMR x (1-0.69) = 95 x (1-0.69) = 29.45
- Calculate mortality rate for children 6-59 months of age as the sum of MR 6-11 months and MR 12-59 months: 73+29.45=102.45 deaths per 1000 births.

9 Incremental costs and average total costs are defined in Ching et al. as follows:

$I = (v * k * d) / z$ and $A = (b * k * d) / Z$; where I = incremental costs per death averted above the cost for polio immunization alone, A = average total cost per death averted for delivering vitamin A supplements alone, v = assumed incremental cost per child reached in addition to costs already incurred for polio vaccination, b = assumed average total cost per child reached for delivering vitamin A supplement alone, k = total number of children reached in a campaign, d = total number of doses administered (or campaign held) during one year, and Z = estimated number of deaths averted with vitamin A supplementation. Since I and A are comparable to, but not identical with, program-specific and total costs as defined in the present study, some caution is necessary when comparing estimates in the two studies.

10 Several factors accounted for the variations in the costs per death averted by country, including campaign strategy use, number and proportion of the child population targeted and reached, and variations in child mortality rates among countries.

The Zambia CHW program is highly cost-effective relative to many other public health care interventions.¹¹ When measured in terms of cost per death averted, the CHW program compares favorably with malaria chemoprophylaxis, breast-feeding promotion, and measles immunization, and is measurably more cost-effective than most other programs such as cholera immunization and health interventions associated with diarrheal disease (Table 3.7).

Thus, it would appear that the campaign-based approach to vitamin A supplementation now practiced in Zambia more than justifies its cost.

Table 3.7: Cost-Effectiveness of the Vitamin A Supplementation Program in Zambia Relative to Other Public Health Care Interventions *

Intervention **	Cost per Death Averted ***
Vitamin A Supplementation through CHW in Zambia	Program-Specific Costs: \$63 (a) Total Costs: \$162 (a)
Tuberculosis (4)	\$20-\$76 (d)
Malaria Chemoprophylaxis (1)	\$145 (c)
Insecticide-Treated Bednets (2)	\$188 (c)
Breastfeeding Promotion (5)	\$190 (a)
Measles Immunization (5)l	\$243 (a)
Rotavirus Immunization (5)	\$375 (a)
Measles Outbreak Response Immunization (3)	\$600 (b)
Acute Respiratory Infection (4)	\$379-\$1,610 (b)
Malaria (4)	\$78-\$990 (a)
Malaria Vector Control (5)	\$1,411 (a)
Complications of Pregnancy (4)	\$836-3,967 (b)
Cholera Immunization (5)	\$3,405 (a)
Oral Rehydration Therapy (5)	\$3,835 (a)
Diarrheal Diseases (4)	\$1,000-\$10,000 (b)

Notes —

* Figures for interventions other than vitamin A are not for Zambia.

** Since the list of interventions contained in this table is not based on a comprehensive literature search, it is presented for illustrative purposes only.

*** Unless otherwise specified, more than one figure indicates a range of estimates, rather than a single estimate.

(a) Y2000 dollars; (b) Y1993 dollars; (c) Y1990 dollars; (d) Y1989 dollars.

Sources: (1) Picard et al. 1993, (2) Picard et al. 1992, (3) Sniadack et al. 1999, (4) Cited in Filmer and Pritchett, (5) Cited in Fiedler

11 It is extremely important to stress that the estimated results supporting this conclusion should be taken to represent an order of magnitude, rather than an absolute level for several reasons. First, the potential sources of estimation error in this study as well as in all the studies reviewed place certain limitations on the cost estimates used for comparison. Second, the assumptions used to derive estimates vary widely among studies. Third, it is not clear in most instances whether program-specific or total costs are used. Even when both cost categories are spelled out, it is not apparent that all costs are included in the estimates. This omission applies more particularly to capital and labor. It is evident that these and other limitations carry over into the cost-effectiveness comparison. It should also be noted that since labor and capital are not always adequately accounted for, it is not always obvious whether program-specific or total costs should be used for comparison. For this reason, it was decided to include estimates for CHW using both program-specific and total costs in Table 3.7.

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