



## TECHNICAL BRIEF

# The Costs of Micronutrient Interventions: Policy Issues and Interventions

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## INTRODUCTION

### The Societal Costs of Micronutrient Deficiencies

Vitamin and mineral deficiencies negatively impact the ability of individuals, households, communities, and nations to lead healthy and productive lives. Reducing micronutrient deficiencies can reduce the rate of maternal and child mortality, morbidity, and disability and increase adult physical work capacity and productivity. Proper nutrition also improves cognition and learning. In school age children, micronutrient deficiencies have been shown to reduce a child's ability to attend school and pay attention. Addressing micronutrient deficiencies increases school attendance, which contributes to greater productivity and income in adult years.

### Interventions that Work

There is ample evidence that micronutrient programs work. Supplementation and fortification programs have been demonstrated to be effective in improving micronutrient status in a variety of country settings and in programs of widely varying scale. Although food-based strategies that promote increased dietary diversity and intake of vitamins have also been found to be effective, most of these interventions have been small in scale.

This brief will discuss the cost analyses and factors involved in planning and implementing successful programs, focusing on supplementation and fortification. Before looking specifically at supplementation and fortification programs, we should briefly discuss the value of cost studies in general.

## WHY DO COST ANALYSIS?

### Promoting Evidence-Based Policies at the National, Regional, and Local Level

Cost studies are usually conducted to provide budgetary estimates or to estimate the costs of a program initiative, such as scaling-up or replication. The way in which a cost study is designed is important for how results might be used. Carefully designed studies can provide relevant information for policy development and program management. Activity-Based Costing—a methodology with the most practical applications for programs—structures cost analysis around major program activities. This method can provide a detailed understanding of the program and facilitate identifying:

- The levels and composition of costs
- Variations in how a program is implemented over time and/or space and the cost implications
- The means and the costs of increasing a program's coverage
- How a program might be made more effective and more cost-efficient

Cost analyses can also help to standardize a program, identify management domains within an organization or program, provide a system of accountability, improve organizational capability, and provide incentives to improve the performance of the program. They can also provide a framework to revamp an existing cost accounting system into something more managerially relevant and provide a routine source of data for budgeting and annual work plans.

## Enhancing the credibility of the Ministry of Health

A cost analysis can assist the Ministry of Health to better negotiate with the Finance Ministry for necessary program funding by bringing greater focus, precision, and consistency to the national nutrition strategy. This greater level of specificity can enhance the credibility of the Ministry of Health in its annual budget negotiations with the Finance Ministry. It can also improve the likelihood that nutrition will be funded in national health programs.

## LESSONS FROM THE MICRONUTRIENT PROGRAM LITERATURE

### Estimates of the Cost of Micronutrient Interventions

Since the 1993 publication of the World Bank's Disease Control Priorities in Developing Countries and the World Development Report: Investing in Health, micronutrient interventions have been recognized as being among the most cost-effective public health interventions. A glance at the still relatively limited literature, however, reveals that there is enormous variation in the estimated costs of different micronutrient interventions. Factors such as the types of platforms used to deliver micronutrients and other country- and program-specific characteristics, together with differences in costing methodologies, all contribute to the variability in cost estimates found in the literature. As a result, it is not useful to generalize cost estimates across different types of programs and countries. In order to extract the most useful information from cost studies, it is important that estimation techniques be more transparent and more specific in describing the programs, methods, and results.

### Indicators for Measuring the Costs of Programs

The ideal indicator to measure costs needs to capture the ultimate objective of the program, such as the number of persons who experienced a reduction in micronutrient deficiencies as a result of the program. This comparator, however, is rarely used because there is a dearth of individual-specific data on micronutrient status, primarily because this information is relatively difficult and expensive to collect and maintain.

As a result, costs are usually measured using a compromise, second-best indicator, which is often the number of persons reached in a program (also referred to as "program coverage"). The most common cost measure is the average (or unit) cost

per beneficiary. Several other measures frequently used include: the average cost per deficient person, (sometimes referred to as the average cost per "useful" coverage); the average cost per disability-adjusted life year (DALY); and the average cost per death averted. In addition, there are some cost measures that are reported for specific types of program interventions. Vitamin A supplementation studies, for example, frequently report the cost per dose or capsule.

## SUPPLEMENTATION PROGRAMS

### Program Structures and Costs

The literature contains inadequate discussion of intervention characteristics that have important policy, program design, and cost implications. The major cost reviews, for instance, refer to the cost of "supplementation programs" without distinguishing between supplementation programs that are routine service-based, campaign-based, or in-facility versus outreach-based. Supplementation program approaches are not standardized. The role and significance of personnel also vary substantially by the type of supplementation program. Moreover, there are many country-specific variables that can affect costs.

Variations in the cost per person differ significantly in countries where cost-effectiveness analyses of alternative intervention configurations were investigated. Cost estimates are affected by country characteristics, such as prevalence, composition, rural-urban distribution, and geographic clustering of the deficiency. Other important factors include: key population characteristics, geographic and climatic conditions that affect logistics, packaging and storage requirements, and the Ministry of Health's programs and treatment protocols, including its definition of target populations, the specific ways in which it structures and implements a particular program, and its regulatory capacity.

Characteristics of a health care delivery system also affect cost estimates. Factors such as the composition, size, and distribution of its infrastructure, and the rate of health care utilization, will affect supplementation program coverage and costs. The general level of wages of a country is an important determinant of costs of the program, given the high proportion of personnel costs included in the total costs.

### Common Cost Structures of Supplementation Programs

Supplementation programs have different implementation mechanisms, contributing to the large variations in their cost levels. An analysis of seven vitamin A supplementation cost studies reveals common cost structures. The studies found the following:

- Personnel costs were the single most important cost in five of the seven programs accounting for an average of 69 percent.
- All of the programs relied upon volunteers, and all valued the time of volunteers in estimating their costs. The volunteers represented 10 to 30 percent of total program costs and averaged around 20 percent of total personnel costs.
- The second major cost category, “program-specific,” generally accounted for about 30 percent of total costs.
- The third major cost category—capital costs—was estimated in only three of the seven studies. They were uniformly the least important category of costs in the three analyses, although their importance varied substantially across the three countries.

## VITAMIN A PROGRAMS

Most policy discussions about the costs of vitamin A focus exclusively on program-specific costs and substantially underestimate the cost of vitamin A supplementation programs. The major cost of the vitamin A supplementation programs is not the supplement itself, but rather the costs of the system used to deliver it. Vitamin A capsules constitute a mere six percent of total program costs. With personnel accounting for more than two-thirds of total costs, a fundamental determinant of the level of supplementation program costs (and a source of considerable variation in the cost of programs) is how programs are organized and implemented, and what types of personnel (permanent, salaried versus temporary workers versus volunteers) are involved.

### The Cost of Vertical versus Integrated Service Campaign Approaches

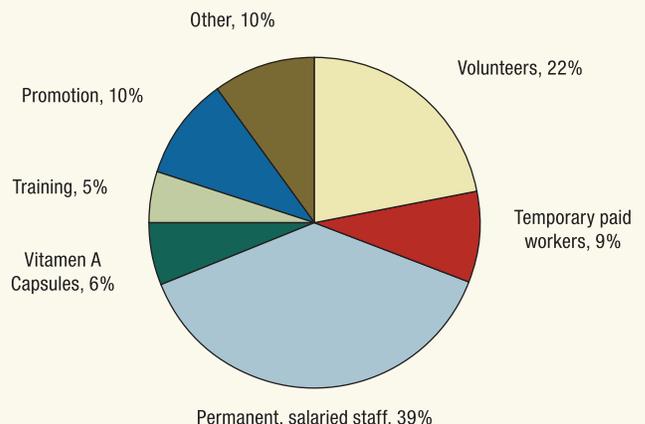
Integrated approaches are considerably cheaper than stand-alone approaches. When vitamin A supplementation was integrated with routine Expanded Program in Immunization (EPI) services in Peru, the cost was 55 percent of the cost of distributing them through a vitamin A stand-alone, campaign-based approach (Baiocchi and Campos, 1998). In the Philippines, the cost of a vitamin A capsule distributed through a stand-alone micronutrient campaign day was estimated to cost nearly twice as much as a distribution program linked with a National Immunization Day (NID) (Fiedler et al, 2000). Similarly, a Zambian study that estimated the cost per child of two distinct mechanisms which included vitamin A capsule distribution, found that the average cost per child of a NID round was more than six times that of a child health week (Rassas et al, 2004).

The composition of services provided in campaign approaches has changed. Campaign approaches are still often considered to be vertical programs. However, this is no longer true and many programs have evolved to add de-worming, nutrition education, iron distribution, and catch-up immunizations, among other services. This is perhaps most dramatically demonstrated by the recent growth in what have come to be called Child Health Days or Child Health Weeks. Child Health Days or Child Health Weeks have now been held in more than 30 countries. These have grown in popularity because:

- Campaign-style services provide households with an opportunity for “one-stop shopping”; they are able to economize on the transaction costs related to obtaining services.
- The importance and perceived value of integrated service campaigns is manifested in two ways: (1) the high and still growing coverage rates of the programs in these countries, and (2) the enormously important role of volunteers in these programs that increase household perception of their value.
- Supply-side considerations are relevant in the development of more integrated campaign approaches. In countries with low health care delivery system coverage and/or capacity, integrated service campaigns provide a way in which key services can achieve adequate coverage. Even 20 years after the launch of the Expanded Program in Immunization, in many countries there remain key supply-side constraints to the achievement of adequate levels of coverage.

### Common Cost Structure of A Supplementation Programs

(adjusted median values based on eight studies)



## INCREASING COSTS WITH INCREASING COVERAGE AND THE GROWING NEED TO TARGET BENEFICIARY POPULATIONS

The impact of a vitamin A supplementation program on child mortality depends on the coverage of the program. It is estimated that between 70 and 85 percent of the population must be covered by a vitamin A program if the country is to realize the program's full potential mortality impact. Relatively few country programs reach these levels of coverage, and to do so, will likely result in higher costs per child than current efforts have shown. Unit costs are likely to increase because attaining progressively higher rates of coverage requires reaching more remote and hard to reach populations.

### Cost-Effective Targeting of Supplementation

As countries with national supplementation programs begin to adopt fortification, there will be an opportunity to scale back the supplementation program efforts and make them more targeted to less accessible segments of the population. The development of a household-level food consumption analysis is particularly worthwhile for a national supplementation program to be transformed into a targeted effort. The costs of devising and applying a targeting method will mean higher initial and recurrent costs of maintaining the new program. However, as fortification comes to provide greater coverage, targeting can become a means to save substantial amounts of supplementation program resources. Fortification will become an increasingly important tool for better ensuring high coverage rates—with its attendant high mortality impacts—and will become a cost-effective strategy in a growing number of countries.

## FORTIFICATION PROGRAMS

### Different Program Structures and How the Structural Differences Affect Costs

The most important country-specific factors influencing fortification costs are food consumption patterns and the industrial structure of the food fortification vehicle (the amount of the product produced, where and how it is marketed and the degree of concentration in the industry). Other considerations include:

- The size, distribution, and degree of the industrial concentration of potential food fortification vehicles are variables that must be analyzed when assessing the feasibility of a fortification intervention. When the number of firms is judged to be “unmanageable” (in

terms of the costs of monitoring and enforcement), or the location of the plants is not accessible, fortification is generally deemed too expensive or simply “not viable.” There is evidence, however, that even relatively minor advances in fortification programs—when only a small proportion of the population consumes the food vehicle—can have an important “demonstration or feasibility” effect.

- Other aspects of the economic environment, including differential rates of taxation and tariff levels, different interest rates, and different levels of price competition, constitute other potential sources of significant variation in the estimated costs of a fortification program. For example, the import duties on nutrients in some Asian countries vary from 1 percent in Thailand (Asian Development Bank, 2004) to 47 percent in Bangladesh (Dary and Rassa, 2004).
- The costs that government incurs monitoring industry's fortification efforts constitute another factor that can add to variation in costs. In many studies, these costs are ignored or neglected. The magnitude of these costs will vary substantially and will depend on whether or not the government already has this type of capability—as demonstrated by whether it is monitoring food safety (as was the case in the Philippines and South African studies), or whether it has to develop this capability (as in Zambia).

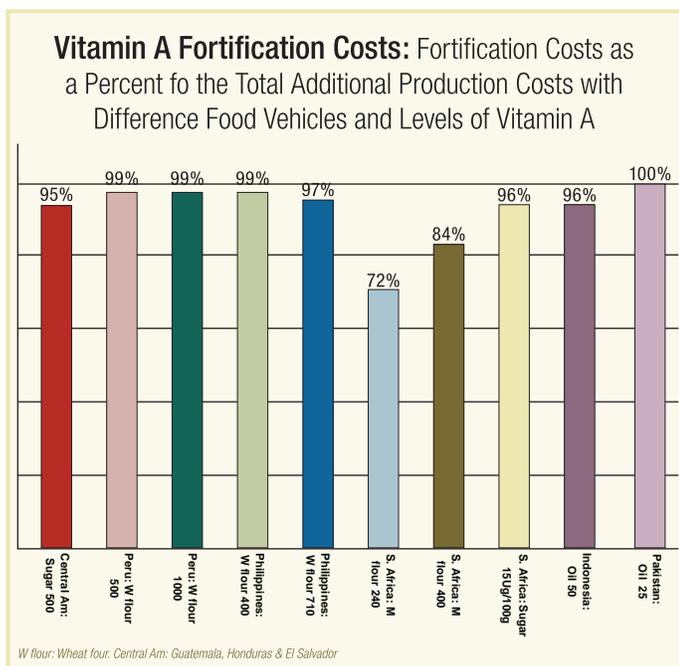


**A child receives a dose of vitamin A.**

## The Common Cost Structures of Fortification Programs

Fortification programs have cost structures that are more concentrated than those of supplementation programs. They are composed overwhelmingly of the cost of the micronutrients themselves, which accounts for a mean of 77 percent and a median of 83 percent of the food industry's incremental total costs, and a mean of 93 percent and a median of 96 percent of production costs in the studies reviewed.

The graph below shows the percentage of annual production costs accounted for different levels of vitamin A fortification using different food vehicles.



- Changing the nutrient mix also affects the rate at which it is mixed with the food vehicle. This too affects costs. As a result, wheat flour fortification costs can vary by a factor of nearly nine, depending upon the nutrient composition used.
- The structure of the food industry has a bearing on costs both in terms of costs to the industry and the cost of government monitoring and enforcement.
- Marketing, distribution, and customer use patterns can influence costs.

## Fortification Program Cost Findings Inform Policy

Fortification programs, implemented through the market, involve a bigger role for the private sector. Developing an effective fortification program requires either legislation that mandates private sector participation or effective communication and partnering with several different public and private sector agencies. Governments often find that designing and implementing a fortification program is not an easy task and the requirements are very different from those of a supplementation program. Fortification programs involve governments taking on what are commonly non-traditional roles and responsibilities that are essential to the development and maintenance of the program.

## The Role of Government in Quality Assurance, Monitoring, and Enforcement of Fortification

For purposes of cost analysis, neither legal mandates, nor the actual fortification of food can be equated with the effective delivery of a “properly” fortified food product to the final consumer. What happens to the nutrient—whether it is appropriately mixed, packaged, stored and transported, sold in a timely manner, and how it is ultimately prepared and consumed in the home, all constitute potential pitfalls to the delivery of micronutrients. The extent that these pitfalls are addressed constitute other potential sources of variation in cost estimates with cost measures that incorporate impact measures (such as cost per level of micronutrient intake, cost per DALY gained, or cost per death averted).

Fortification is a process that requires on-going government monitoring and enforcement to ensure compliance if foods are to be properly fortified and if fortified foods are to be properly distributed. These types of activities are not always included in what is considered to be a fortification program and have contributed to the non-comparability of cost estimates. The Asian Development Bank's Regional Technical Assistance Project fortification studies estimate government costs are

## Lessons from the Fortification Program Literature Review

- Fortification intervention costs vary substantially by the type of food vehicle, the characteristics the food vehicle's industrial structure and the composition and level of the nutrient(s). In order to make valid comparisons when juxtaposing the costs of different fortification programs, it is essential that these characteristics of programs and their cost impacts be described and taken into account.
- Variation in the nutrient mix is a potential source of variation in the cost of fortification, given that nutrient costs are commonly 85 percent of the total cost of fortification.

related to more than just quality assurance and monitoring. They include the costs of preparing the policy environment (including the costs of legislation, advocacy) as well as social marketing and education. This new, more inclusive approach, furthers the understanding of the fundamental importance of developing a collaborative, working relationship between the public and private sectors.

## POLICY ISSUES AND THE FUTURE OF MICRONUTRIENT PROGRAM PORTFOLIOS

### Cost-effectiveness versus coverage and public health impacts

Several studies have identified fortification as the most cost-effective intervention. However, these studies also showed that fortification programs inadequately address the micronutrient deficiencies of program participants (Fiedler et al, 2000).

- If the prevalence of deficiencies is going to be adequately reduced, cost-effectiveness cannot be the only criteria for informing program choice and other policy decisions.
- The optimal portfolio of interventions programs is increasingly being recognized as a critical micronutrient policy issue. It has now become the general consensus that the best approach is not either fortification or supplementation, but a combination of different programmatic interventions.

### Initial and Likely Future Strategic Policy Issues

There is a need to establish a standardized set of fortification regulatory requirements and to estimate what such a system would cost. Estimating the initial investment and recurrent costs of these requirements would entail:

- Developing a minimal set of standardized functions and basic structures for regulatory programs
- Investigating the possibility for developing regional quality assurance/regulatory capabilities where indicated by considerations of: market structure, economies of scale, and government laboratory capabilities
- Collecting data on market structure and market flows to promote evidence-based decision-making, e.g. Micronutrient Initiative's recently developed pan-Africa analysis (MI, 2007)
- Promoting regional harmonization in fortification requirements to ensure those who do not fortify are not

allowed a competitive advantage.

The absence of consumption data for potential food vehicles often constitutes the greatest impediment to developing a fortification program (Micronutrient Initiative, 1997). To address this glaring data gap, it is important to:

- Conduct and analyze food consumption surveys for optimal micronutrient programs and to develop tools for targeting.
- Monitor the dynamics of changing markets, population characteristics, population residential locations (including urban-rural migration), and changing food consumption habits and patterns in order to understand changing structural conditions affecting viability and strategic approaches to supplementation and fortification program design.

Devising strategies for scaling-down and targeting supplementation programs will be beneficial as fortification comes on-line. There remains an important role for supplementation programs. We need to better understand programs and how their role is likely to change in the future as fortification becomes more common. With declining National Immunization Days, what are the costs, effectiveness and coverage tradeoffs of alternative ways of re-structuring programs? Under what conditions are Child Health Weeks an attractive and sustainable option? Is it feasible to graft a micronutrient intervention component onto other community-based programs? What promise do sub-national strategies that play to the strengths of alternative delivery system options hold? In countries that do not have supplementation programs, what are the cost and coverage of different potential program structures, given the country's specific characteristics and initiatives (e.g., decentralization)?

## CONCLUSION

Cost studies can play an important role at the individual country level in helping to identify how and where to improve the efficiency and coverage of programs and thereby make resources "go further" and contribute to the programs becoming more sustainable. They can also help to identify geographic areas in which micronutrient programs are particularly expensive and/or have especially low coverage rates so that these areas can be targeted for alternative delivery mechanisms and/or more intensive assistance.

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