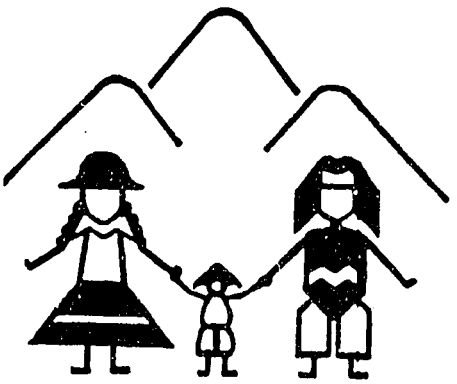
The Census-Based, Impact-Oriented Approach and Its Application by Andean Rural Health Care in Bolivia, South America

Volume I

The Census-Based, Impact-Oriented Approach
and a Summary of the Results Achieved
by Andean Rural Health Care



THE CENSUS-BASED, IMPACT-ORIENTED APPROACH AND ITS APPLICATION BY ANDEAN RURAL HEALTH CARE IN BOLIVIA, SOUTH AMERICA

Final Report

to the United States Agency for International Development

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Henry B. Perry, III

Program Advisor
Andean Rural Health Care
Box 216
Lake Junaluska, North Carolina 28745

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EXECUTIVE SUMMARY

As the global child survival movement approaches the year 2000, the year of "Health for All," it is an appropriate moment to consider new ideas and approaches which build on the strengths of the selective primary care approach (otherwise known as GOBI or GOBI-FF*) and which offer promise for improved effectiveness. Toward this end, the AID PVO Child Survival Program has made possible an evaluation of the census-based, impact-oriented (CBIO) approach to child survival which has been under development in Bolivia by Andean Rural Health Care (ARHC) since 1987. This document describes the principles of the CBIO approach, the manner in which this approach has been implemented by ARHC, and the results achieved.

The CBIO approach involves determining the health priorities of a community or set of communities from an epidemiological perspective as well as from the perspective of the community members themselves. Based on available resources, a program is developed which addresses these health priorities and which evaluates the impact of program activities on the health status of the community. The approach is "census-based" because it involves community censuses to identify all members of the community and the most frequent, serious preventable or treatable health problems in the community. It is "impact-oriented" because the overarching goal of this approach is to improve health and to show that health has been improved.

In the Bolivian settings where ARHC has its field programs, home visitation has become an integral part of the CBIO approach. Through a process known as routine systematic home visitation, all homes in the program area are visited on a regular basis, usually at least every six months. Homes with high-risk individuals are targeted for more frequent visitation. Through home visitation, censuses are updated and vital events (births, deaths, and migrations) along with pregnancies are registered. Child survival interventions and basic primary care services are also provided at the time of a home visit if indicated.

The CBIO approach provides another unique advantage, that of being able to measure mortality rates in the communities being

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* GOBI- growth monitoring, oral rehydration therapy for diarrhea, breast feeding, and immunizations.
FF- family planning, food supplementation

served by the program. This approach also provides the opportunity to achieve high levels of coverage of child survival services such as immunizations, ORT use, growth monitoring, and treatment of ARI since all children are identified through the census and can be reached, if necessary, through home visitation. Furthermore, the CBIO approach combines basic primary care services for the entire population with child survival interventions, thereby leading to strong local political support for the program and a greater potential for longer-term sustainability.

Previously, home visitation for provision of child survival interventions and for registration of vital events has not been given serious consideration because of the presumed complexity and the relatively high costs of the endeavor. Given the fact that the evidence documenting improvement in child survival in typical field settings using the more traditional selective, GOBI approach remains limited, it is now appropriate to consider alternatives.

The field staff of ARHC have found the CBIO approach to be workable and highly motivating. They have found this approach to give them a most useful conceptual framework for addressing the health needs of the entire community and for evaluating the results of their efforts.

The full document contains a detailed analysis of the CBIO approach at three established ARHC program sites in Bolivia which serve a total of 27,500 people. These sites differ substantially in culture, ecology, disease patterns, and urban/rural dimension. In each of these three program areas, the highest mortality rates are found in children under two years of age. Neonatal mortality and mortality from respiratory causes are relatively high in ARHC's Altiplano program in Carabuco (at 13,000 feet altitude). In the tropical lowland periurban program of Villa Cochabamba/Montero, diarrheal diseases and malnutrition are far and away the leading causes of death. Neonatal mortality there is quite low relative to postneonatal mortality. Second year death rates are as high as first year rates.

Case-control studies of infant and child deaths controlling for ecological zone and age show different risk factors for each program area. In Carabuco, weight loss, having fewer siblings, and having an unmarried mother were associated with a greater risk of death. In Mallco Rancho, lack of growth monitoring and immunizations was associated with a greater risk of death. In Villa Cochabamba/Montero, evidence of growth faltering, having a mother with no formal education, and having a mother who spoke no Spanish were associated with an increased risk of death.

Having this type of information makes it possible for local programs to more carefully target their activities for maximal mortality impact.

Locally perceived health priorities in all three program areas include the expansion of primary health care services for all age groups as well as improvements in water and sanitation.

Coverage rates of child survival services are quite high in all three program areas. Complete immunization coverage, for instance, among children 12-23 months of age is above 73% for all three program areas and reaches 85% in Carabuco. The percentage of children who have had four or more growth monitorings during the previous year is 89% for Carabuco and 56% for Mallco Rancho. The percentage of mothers who know how to use oral rehydration therapy (ORT), who have used ORT, or who used it for their child during a recent case of diarrhea is around 50% in Carabuco and Mallco Rancho.

An analysis of infant and childhood mortality data indicate that the probability of death between birth and five years of age in ARHC's established program areas is 46% less than in similar adjacent areas where this approach is just beginning to be implemented and 31% less than in similar areas in Bolivia where this approach has not been applied.

Current estimates are that the entire program can be provided for an annual cost of approximately $9 per capita on average. The non-child survival primary care component costs on average approximately $3 per capita per year. The average cost of the child survival component of the overall program is $44 per child per year. While the child survival component is relatively expensive, our findings show that this approach is effective in achieving high levels of coverage of child survival interventions AND in demonstrating a favorable impact on actual child survival to age five. The cost could be lowered by carefully reducing the numbers of planned home visits, by substituting lower level workers for some higher level workers, and by relying more heavily on volunteers. More intensive efforts to foster local income generation would further reduce external costs.

The CBIO approach has made strong progress in financial sustainability in one of its three established program sites where the program beneficiaries have more financial resources. In terms of other aspects of sustainability, such as local community political sustainability and sustainability of professional resources required for program leadership, the CBIO approach is definitely sustainable.

Individual elements of the CBIO approach could be applied in

other settings in a less intensive way than has been the case at ARHC program sites. Possibilities for a more "streamlined" CBIO approach include selecting a small area for more intensive home visitation to identify the major causes of death as well as to identify risk factors for death. These findings could then be applied on a broader geographic basis (such as an entire health district), particularly with the assistance of highly targeted home visitation throughout the district.

Routine systematic home visitation and more frequent visitation to high-risk individuals are an integral part of the CBIO approach and service delivery. A more cost-effective approach might be to apply home visitation throughout an entire large program area but in a less intensive and a more highly targeted fashion. Thus, all homes would be visited, but less frequently than in ARHC's programs. Homes with high-risk individuals would be visited, but the definition of "high-risk" would be more narrowly defined.

The CBIO approach deserves application in other settings and at varying levels of intensity so that its efficacy and cost can be more rigorously evaluated. The experience with this approach so far is sufficiently positive to justify encouraging its application by other health programs under carefully evaluated conditions.

This approach has the potential of combining the best elements of the selective primary health care movement (GOBI) and the comprehensive primary care movement (Alma Ata) into an affordable, effective, and sustainable program for developing countries. The capacity of the CBIO approach to measure mortality changes gives it the unique advantage of providing much needed mortality impact assessments for policy makers.

The CBIO approach incorporates strategies for child survival program evaluation which have recently been recommended by the Working Group on Effects of Child Survival and General Health Programs on Mortality (Ewbank and Gribble, 1993, p. 3). These include:

a. judging the effectiveness of child survival interventions on declines in age-specific mortality rates;
b. assessing packages of interventions rather than single interventions; and
c. monitoring long-term mortality trends through the regular collection of vital events.

AID and other international health organizations should provide support for the further development and evaluation of the CBIO approach to health care delivery in developing countries.

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VOLUME I.

THE CENSUS-BASED, IMPACT-ORIENTED APPROACH AND A SUMMARY OF THE RESULTS ACHIEVED BY ANDEAN RURAL HEALTH CARE

PREFACE

An earlier version of this document was prepared for the Expert Review Panel which was convened to evaluate the census-based, impact-oriented approach to child survival and the application of this approach by Andean Rural Health Care (ARHC) as a potential useful approach to child survival activities in developing countries. The Expert Review Panel's report about the merits of the CBIO approach is available separately.

This report contains updated information on costs as well as case-control data which were not included in earlier versions.

Everyone associated with ARHC is forever indebted to Dr. John Wyon, Senior Lecturer Emeritus at the Harvard University School of Public Health, for his long-standing interest in ARHC and for his patient sharing of ideas which are now institutionalized at ARHC as the CBIO approach. John's ideas have emerged over the course of a life dedicated to attempting to understand how health programs can effectively serve the needs of people living in economically disadvantaged areas of the world.

The contents of this report reflect the dedication and commitment of the field staff of Andean Rural Health Care in Bolivia, a truly outstanding group who are improving the lives of their fellow Bolivians. They shared freely with me their thoughts and opinions about their work. For this we are grateful.

Many friends and colleagues provided invaluable assistance at every stage of this project. The field staff at each of the program sites in Bolivia were indispensable in providing access to basic data and in interpretation of the data. The staff at the ARHC national office in La Paz including Mr. Nathan Robison, ARHC National Director, were most helpful in coordinating my work in Bolivia for this project. Mr. Joaquin Flores, statistical consultant in Bolivia, provided valuable assistance in data collection and computer data input. My son, Baker Perry, assisted me with the collection of data for the case-control studies included in this report. Dr. Scott Hamilton of the Department of Biostatistics at the University of North Carolina School of Public Health provided critical comments on an earlier version of the mortality analysis.

PREFACE

A number of people provided helpful comments and suggestions regarding the methodology and regarding earlier drafts of this document. Dr. John Wyon provided valuable assistance with Chapter II, with the death analysis, and with general editorial comments. Dr. David Parker of UNICEF provided helpful suggestions regarding the overall structure and content of the report as well as made suggestions for the financial analyses. Dr. Annemarie Wouters of the Johns Hopkins University School of Hygiene and Public Health assisted me with the development of the cost analysis methodology. She also carried out a very careful review of an earlier version of the cost analyses. Mr. David Shanklin, Andean Rural Health Care's Executive Director, provided helpful editorial comments. Ms. Sara Espada, ARHC Program Associate, was invaluable with the final editing. All the members of the Expert Review Panel, in their group discussions about the document at various stages of its evolution, helped me to fashion it into a form which I hope will be both provocative and useful. Of course, I must take final repsonsibility for the contents of this report.

Perhaps ARHC's experience with the CBIO approach will be a small but significant step in encouraging critical thinking by policy-makers, donor agencies, health program managers, and community members themselves regarding the most effective use of the limited resources which are available for health care and health improvement.

Finally, I would like to express my appreciation to the PVO Child Survival Program of the United States Agency for International Development for its support of ARHC's field programs and for support which has made this analysis possible.

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CHAPTER I. THE CHILD SURVIVAL "REVOLUTION" IN CONTEXT

The child survival movement is now completing its first decade and the year 2000, the year of "Health for All," is rapidly approaching. Since the early 1980s, most international health donors, including the U.S. Agency for International Development, have been strong supporters of the selective primary health approach, sometimes referred to as GOBI (growth monitoring, oral rehydration, breast feeding, and immunizations) or GOBI-FF if family planning and supplemental feeding are included. This selective approach, advocated initially by Walsh and Warren (1979), was adopted by most international donor agencies rather than the comprehensive primary health care approach advocated by the 1978 Alma Ata Conference sponsored by the World Health Organization (WHO) and UNICEF (WHO/UNICEF, 1978). The focusing of donor effort on the GOBI approach to child survival heralded the beginning of the child survival "revolution," as it is referred to by UNICEF.

Walsh and Warren (1979), on the basis of a review of the literature at that time, estimated the more comprehensive primary health care approach to cost $2.00 per capita annually while the selective primary health care approach could be provided for $0.25. The cost per infant/child death averted was estimated to be $700 for the more comprehensive primary care compared to $225 for the selective primary care approach.

The greater cost of the more comprehensive primary care approach together with concern about whether this approach would actually lower mortality from the major causes of childhood death around the world led to strong support for the selective, GOBI approach. The selective, GOBI approach was not without its critics, however. Gish (1982), for instance, expressed concern that the selective, GOBI approach would not address perceived needs of program recipients nor would it emphasize continuity and cultural considerations in the provision of health care services. Others have criticized the selective, GOBI approach for not enhancing local capacity to provide primary health care services.

The application of "proven" low-cost child survival

technologies, especially the "twin engines" of oral rehydration therapy (ORT) and immunizations (as AID called them), was seen in the mid-1980s as having the greatest hope of saving the most lives at the lowest cost. This conclusion led to an emphasis on delivering as many vaccinations and ORT packets as possible to needy populations with less concern to identify and reach the highest-risk groups. Similarly, program mortality impact evaluations were not viewed as necessary since these were "proven" technologies and impact could legitimately be inferred or assumed from the provision of immunizations and ORT packets.

Although the growth in the number of child survival services provided around the world during the past decade is truly remarkable, there is little evidence that these efforts themselves have actually improved child survival in routine, ordinary field situations. The data upon which claims of impact are made depend on major assumptions about efficacy and coverage which may be unrealistic in many field situations.

In the 1970s and early 1980s, a number of field studies were published demonstrating impacts on infant and childhood mortality as a result of low-cost child survival interventions (Berggren, et al, 1981; Gwatkin, Wilcox and Wray, 1980; Kielman et al, 1983; Taylor, et al, 1983). During the past decade, however, only limited results have been published about the impact of the GOBI-FF approach on actual child survival in routine field settings. There have been a number of community field trials assessing the impact on child mortality of Vitamin A supplementation (Sommer, et al, 1986; Rahmathullah et al, 1990; West, et al, 1991; Daulaire, et al, 1992) and antibiotic treatment of acute respiratory infection (Sazawal and Black, 1992; Faveau, et al, 1992; Khan, et al, 1990, Datta, et al, 1987, Bang, et al, 1990; Pandey, et al, 1989; Mtango and Nevians, 1989; Pandey et al, 1991). These studies are clinical field trials of closely supervised and monitored single interventions and are therefore not representative of "routine" field situations.

Even though in general there is no question that the GOBI child survival interventions are effective in closely supervised field trials, there is a growing body of evidence which questions the actual impact of these interventions as applied in more typical field situations. For instance, Gerein (1988) found no evidence from a review of the literature that growth monitoring improves nutrition, much less mortality. The Working Group on Effects of Child Survival and General Health Programs on Mortality has just recently reached an identical conclusion (Ewbank and Gribble, 1993, p. 122). A UNICEF supported community-based nutrition program in Iringa, Tanzania, did improve the nutritional status of children in the program area but no impact on mortality was demonstrated (Joint WHO/UNICEF Nutrition Support Programme, 1988). Other experiences with nutrition interventions have not been as promising (Berg, 1991).

A recent review of the past decade's experience at the Bangladesh field site of the International Centre for Diarrhoeal Disease Research (ICDDR) has revealed that childhood mortality from diarrheal disease has not declined in spite of the promotion of ORT (Fauveau, et al, 1992). These same authors (Fauveau, et al, 1991) had previously shown that over half of the diarrheal-associated mortality among children 1-4 at Matlab, Bangladesh, was caused by persistent rather than acute diarrhea and not amenable to resolution with oral rehydration therapy. Acute non-watery diarrhea (also not readily resolved with ORT) was associated with 16% of the deaths among children in this age group as well. Even more surprising, the provision of ORT did not improve the mortality from acute watery diarrhea in this field setting. There have been no evaluations of the mortality impact of ORT in Sub-Saharan Africa (Ewbank and Gribble, 1993, 9. 81).

The effectiveness of childhood immunizations has not been questioned.* What is now being questioned, however, is the epidemiologic relevance of placing priority on this child survival intervention when the diseases for which the vaccines are designed to prevent may not be leading causes of child death in specific populations (Martin, et al, 1992).

Acute respiratory infection, a leading cause of death in children around the world, was not included in the selective approach of GOBI. Walsh and Warren (1979) had placed respiratory infections in the medium priority rather than high priority group because no effective control then existed. There has been a notable delay in the inclusion of ARI treatment as a priority within the selective approach to child survival although this has been changing recently as a result of the controlled clinical trials cited above and other epidemiologic research.

Finally, there has been a growing recognition that in many areas of the world a high percentage of childhood deaths occur during the first three months of life from causes such as prematurity and low birth weight which the GOBI approach could not be expected to affect (Henry, et al, 1990; Costell, 1988).

In addition to these concerns about the child survival strategy of the 1980s, Mosley and Becker (1991) argue that infants and children in developing countries are typically afflicted with multiple disease conditions concurrently, as well as sequentially. Successfully treating one episode of an illness such as acute, watery diarrhea leaves the child at risk for another episode of diarrhea or another type of illness. Furthermore, treating the overt symptom, such as diarrhea, with a

* see Ewbank and Gribble (1993, pp. 26-72) for a recent review of the effectiveness of immunizations in Africa.

highly-focused technical intervention, such as ORT, may in fact be treating only the tip of the iceberg of the problem. The child's underlying nutritional status along with the level of environmental exposure to pathogens may be far more powerful determinants of long-term survival from diarrheal disease than the provision of ORT. Thus, overall improvement in child survival is not assured by a highly technical intervention which does not address the child's complex biological, nutritional, and socioeconomic milieu (Mosley and Chen, 1984).

Reports of longitudinal field programs assessing overall child mortality impact are surprisingly few in view of the importance of this issue for the health of millions of children around the world. I have been able to identify only a small number of programs which have recently attempted to assess and report the impact of their overall impact on child survival.

The Matlab, Bangladesh, program of the International Centre for Diarrhoeal Disease Research reported an approximately 10% reduction in childhood mortality between 1979 and 1981 and a further 32% reduction between 1981 and 1987 as a result of controlled maternal and child health interventions (Chen, et al, 1983; Fauveau, et al, 1990). There is limited published information currently about the Jamkhed Comprehensive Rural Health Project in Jamkhed, India, but a monograph describing this project is soon to be released. The infant mortality rate has apparently been gradually reduced there over more than a decade from 120 per 1,000 livebirths to the low 20s through simple preventive and curative services provided mostly by low-caste and illiterate women selected by the villages (Arole and Arole, in press; Arole, 1987).

Several programs in Africa have reported substantial declines in child mortality rates following the introduction of relatively comprehensive primary care and child survival services. In Mlomp, Senegal, the percentage of children dying before the age of five fell from 37% to 8% over a 15 year period following the introduction of basic health services (Pison, et al, 1993). There was no improvement in the socioeconomic conditions of the area during this period. In four villages in the West-Kiang district of The Gambia the percentage of children dying before the age of five fell from 49% to 11% over several decades as a result of primary care and child survival activities (Lamb, et al, 1984). In Niakar, Senegal, the percentage of children dying before the age of five fell from 50% to 16% following the introduction of child survival and primary care services (Ewbank and Gribble, 1993, p. 136). It is interesting to note that all of these programs demonstrating improvements in child survival provided relatively comprehensive primary care services along with specific child survival interventions.

Finally, it should be noted that a number of studies have

assessed the quality of implementation of child survival activities in typical field situations around the world. These studies have raised serious concerns about the effectiveness of the interventions because of the manner in which they are being provided (Nicholas, et al, 1991).

For all these reasons, there is justifiable concern about whether the investments currently being made in the global child survival movement are actually improving child survival. Ewbank and Gribble (1993), for instance, make the following statement after an exhaustive review of the African child survival experience:

> ...we cannot make strong statements about the overall effectiveness of health programs in Africa....Our first and most important finding is that many of the central elements of most national health programs in Africa have never been evaluated in terms of their likely impact on mortality.... [T]here are very few studies of the effects of health centers and integrated programs on mortality... (pp. 146-7).

Therefore, the following questions are still highly relevant and critical to the well-being of economically disadvantaged people in developing countries: are we doing the right things and are we doing things right? Gadomski, et al (1990) argue that new approaches are needed. They state the following:

> while the direct interventions [growth monitoring, breastfeeding promotion, ORT, immunizations, and so forth] have proved to be highly efficacious and cost-effective in more controlled clinical settings, their large-scale implementation in communities appears to be less so. It is instructive to examine what happens to the effectiveness of technologies when they must be delivered under diverse field conditions, on larger scales, and with fewer resources than in pilot or experimental settings. It appears that simply providing these technologies to developing countries is not the solution for 'health for all' because a variety of socio-political and economic factors modify the potential of these interventions (p. 235).

A final concern which is emerging after a decade of experience with the selective, GOBI approach to child survival is

that child survival programs per se on their own, whether carried out by Ministries of Health or by private organizations, are difficult to sustain. In the case of Bolivia, for instance, a recent report (Martin, et al, 1992) noted that donor organizations encouraged vertically-oriented services beginning in the mid-1980s, particularly for vaccination campaigns. Although this approach was helpful in achieving short-term gains, the Bolivian A.I.D. mission later came to the conclusion that the vertical structure was not sustainable or efficient in the long run (Martin, et al, p. 105).

Private organizations working with the selective, GOBI approach to child survival have found it extremely difficult to generate funds locally for the child survival effort per se. This is because many of the activities involved are preventive or educational in nature while people generally are only willing to pay out-of-pocket for acute curative services, and then only if they believe them to be affordable and of reasonable quality.

Thus, because the selective primary care approach to child survival has fostered a vertically-oriented approach in Ministries of Health which is difficult to sustain and inefficient, and because the selective approach has neglected integration with local health services, the sustainability of this approach has now become a very serious concern.

The past decade of the child survival "revolution" indeed has generated widespread financial and political support for programs based on "proven" technologies which have been assumed to improve child survival. Evidence that child survival in fact has been improved during the past decade in ongoing health programs has been demonstrated in only a small number of field studies from around the world. It is particularly notable that the foremost field research unit in the world dedicated to the prevention and treatment of diarrheal diseases has been unable to demonstrate that ORT alone, a cornerstone of the GOBI approach, has made an impact on child mortality or, for that matter, on diarrheal disease-related mortality.

The child survival "revolution" could falter because of a lack of documented efficacy of the approach as it is applied in typical field situations and because of an inability to sustain the effort in the longer run. There is sufficient concern about the overall effectiveness of the selective, GOBI approach to give serious consideration to alternative approaches which might have merit.

It is in this spirit that the census-based, impact-oriented approach being developed by Andean Rural Health Care in Bolivia is presented for review. Hopefully, the concerns and issues raised here will encourage critical thinking as plans begin for the next phase of child survival programming around the world.

Conclusion

As the child survival "revolution" moves beyond its initial focus on oral rehydration and immunizations, new ideas and approaches are needed which offer the promise of improved effectiveness in lowering child mortality. The evidence of actual impact in typical field settings of the selective primary care approach (GOBI) on improvement in child mortality is limited. There is also a growing body of evidence demonstrating that specific "proven" interventions have not had the mortality impact that it was widely assumed they would have.

Continued forward momentum in expanding child survival efforts will require careful documentation of impact in typical field settings around the world. The development of new approaches which appear to have potential for greater effectiveness at a reasonable cost needs financial support from international development organizations.

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CHAPTER II. THE CENSUS-BASED, IMPACT-ORIENTED APPROACH: THEORY AND PRINCIPLES

(written in collaboration with John B. Wyon*)

Throughout both the developed and the developing world, curative health programs are responding to the health needs of those seeking medical assistance. Public health programs are working to prevent illness, disability, and death from preventable causes, mostly through the control of specific epidemic and endemic diseases. Programs in developing countries face severe resource constraints along with the terribly difficult problem of how most effectively to (1) reach those in need of services and (2) use limited resources to achieve a maximum impact on the health of the people being served.

The traditional practice of most curative programs throughout the world has been to establish a facility where health professionals, medical equipment, and medical supplies are ready and available to provide services to those who seek attention. Community outreach services sometimes have been developed to improve access to care. For instance, child survival programs in developing countries have frequently sent staff out into villages for immunization and growth monitoring sessions. Even an approach such as this depends on a mother taking the time and effort to attend these sessions. This is not an easy decision for a busy mother with limited financial resources and little experience in the utilization of health services.

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* Senior Lecturer Emeritus, Department of Population Sciences, Harvard University School of Public Health, Boston, Massachusetts

Theory Behind the CBIO Approach

Unfortunately, these traditional approaches are unable to address two fundamental issues which are important if health programs are going to improve the health of ALL the people for which they are responsible. The first issue has two components: (1) "what are the most frequent, serious, preventable or readily treatable health problems in the population for which the program is responsible?" and, (2) "who are those at greatest risk of developing these problems?" The second issue is "are those at greatest risk of developing health problems receiving basic services designed to prevent or treat these problems?"

The immediate and underlying causes of preventable or treatable sickness and death may vary from one community or set of communities to another, as do those who are at greatest risk. Social and economic circumstances often differ from one geographic area to another. Climatic and ecological characteristics also frequently differ between geographic areas, as do basic biological characteristics such as nutritional status. For these reasons, it is critical to determine for a given program area, using data derived from within the program area, the epidemiologic priorities for the area and those who are at greatest risk of sickness and death. Traditional approaches to health care delivery in both developed and developing countries only in rare instances have been able to deal effectively with these issues.

Traditional approaches to health care are also unable to address the issue of whether a given program has improved the health of the population it serves. For this reason, there are very few examples of health programs around the world which have been able to measure mortality rates, much less demonstrate a favorable mortality impact on the health of the people served.

Data arising from hospitals and clinics (and for that matter from groups of people in communities who have come together periodically to receive services) have no valid denominator with which to assess mortality rates for the entire population. Mortality rates are beginning points from which to assess health status in a population of people. In developing countries, population data are generally inaccurate or out of date, and accurate vital events registration systems are rarely, if ever, in place. Furthermore, most illnesses and deaths still take place without any formal contact with the staff of health programs.

The census-based, impact-oriented approach is a conceptual advance over traditional approaches to health improvement in populations because it addresses the two issues described above. Table II.1 summarizes the basic theoretical concepts of the CBIO approach.

The Context of Primary Care and Public Health

We consider the CBIO appproach to be an example of community-oriented primary health care (COPC) as well as an example of community-oriented public health (COPH). The goal of COPC is to provide culturally appropriate and effective primary health care in communities. The goal of COPH is to improve the level of health in defined communities. These goals are obviously closely congruent but not identical.

COPH is one of three types of public health practice. The other two types, much more fully developed around the world, are disease-oriented public health and services-oriented public health. The goal of disease-oriented public health is to prevent or control a specific disease or health problem within a population of people, while the goal of services-oriented public health is to distribute more equitably health care services throughout a population of people. These two types of public health are usually practiced in large populations such as in regions or states, but also nationally , internationally, and even globally. COPH, on the other hand, is much newer than the other two approaches to public health and is usually practiced in small populations. At this point, the CBIO approach is considered most relevant to smaller populations of people living in defined geographic communities, though in principle it could be applied to large populations and to populations not defined by geographical criteria. For instance, this approach could be applied to enrollees in a health maintenance organization in the United States.

The CBIO approach is an outgrowth of a tradition of prospective, longitudinal studies of mortality, fertility, and migration in relatively small, defined communities which began in the 1950s with the professional guidance of Dr. John Gordon, then Professor of Epidemiology at the Harvard University School of Public Health. Resulting from this tradition have been the Khanna studies led by Dr. John Wyon (Wyon and Gordon, 1979) the Narangwal studies in India led by Dr. Carl Taylor (Kielman, et al, 1983; Taylor, et al, 1983), the INCAP studies in Guatemala led by Dr. Nevin Scrimshaw (Scrimshaw et al, 1968, 1969; Gordon, 1968; Guzman, 1968) and the Haiti studies led by Drs. Warren and Gretchen Berggren (Berggren, Ewbank, and Berggren, 1981).

It has been through community-based studies such as these that the problem of infant and childhood mortality in developing

Table II.1

Theoretical Concepts of the
Census-Based, Impact-Oriented Approach

1. Health improvement arising as a result of health program activities is unlikely in a set of communities unless the program staff know the most frequent, serious, preventable or readily treatable conditions in these communities, can identify those persons at greatest risk of developing these problems, and can provide appropriate preventive or curative services to these persons.

2. Rates of sickness and death in communities must be measured if health improvement is to be documented.

3. The calculation of these rates requires developing the capability to identify those persons in the communities who have become sick or have died, and to determine the population composition by age and sex.

4. Epidemiological priorities and those at greatest risk of preventable or treatable health problems vary from one locale to another; therefore, for greatest program effectiveness, diagnoses of the community's health problems and those at greatest risk are best made using information obtained from within the program area.

countries has become better understood. This understanding, together with the currently available child survival technologies such as immunizations, ORT, and growth monitoring, has helped to form the scientific basis for the child survival movement as we know it today.

Described below are the basic features of the CBIO approach to child survival, to community-oriented primary health care, and to community-oriented public health. This approach builds upon previous experience and offers the promise of using limited resources to maximize mortality impact in a way which can be demonstrated empirically, and it also responds to the diversity of health problems existing in different communities and in different geographic regions of the world.

Basic Principles of the CBIO Approach

The application of the CBIO approach assumes the existence of a health practitioner working with a health team and a population of people who, it is assumed for the sake of this discussion, live in communities readily demarcated geographically. It is also assumed that the practitioner and the population are located in a developing country with limited health resources, manpower, facilities, and equipment. A further assumption is that the people living in these communities have limited economic resources. The principles of the CBIO approach, however, could be readily applied in an environment with greater resources such as are found in developed countries.

The overarching goal of the CBIO approach is to improve health in a specific community or communities. For present purposes, it is assumed that the practitioner's main goal is to lower mortality rates. In settings in which mortality rates are not excessive, a practitioner might select a different aspect of health improvement such as disability or morbidity from a particular condition. Or the practitioner might choose to focus more narrowly on one particular aspect of mortality.

In order to assess the degree to which the goal of mortality improvement has been attained, it is necessary to measure mortality rates within the defined communities at the beginning of the program intervention and at successive stages. It is highly useful to know which people are at the highest risk of death. Those at greatest risk may be defined in terms of age, sex, household location, occupation, nutritional status, or some other observable characteristic. It is also necessary to understand the causes of mortality, both immediate and underlying.

Although in theory one might be able to develop a program oriented specifically to mortality, one of the principles of the

CBIO approach is to understand the community's perspective of its own health priorities. It is very likely that lowering mortality rates is not a high priority within the community. Human communities being what they are, it is difficult for a health practitioner to work effectively without responding to the day-to-day health problems of the local people. Furthermore, health practitioners have a moral obligation to respond within their capabilities to acute illnesses which are brought to their attention.

A final principle of the CBIO approach is to use available health resources for the purpose of responding to the health priorities as defined both by the health practitioner and by the community. This implies that a significant portion of program resources be devoted toward the longer term goal of mortality reduction within the defined communities. Table II.2 summarizes the principles of the CBIO approach.

Table II.2.

Principles of the Census-Based, Impact-Oriented Approach to Community-Oriented Public Health (COPC)

1. The overarching goal of the CBIO approach is to improve health in communities and to be able to demonstrate that health has been improved.

2. Mortality rates need to be measured at the beginning and at successive stages of program implementation.

3. It is important to understand the immediate and underlying causes of mortality and to identify those within the communities who are at greatest risk of death.

4. The health practitioner needs to respond to the community's perceived priorities as well as to the epidemiologic priorities.

CBIO APPROACH Chapter II.

Implementation of CBIO Theory and Principles

We have conceptualized four phases of implementation of the CBIO approach (see Figure II.1). Phase 1 consists of community diagnosis, followed by Phase 2, program planning, and Phase 3, program implementation. The final phase, Phase 4, consists of program evaluation and community rediagnosis. The more accurate the community diagnosis, the more effective the "treatment" is likely to be. The "treatment," based on the community diagnosis, needs to be carefully planned prior to its execution. After carrying out the "treatment" for a period of time, its effectiveness needs to be evaluated on the basis of information obtained from epidemiologic surveillance and other approaches to program evaluation. At the same time, the community diagnosis phase can be repeated.

Community diagnosis (Phase 1) has five specific steps which are outlined in Figure II. 2. Step 1 involves establishing a relationship between the health practitioner and the community. This is a process whereby the practitioner comes to know the community and the community comes to know (and have confidence in) the practitioner. Obviously, this can only be accomplished by competent and dedicated practitioners able to understand and respect the people living in the community.

During the process of establishing this relationship, it is necessary in Step 2 for the practitioner to "define" the community. By community definition, we refer to establishing clearly the geographic boundaries of the community, who the community members are, where they live, and what their relationships are within the family structure.

Step 3 involves the determination of the most frequent preventable or treatable causes of sickness and death in the community. It is necessary for the health practioner to learn what the mortality rates in the community are, what the causes of mortality are (as best as can be understood with the resources and technical competence available), and who is at greatest risk of death. While this may appear on the surface to be the work of a professional epidemiologist rather than that of local program staff, we believe that this can be accomplished with limited additional training.

In Step 4, the health priorities from the community's perspective are identified. A determination of a community's health priorities can be accomplished as a byproduct of Step 1 by coming to know the community and understanding its inhabitants. Other means by which the community's perceived health priorities can be determined include responding to the spontaneous health needs of the people for curative medical services as well as canvassing the opinions of household members or the opinions of community leaders.

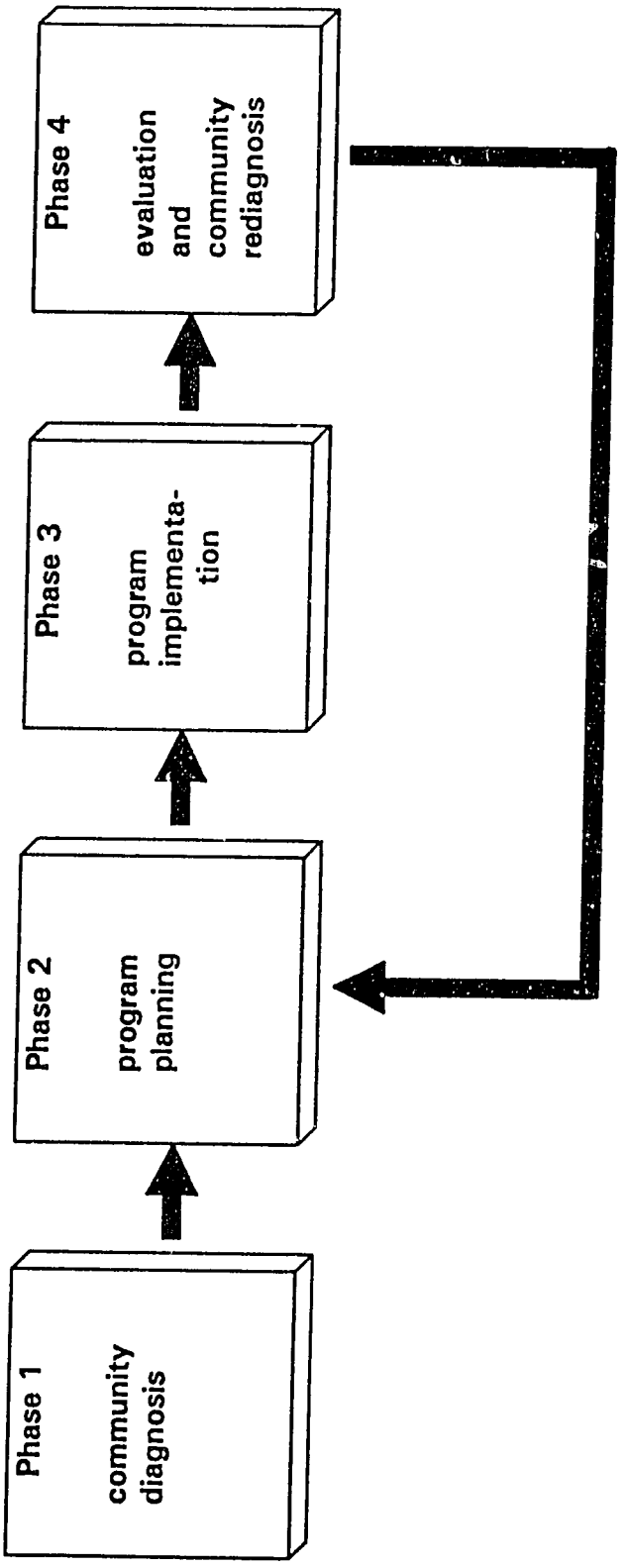
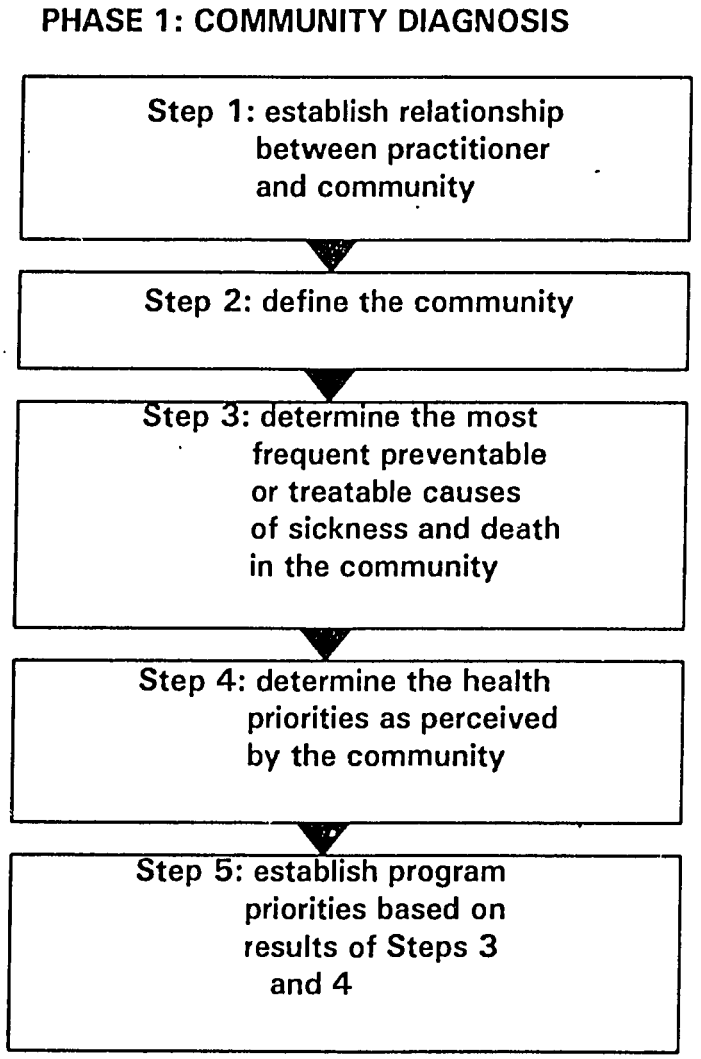


FIGURE II.1.
IMPLEMENTATION PHASES OF THE CBIO APPROACH

Figure II.2.
Steps of Phase 1 of the CBIO Approach



Step 5 involves the determination by the health practitioner of priorities for the program which arise from an epidemiologic assessment of community mortality and of those who are at greatest risk of death. From the epidemiologic and community priorities ascertained in Steps 3 and 4, overall program priorities can be established.

Once Steps 1-5 of Phase 1 have been completed, Phase 2 (Program Planning) begins. Phase 2 has two separate steps (see Figure II.3). In Step 1, program resources are clarified. In Step 2, a work plan is created on the basis of the program's priorities and the resources available.

In Phase 3 (Program Implementation), the program is actually carried out using the developed work plan as a guide.

Phase 4 (Evaluation and Community Rediagnosis) involves epidemiologic surveillance to provide data to evaluate program outcomes. Has the relative importance of the most frequent preventable or treatable causes of death changed since the initiation of the program? Have those groups changed who are at greatest risk of death from these causes? Have the community's health priorities changed as a result of program efforts? Has the program been successful in lowering mortality rates? Has the program successfully responded to community health priorities?

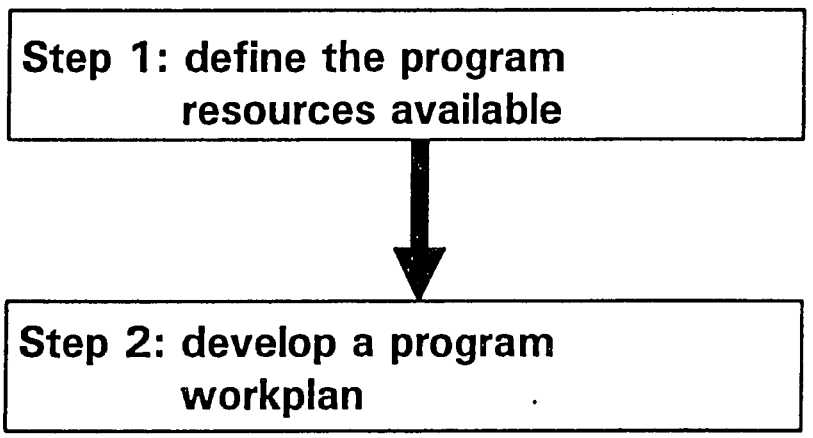
The findings from the inquiries in Phase 4 make it possible to determine anew the priority health problems of the community. Combining these redefined health priorities with a reassessment of resources available for the program make it possible once again to establish a work plan for the program. The process then repeats itself indefinitely.

Practical Considerations Regarding the Implementation of the CBIO Approach

As a practical matter of applying these principles in developing countries, a number of these steps require routine systematic home visitation (RSHV). RSHV involves the health practitioner making direct or indirect contact with everyone in the community on a periodic basis, usually at least every six months. At the time of RSHV, the community is redefined by determining the current household composition. In addition, vital events are registered. These include births, deaths, and in- or out-migrations. Causes of death are determined as accurately as possible under the circumstances.

In addition to RSHV, targeted home visits to high-risk or priority individuals is another closely related necessary

Figure II.3
Steps of Phase 2 of the CBIO Approach



activity. This approach makes it possible for the practitioner to deliver important basic services to those who may not choose or be able to seek out services. This is particularly necessary for those within the community who have limited educational or financial resources or who are socially disadvantaged.

The four phases of CBIO implementation cannot realistically be expected to be completed in less than five years. The process of program implementation is unlikely to proceed in an orderly fashion from one step to another because of numerous field constraints that arise. These constraints include problems with staffing, logistical support, and local, regional or national political issues, to name only a few. Even so, the CBIO theory, principles, and phases of implementation can be used as guides and can help to provide a useful conceptual framework for both the practitioner and the community.

Usually, some type of health care services need to be provided in the early stages of establishing a relationship with the community if a warm working relationship of trust is to be established. The implementation of traditional primary health care together with child survival activities seems to be a practical means of initiating work, although the nature of the program may change later.

The CBIO approach is very different from traditional approaches to health care. Consequently, it takes time for health staff and communities to become comfortable with it. Home visitation involves considerable staff energy and may not be enthusiastically embraced by health workers used to less energetic work patterns.

Specific methods for field work need to be developed in each community. ARHC's experience has been that it is best for field staff to work together in a small pilot area, implementing the principles of this approach and modifying the methodology until it is suitable for the local situation. In addition, this pilot experience gives program leaders an opportunity to assess the staff and resource requirements required to extend the methodology on a broader scale.

Strong leadership is required if this approach is to be successfully implemented. Program leaders must be persons sensitive to the social environment in which they are working. They must be able to present the program to the community in a way that the community will find appealing. Program leaders must also be able to learn about the community structure, organization, and history. Finally, program leaders need to be able to define which tasks need to be performed and what staff are required to carry out these tasks.

The health information system (HIS) is a critical element of

the CBIO approach. Without an effective and efficient system for collecting information, for tabulating it, and for using the results in program evaluation and planning, the CBIO approach will fail.

Conclusion

The CBIO approach is a further refinement of community-oriented primary care and community-oriented public health principles. This approach is an improvement over more traditional forms of primary health care in that it makes it possible for the health care practititoner to determine within the program area (1) what are the most frequent serious preventable or treatable causes of sickness and death, (2) who are those at greatest risk of developing these health problems, and (3) if changes in health status have occurred over time.

Since the overarching goal of this approach is the empirical demonstration of improvement in the health of persons living in defined communities, it is an "impact-oriented" rather than a services-oriented approach. Since the approach requires identifying every member of the community through periodic home visits and establishing a relationship with every family in the program area, we refer to this as a "census-based" approach. The CBIO approach is carried out in four phases: community diagnosis, program planning, implementation, and evaluation with community rediagnosis.

It is critical to develop strong program leadership and to begin the CBIO approach in a pilot area prior to extending it to the entire program area. The ability of this approach to make an accurate community diagnosis and to evaluate program impact depends heavily on the effectiveness of the health information system.

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CHAPTER III. COVERAGE OF CHILD SURVIVAL SERVICES

Coverage of basic child survival interventions in a program population area has been considered to be an important measure of program effectiveness. While there is significant variation in the causes of childhood death from one ARHC program area to another within Bolivia (see Chapter VI), all of the programs have given priority to achieving high immunization coverage, high rates of ORT knowledge and use for diarrheal disease, high rates of participation in the growth monitoring program, and high rates of coverage of antibiotic treatment for pneumonia and ARI (acute respiratory infection). It is the overall progress with coverage that we will now review.

ARHC has three established program sites. The Carabuco Program on the rural Northern Altiplano has been in operation since 1984 and serves approximately 9,500 people. The Mallco Rancho Program has been in operation since 1987. This program is located in the rural Cochabamba valley area of Bolivia and serves almost 6,000 people. The Villa Cochabamba/Montero Program was established in 1988. It is located in the tropical lowland area of Santa Cruz and serves approximately 12,000 people in a periurban section of the city of Montero. The location of these program sites is shown in Figure III.1 Each of the program sites is described in more detail in Chapters IX - XI. These three established program sites serve approximately 27,500 people altogether.

Over the life of these programs, household surveys have been carried out to assess coverage of child survival services. In the Carabuco Health Program Area, there have been three cluster sample surveys of 30 randomly selected clusters of seven households each. In Mallco Rancho and in Villa Cochabamba/Montero the household surveys have been more inclusive. In the case of Mallco Rancho, with its smaller population, all homes in the program area were surveyed in 1990 and 1992. All children encountered under three years of age were included in the

Figure III.1


South America
GUYANAS
VENEZUELA
HOLANDEZA FRANCEZA
COLOMBIA
ECUADOR
BRAZIL
PERU
BOLIVIA
PARAGUAY
URUGUAY
ARGENTINA
CHILE
Bolivia
Andean Rural Health
Care Programs
CARABUCO
MONTERO
MALLCO RANCHO

surveys. In the case of Villa Cochabamba/Montero, every other home was contacted at the time of the 1991 survey. Those children under three who were identified were included in the survey.

Ability of the CBIO Approach to Enroll Children in Program Activities

Prior to discussing coverage, it is useful to consider what percentage of the children in the program area included in the coverage surveys had actually been identified previously by the health program. We use the term "identify" to mean that the child had been previously contacted by the program and had received a "road to health" growth chart containing a space to record immunizations (referred to here collectively as a health card).

These results are shown in Table III.1. The Carabuco Health Program, with the most developed version of the CBIO approach, demonstrates a gradually improving coverage with health cards which in 1992 reached 99% of the children. In Mallco Rancho, the coverage reached 91% in 1992. There has been only one household survey in Villa Cochabamba/Montero so far. This was conducted in 1990 after only six months of limited routine systematic home visitation activities. The results achieved at this point in Villa Cochabamba/Montero give an idea of the potential coverage obtainable by more traditional but intensive approaches of delivering child survival interventions.

It is interesting to note that in all three program sites at the time of the first household survey, the coverage ranged between 70 and 74%. At each of the three program sites, "traditional" child survival interventions provided at growth monitoring and vaccination sessions had been relatively well-developed prior to the first household survey.

Table III.1.

Percentage of Children in ARHC's Established Program Areas With Health Cards

program site	year of household survey				
	1988	1989	1990	1991	1992
Carabuco	70%	92%	95%		99%
Mallco Rancho			74%		91%
Villa Cochabamba/ Montero				73%	

source: household surveys at program sites

Immunization Coverage

Immunization coverage has been calculated here for children 12-23 months of age. Coverage was considered to be complete only if the third dose of diphtheria, pertussis, and tetanus had been adminstered (DPT3), the third dose of polio had been administered (polio3), as well as measles and BCG vaccinations. Only those children with documentation demonstrating the administration of these antigens were considered to have received them.

Overall immunization coverage rates of 73% to 85% have been achieved using the CBIO approach. Prior to the beginning of routine systematic home visitation, using the more traditional approaches of "concentration" of children at vaccination sessions, coverage rates of only 23-48% had been achieved. In Villa Cochabamba/Montero, routine systematic home visitation began in one portion of the program area in 1991, where one-third of the program area resides. The coverage rate of 82% observed for 1992 is based on a review of family health folders for this segment of the program area only.

Table III.2.

Vaccination Coverage at ARHC's Established Program Areas, 1988-1992

	year of household survey				
program site	1988	1989	1990	1991	1992
Carabuco	48%	77%	86%		85%
Mallco Rancho			23%		73%
Villa Cochabamba/ Montero				40%	82%*

* The data for the Villa Cochabamba/Montero program in 1992 are for one portion of the total program area where routine systematic home visitation has been carried out. This coverage rate is based on a review of family health folders.

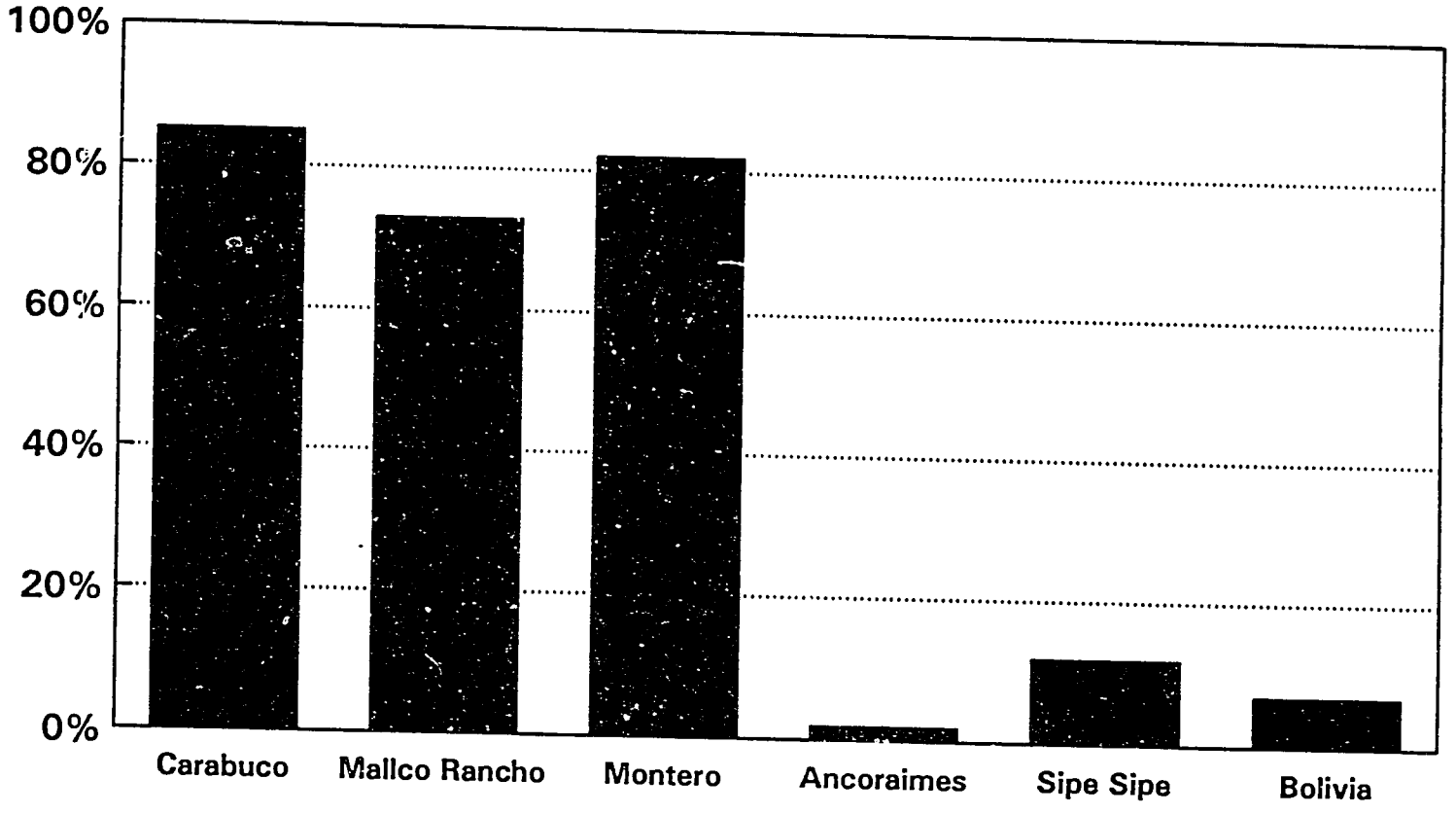
source: household surveys at program sites and review of family health folders for the Villa Cochabamba neighborhood

The 1989 Demographic and Health Survey (DHS) Survey in Bolivia (Sommerfelt, et al, 1991) determined on the basis of maternal recall and health card review that only 8% of Bolivia children 12-23 months of age had been fully vaccinated. In 1992, ARHC conducted baseline surveys in two new rural program areas (Ancoraimes and Sipe Sipe) which are adjacent to established program sites. Coverage there prior to initiation of program activities was only 2% and 12% (see Figure III.2).

Growth Monitoring Coverage

Participation in growth monitoring within ARHC's programs involves weight and height determination followed by nutrition education of the mother. The percentage of children in the program areas who had at least four monitorings during the 12 months prior to the survey is shown in Table III.3. Prior to the initiation of routine systematic home visitation, only 11-21% of

Figure III. 2.
Immunization Coverage in ARHC Program Areas, in Adjacent Areas, and in Bolivia



percentage of children 12-23 months of age who were completely vaccinated
source: see text

Table III.3.

Growth Monitoring Coverage (Defined as Four Monitorings During the Previous 12 Month Period) at ARHC's Established Program Areas*

	year of household survey				
program site	1988	1989	1990	1991	1992
Carabuco	11%	29%	69%		89%
Mallco Rancho			21%		56%
Villa Cochabamba/ Montero				16%	

* The data for Carabuco in 1988, 1989, and 1990 are for children 12-23 months of age. The data for children in Carabuco in 1992 are for children 3-23 months of age. The data for Mallco Rancho in 1990 are for children 0-23 months of age and in 1992 are for children 3-23 months of age. The data for Villa Cochabamba/Montero in 1991 are for children 0-35 months of age.

source: household surveys at program sites

the children had received adequate coverage. In Carabuco in 1992, 89% of the children had received adequate coverage. In Mallco Rancho, with exposure to routine systematic home visitation for a shorter period of time than in Carabuco, 56% had received adequate coverage. In Villa Cochabamba/Montero prior to the onset of routine systematic home visitation only 16% of the children had received adequate growth monitoring.

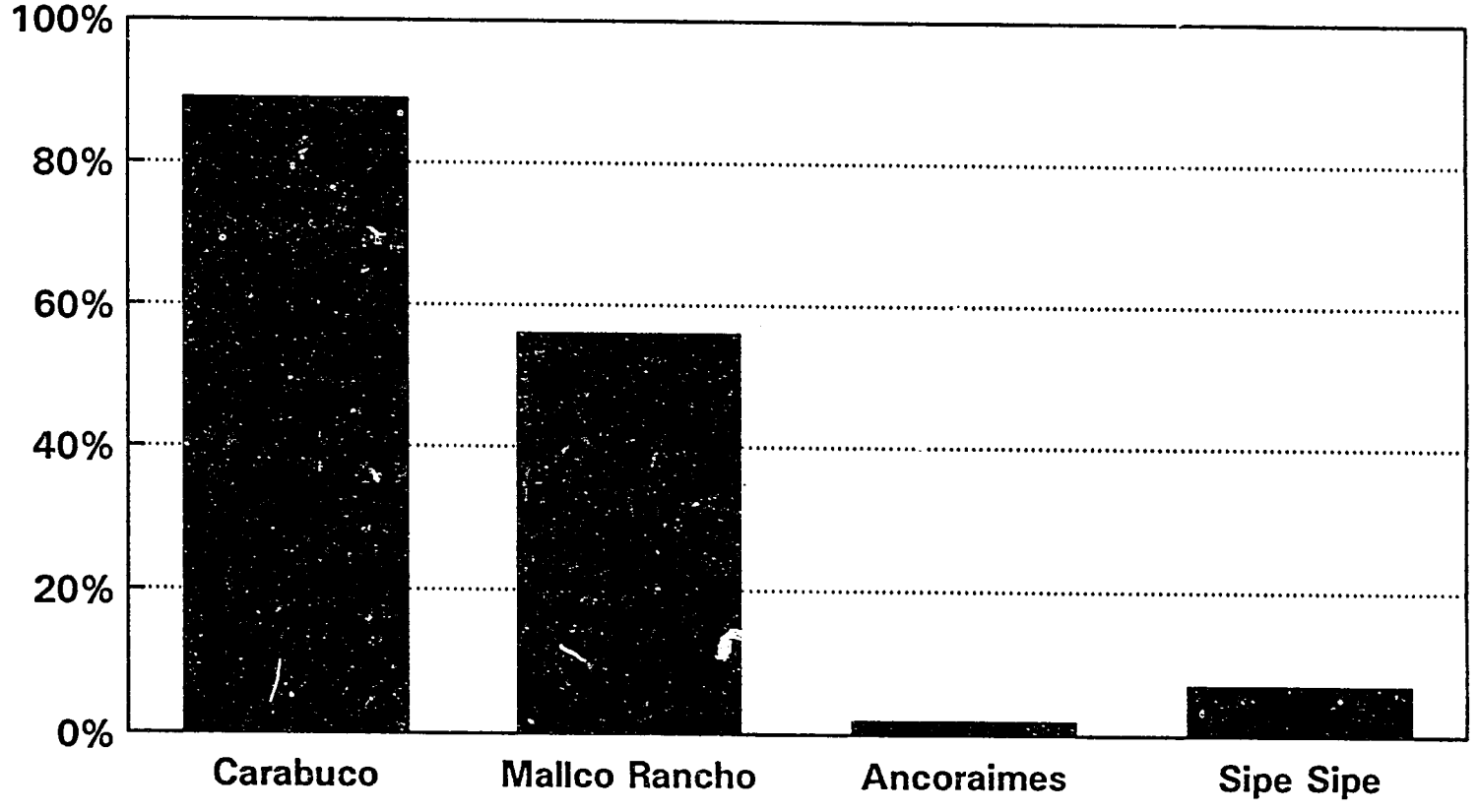
Although national data on growth monitoring coverage are not available, baseline data from two adjacent ARHC areas were obtained in 1992. In Ancoraimes, only 2% of the children 3-36 months of age had been weighed four or more times in the previous year and in Sipe Sipe, 7% (see Figure III.3). Villa Cochabamba/Montero has been excluded from Figure III.3 because only baseline data were available.

ORT Coverage

Oral rehydration therapy coverage for diarrhea treatment can be assessed in a variety of different ways. For our purposes here, we shall consider three approaches: (1) the mother's knowledge regarding the preparation of ORT fluids, (2) whether she had ever actually administered ORT fluid to her children when they had diarrhea, and (3) whether she had given ORT fluid if her child had had diarrhea during the previous two weeks.

In Carabuco, approximately half of the mothers appear to be competent in ORT use and had used it if her child had had diarrhea during the two weeks prior to the 1992 survey. In the Mallco Rancho Program Area, half of the children appear to have ORT coverage. In Montero, where CBIO activities were just getting underway at the time of the 1991 household survey, only one-third of the mothers had ever used ORT and only 20% of the mothers with a child having diarrhea during the two weeks prior to the survey had used it at that time (see Table III.4).

Figure III.3.
Growth Monitoring Coverage in ARHC Program Areas and in Adjacent Areas



percentage of children with four or more growth monitorings during the previous 12 months

Table III.4.

Oral Rehydration Therapy Coverage at ARHC's Established Program Areas as Determined by Household Surveys*

	year of household survey				
program site	1988	1989	1990	1991	1992
Carabuco					
mother knew how to prepare ORT		44%	75%		53%
mother had used ORT sometime in past	28%	43%	64%		52%
mother had used ORT if child had had diarrhea in previous two weeks			41%		48%
Mallco Rancho					
mother knew how to prepare ORT					59%
mother had used ORT sometime in past					55%
mother had used ORT if child had had diarrhea in previous two weeks					49%
Villa Cochabamba/ Montero					
mother knew how to prepare ORT				42%	
mother had used ORT sometime in past				37%	
mother had used ORT if child had had diarrhea in previous two weeks				20%	

source: household surveys at program sites

The percentage of mothers who had used ORT in the past is greater at ARHC's established program sites than in adjacent comparison areas or than in Bolivia nationally (see Figure III.4). The percentage of children with diarrhea during the previous two weeks who had received ORT is also higher in ARHC's established program areas (see Figure III.5). The differences between ARHC established program sites and other areas are not as striking for ORT use as for immunizations and growth monitoring, in large part because of the widespread social marketing of ORT through the mass media. Nevertheless, ORT usage rates are still higher in established ARHC program areas.

ARI Coverage

Coverage of treatment of serious acute respiratory infection (also known as pneumonia or acute lower respiratory infection) is very difficult to gauge since the illness itself is not easy to diagnose in field settings. We have assessed ARI treatment coverage here by simply assessing the percentage of mothers who reported that they sought medical assistance (not merely assistance from a relative or from a traditional healer) for their child if their child had had symptoms of ARI during the previous two weeks. The findings are shown in Table III.5.

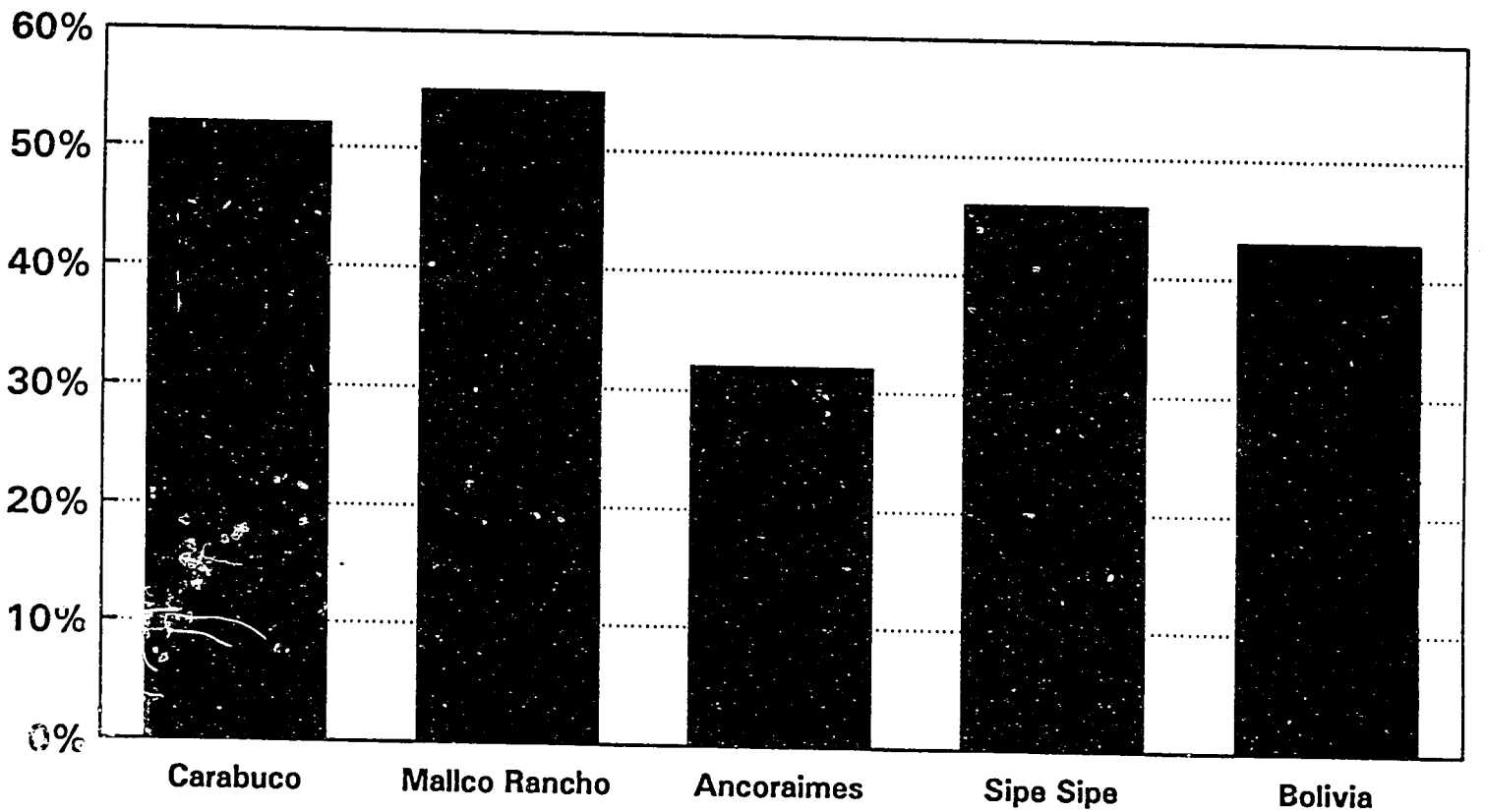
Table III.5.

ARI Treatment Coverage at ARHC's Established Program Areas

	year of household survey		
program site	1990	1991	1992
Carabuco			53%
Mallco Rancho	35%		30%
Villa Cochabamba/ Montero		45%	

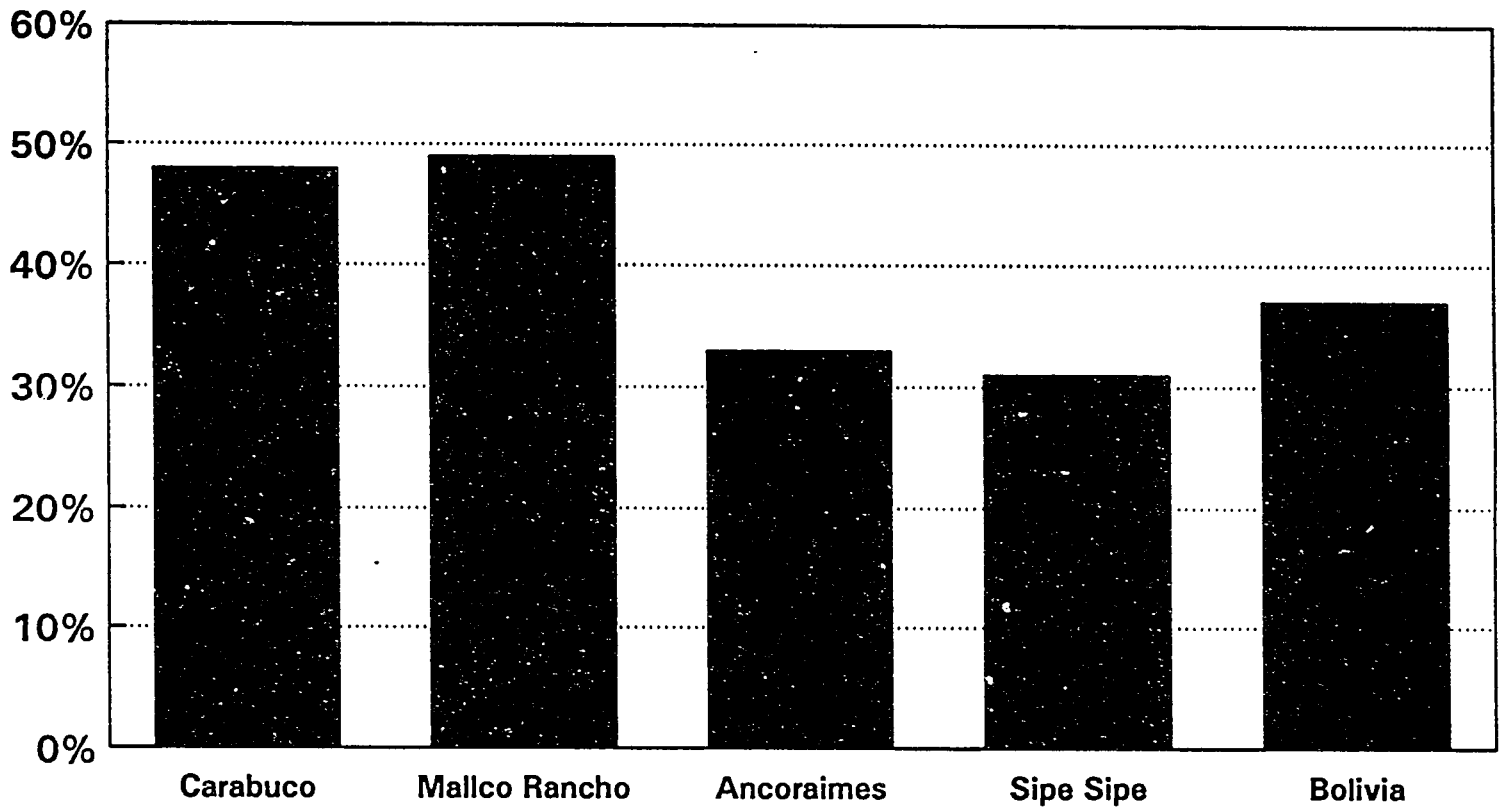
source: household surveys at program sites

Figure III.4.
ORT Use in ARHC Program Areas, Adjacent Areas, and Bolivia



percentage of mothers who had used ORT in the past (national data from Sommerfelt, et al, 1991)

Figure III.5.
Recent ORT Use in ARHC Program Areas, Adjacent Areas, and Bolivia



percentage of children with diarrhea in previous two weeks receiving ORT (national data from Sommerfelt, 1991)

Comparison of ARI coverage rates with adjacent areas and with Bolivia nationally is shown in Figure III.6. ARI coverage in Villa Cochabamba/Montero was not assessed at the time of the 1991 houshold survey. Again, coverage is higher in Carabuco and in Mallco Rancho than in adjacent areas or in Bolivia as a whole. The promptness and adequacy of treatment is not addressed by these data, however. We would expect an even greater difference between ARHC's established program sites and comparison areas if these aspects of ARI coverage had been considered.

Conclusion

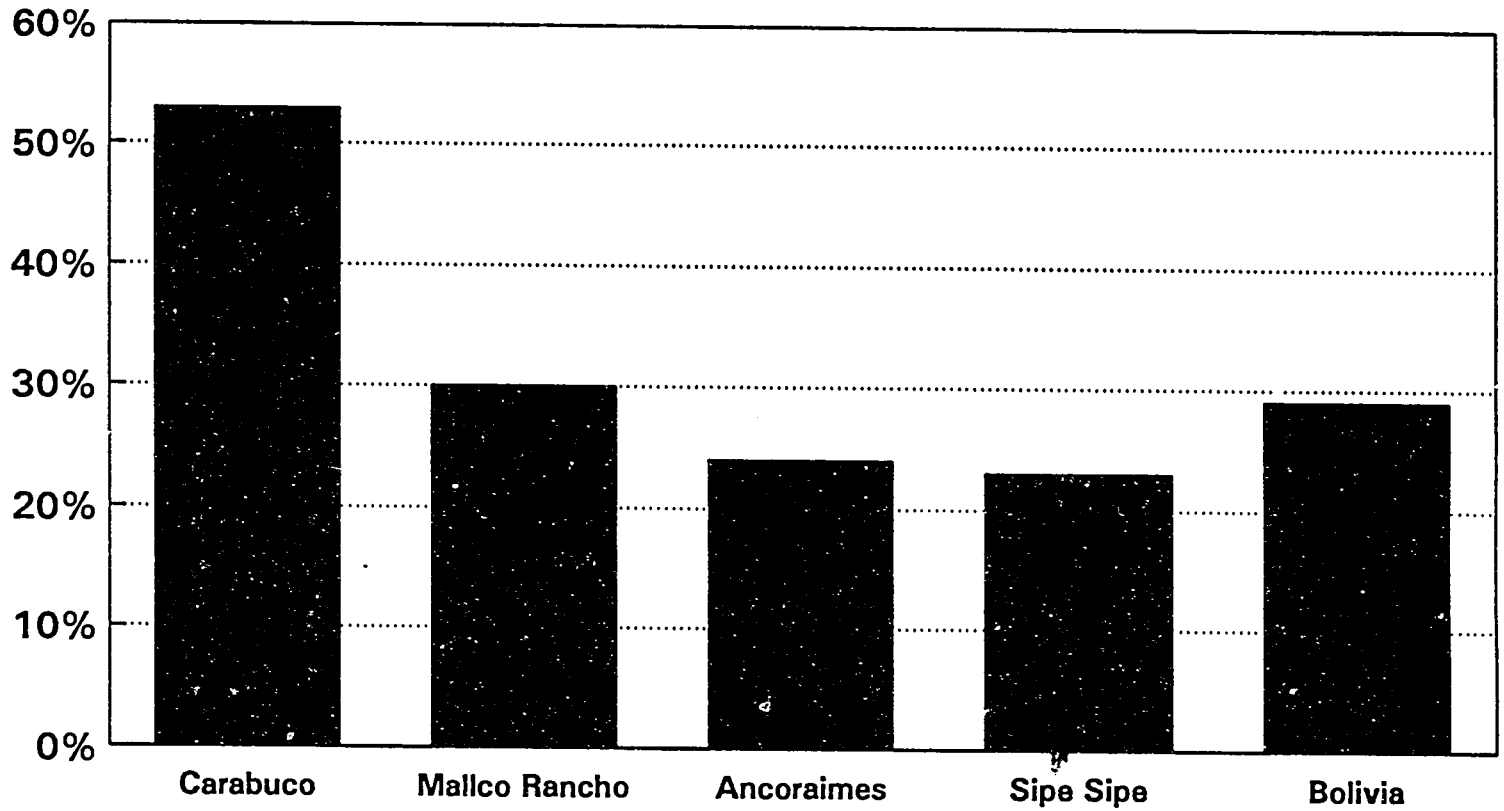
Immunization and growth monitoring coverages in ARHC's established program sites are very high, particularly when compared to adjacent areas and to national data. ORT and ARI coverage rates are higher in ARHC's established sites as well, but the differences are not as pronounced. The CBIO approach, particularly through the delivery of services in the home when appropriate, is able to achieve high levels of coverage of immunizations and growth monitoring.

ORT use is somewhat higher in ARHC's established program sites, but national social marketing of ORT throughout Bolivia has been intensive and apparently rather effective. Consequently, the relative benefits of the CBIO approach with respect to ORT use are not as apparent.

Measurement of ARI coverage as employed here is quite crude: whether a child with symptoms of ARI received some type of modern medical attention. Even so, coverage rates are higher in ARHC's established program areas than in comparison areas.

The coverage data for the Carabuco Health Program, ARHC's oldest program site, are consistently more favorable than for Mallco Rancho, the second oldest program site. We anticipate that within the next few years, as the Mallco Rancho Health Program matures, coverage rates will continue to improve there as well. The Villa Cochabamba/Montero program has at this point only limited longitudinal data, but we expect to see significant improvements when further household surveys are undertaken in the near future. Thus, overall, the coverage rates shown here demonstrate consistent and steady improvement as well as higher levels than in other areas of Bolivia.

Figure III.6.
Coverage of ARI Treatment in ARHC Sites, Adjacent Sites, and Bolivia



percentage of children with sypmtoms ARI receiving some type of modern treatment (national data from Sommerfelt, 1991)

REFERENCES FOR CHAPTER III.

Sommerfelt AE, JT Boerma, LH Ochoa, et al. Maternal and Child Health in Bolivia: Report on the In-depth DHS Survey in Bolivia, 1989. Institute for Resource Development/Macro Systems, Inc. Columbia, Maryland: 1991.

CHAPTER IV. MORTALITY IMPACT ASSESSMENT

Assessment of the impact of mortality attributed to health programs is a treacherous exercise fraught with many possibilities for biased or incomplete data and also for misinterpretation of results (Gray, 1986). Therefore, most knowledgeable health professionals have delegated this task to university research centers and governmental research agencies. One informed program manager for a large international health organization wrote:

> the assumption is that improved activities at the community level will ultimately have an impact on the IMR [infant mortality rate].... CARE does not have to try to prove this relationship in each project (Horner 1989, p. 4).

One of the unique advantages of the CBIO approach is that it attempts to measure changes in health, including improved mortality rates, for each program area and therefore does not have to rely on the bold assumption which those responsible for programs using more traditional approaches to child survival must make.

Methodological Considerations

The labor and cost of obtaining the numerator and denominator data to enable the measurement of mortality rates is substantial. In order to be able to calculate mortality rates, one must have reasonably accurate information regarding the population of a program area by age and sex. Furthermore, one must have an accurate count of the deaths by age and sex. In developing countries, this is a very difficult task.

Population data in these settings usually do not exist. If they do, more likely than not they are based on national censuses which are outdated or inaccurate. Furthermore, the overwhelming majority of deaths take place in the home without any formal and direct contact with the existing health system. In addition, those with extensive field experience believe that retrospective household surveys do not provide a satisfactory degree of accuracy, particularly during the neonatal period. Hill and David (1988, p. 215), for instance, state that:

> asking household members about recent deaths ... appears to produce a serious underestimate of prevailing mortality levels and equally serious biases due to differential rates of omission (more deaths of young children are omitted than deaths of adults).

Aside from the issue of whether a family member might intentionally conceal a death, there is also the issue of remembering when a death actually took place and the age at death. Furthermore, parents may not understand the important distinction from the demographic standpoint between a stillbirth and a live-born child who died within several hours of birth. Several household surveys in Africa, for instance, registered only two-thirds of the expected adult deaths and one-half of the expected deaths among children under five (Clairin, 1985).

In developing countries, the rarely attainable "gold standard" for measuring mortality rates is the ongoing identification of all residents in a defined geographic area and the registration of vital events (births, deaths, and migrations). This is best achieved by means of ongoing visitation of all homes in the given area by persons who are known to and trusted by the household members. All other approaches, such as retrospective household surveys carried out by people not previously known to household members. (for instance, the Demographic and Health Surveys which have been conducted around the world by the Institute for Resource Development/Macro Systems, Inc.) and indirect approaches such as the previous birth technique developed by Brass and Mcrae (1984) are potentially biased and appear to yield underestimates of mortality rates because of underreporting of deaths by family members.

The prospective home visitation approach to mortality rate measurement, while not affected to the same degree by the biasing and underreporting tendencies described above, may still be somewhat biased by underreporting of deaths. This could occur by the health worker not entering all deaths in the health information system, by not visiting all the homes in the geographic area, or by the family not reporting deaths which have

occurred. In our opinion, the potential for substantial bias and underreporting are less with prospective home visition than with other approaches, however.

The CBIO approach, as it is being implemented by ARHC, involves routine systematic home visitation (RSHV) to all homes in the program area, with more frequent visits to "targeted" homes or to homes with persons identified as being at high risk (Perry and Sandavold, 1993). One of the targets is all women of childbearing age so that pregnancies can be identified. Once pregnancies are identified, homes are visited more frequently so that prompt care can be given to newborns, and also so that early infant deaths can be registered.

Although the ARHC field staff are aware of many shortcomings in their actual day-to-day death registration, it is nevertheless the case that the "gold standard" of death registration as described above is being met in ARHC's program areas where RSHV is underway: all homes in the program area are being visited on a prospective and ongoing basis by persons who are familiar with and trusted by family members.

A second set of methodological concerns beyond the actual accurate tabulation of population size and registration of deaths is the problem of interpretation of the data. In ARHC's three established program areas, the total population is 27,500 people. The smallest program area has 5,829 people. The numbers of deaths per year in specific age groups is relatively small, even for the infant and child age groups. For instance, in the smallest established program area (Mallco Rancho), there were only nine infant deaths in 1992, only six deaths among children 12-23 months of age, and only one death among children 24-59 months of age. Because of the small numbers of deaths involved, the mortality rates are unstable from year-to-year. Thus, the ability to answer the question of whether or not there has been a change in mortality rates depends partly on population size.

Finally, there is the important issue of defining whether any observed changes in mortality rates are actually due to program interventions or to other independent influences. More than one program has found that the observed mortality rates went up after program implementation. It is unlikely that health programs themselves actually had a detrimental effect on health, but it is understandable that death registration might improve over time, thereby appearing to show a worsening of death rates.

In most areas of the developing world, infant and childhood mortality rates are slowly improving, partly as a result of improving standards of living and nutrition and partly as a result of curative and public health efforts. Thus, observed changes in mortality rates need to be interpreted in light of the distinct possibility that they would be improving independently

of specific health program interventions.

Double-blind randomized clinical field trials of a specific intervention such as Vitamin A supplementation can more readily determine whether the specific intervention has had an impact on mortality since the study design attempts to control for all other factors. This degree of rigor is not possible for evaluation of an overall integrated health care program or of new approaches to health care delivery such as the CBIO approach.

We are left with two methodologies for assessing mortality impact within ARHC's established programs. One is to determine if there has been mortality improvement over time. The second is to compare mortality rates in ARHC program areas with similar areas in which the CBIO approach has not been implemented. The problem in assessing mortality improvements over time in ARHC's currently established programs is twofold. First, the numbers of deaths on which the rates are based are small and therefore unstable. Second, because the child survival interventions were relatively well-developed prior to the initiation of routine systematic home visitation and death registration, some of the presumed mortality impact of the program may have already been achieved before mortality rates could actually be measured.

A methodology for estimating confidence intervals for death rates is needed. Most confidence intervals are based on sampling theory. In this case, we are not dealing with samples, but rather with a total population having a small number of deaths. This small number fluctuates from year to year, leading to sizeable fluctuations in observed mortality rates.

The monograph, Healthy Communities 2000: Model Standards, published by the American Public Health Association (1991), addresses this issue and provides a guide for estimating confidence intervals for mortality rates (pp. 459-461). The authors recommend that all comparisons of death rates be with rates based on at least 20 deaths. If necessary, events over more than one year can be pooled. Using this approach, Table IV.1 lists the 95% confidence intervals calculated for mortality rates based upon the number of deaths observed. For instance, a 95% confidence interval for an infant mortality rate calculated to be 100 based on 20 deaths would be:

$$100 +/- (0.40)(100)$$
$$100 +/- 40$$
$$60 - 140.$$

Appendix VI contains the description of this approach contained in the APHA monograph.

TABLE IV.1.

95 Percent Confidence Intervals for a Selected Number of Vital Events, Such as Deaths

number of events	confidence interval
20	rate +/- .40 x rate
30	rate +/- .36 x rate
40	rate +/- .31 x rate
50	rate +/- .28 x rate
100	rate +/- .20 x rate
150	rate +/- .16 x rate
200	rate +/- .14 x rate
400	rate +/- .10 x rate
800	rate +/- .07 x rate
1600	rate +/- .05 x rate

source: American Public Health Association (1991), pp. 459-461.

Pooled Mortality for ARHC's Three Established Program Sites

A critical issue to be addressed is what evidence ARHC can show that child survival is better in its program areas than in similar areas in Bolivia. Because of the small populations involved and because it was not possible to measure mortality rates prior to beginning the programs, there is so far no strong evidence that infant and child mortality rates have fallen over time within the program areas. In the case of Carabuco, infant mortality rates have increased from 74 in 1988 to 88 in 1992, presumably reflecting an improvement in death registration. In Mallco Rancho, infant mortality fell by almost half (from 78 to 46) between 1991 and 1992. In Villa Cochabamba/Montero, only baseline rates are currently available.

Our case for demonstrating mortality impact with the CBIO approach must therefore rest at this time on showing a statistically significant difference in the probability of child survival between ARHC's program areas compared to similar areas. Demonstrating a difference does not prove from the strict scientific standpoint that the program itself has led to improved mortality. The mortality rates estimated for the "control" areas

may be erroneous in some way. If they are not erroneous, they may arise from populations which differ in some important way from ARHC's intervention areas. Nevertheless, it is the best that can be done under the circumstances.

The strongest case that can be made for mortality impact on child survival at ARHC's program sites must rest on comparing the probability of childhood death (based on observed mortality rates from birth to age five) compared to probabilities computed from mortality rates for infants and children in similar areas. Only through such pooling can one achieve statistical confidence in the findings.

The infant and child mortality data for all three ARHC program sites have been pooled to generate a probability of death. These data are based on three years of experience in Carabuco (1990-1992), two years of experience in Mallco Rancho (1991-1992), and one year of experience for a portion of the Villa Cochabamba/Montero Program (1992). These data are shown in Table IV.2.

These data give an estimate of overall probability of death before the age of five for ARHC's program areas. Using data from the TOTAL column of Table IV.2, the observed pooled mortality rates are shown in Table IV.3.

Estimating the probability of death before the age of five can be done in two ways. One is a cohort method in which a hypothetical cohort of births is subjected to the above mortality rates over a five year period and the percentage of the cohort which would die at these rates is determined. A second method is to simply calculate for the population of children the overall death rate per 1,000 children per year and multiply this by five.

These two methods are shown in Table IV.4. Using the cohort method, the probability of death before age five is 0.111. That is to say, we estimate that 11.1% of the children throughout ARHC'c established program sites die before reaching the age of five. Since this estimate is based on 134 deaths, we can use +/- .18 x rate as our 95% confidence interval (see Table IV.1). Thus, we estimate with 95% confidence that between 9.1% and 13.1% of the infants born in ARHC's program areas die before the age of five. Using the under-five mortality rate method whereby the number of deaths observed is divided by the population and multiplied by 5, essentially the same results are obtained.

Table IV.2

Death and Population Data for ARHC's Three Established Program Sites From Which Probability of Childhood Death Is Calculated

	Carabuco			Mallco Rancho		Montero	TOTAL
	1990	1991	1992	1991	1992	1992	
0-12 months							
# deaths	13	25	19	13	9	9	88
# births	194	228	215	164	194	142	1,137
population	219	211	210	150 (est)	150	135	1,075
12-23 months							
# deaths	4	0	3	7	6	9	29
population	236	255	228	212	187	139	1,257
24-35 months							
# deaths	4	1	1	na	na	1	-
population	288	243	221	na	na	147	-
36-47 months							
# deaths	0	1	2	na	na	0	-
population	223	267	214	na	na	123	-
48-59 months							
# deaths	1	0	0	na	na	1	-
population	254	298	259	na	na	128	-
24-59 months							
# deaths	5	2	3	4	1	2	17
population	765	808	694	488	542	398	3,695
0-59 months							
# deaths	22	27	25	24	16	20	134
population	1,220	1,274	1,132	850	879	672	6,027

source: annual censuses; birth and death registries

TABLE IV.3.

Pooled Mortality Rates for ARHC's Three Established Program Sites

infant mortality rate	77.4 deaths per 1,000 live births per year
12-23 month mortality rate	23.1 deaths per 1,000 children of this age group per year
24-59 month mortality rate	4.6 deaths per 1,000 children of this age group per year

source: derived from data in Table IV.2.

Pooled Mortality for ARHC's Newly Established Program Sites

In 1992, ARHC established two new program sites. One of these, Ancoraimes, is geographically contiguous with the established program site in Carabuco. The other new program site, Sipe Sipe, is geographically contiguous with the Mallco Rancho Program. These two new program areas are, as far as can be determined, similar if not virtually identical to the adjacent areas where ARHC has established programs except for the health program intervention.

In 1992, as new program activities began in these new program sites, routine systematic home visitation (RSHV) and census work did begin in a small portion of the new areas. In Ancoraimes, eight pilot communities were included, with a total population of 2,008 persons. In Sipe Sipe, the pilot area included eight communities with a similar population size, 2,064. RSHV was undertaken and it was possible to determine the numbers of deaths and the overall population in the pilot areas from which these deaths came for the period from April, 1992, until March, 1993. These data are shown in Table IV.5. The pooled mortality rates for these new program sites are shown in Table IV.6 and are based on the data shown in Table IV.5.

TABLE IV.4.

Estimates of the Probability of Death Before Age Five in ARHC's Established Program Areas

cohort method

age group	mortality rate	# of deaths to be expected in a cohort of 1,000 live births	cohort size at end of age period
0-12 months	77.4	77.4	922.6
12-23 months	23.1	21.3	901.3
24-59 months*	13.8	12.4	888.9

estimated percentage of live-born infants surviving to age five = 88.9%

estimated probability of death between birth and age five = 1 - 0.889 = 0.111

95% confidence limits for the estimated probability of death = 0.111 +/- 0.020 =

0.091 - 0.131

under-five mortality rate method

deaths observed: 134
under-five population: 6,027

annual probability of death for children under 5 = .022
five year probability of death (i.e., probability of death prior to age five) = .022 x 5 = .110

95% confidence limits for the estimated probability of death = .110 +/- .020 =

.090 - .130

* The annual 24-59 month mortality rate (4.6) was multiplied by three since this age period covers three years.
source: Carabuco, Mallco Rancho, and Villa Cochabamba/Montero birth and death registries and annual census

TABLE IV.5.

Death and Population Data from ARHC's Two "Control" Program Sites From Which Probabililty of Childhood Death Is Calculated

age group	Ancoraimes 4/92-3/93	Sipe Sipe 4/92-3/93	Total
0-12 months			
# deaths	9	5	14
# births	73	47	120
population	60	51	111
12-23 months			
# deaths	3	4	7
population	52	69	121
24-59 months			
# deaths	2	2	4
population	183	181	374
0-59 months			
# deaths	14	11	25
population	295	301	596

source: annual census and death registry, Ancoraimes and Sipe Sipe

TABLE IV.6.

Pooled Mortality Rates for ARHC's Newly Established "Control" Program Sites

infant mortality rate	116.7 deaths per 1,000 live births per year
12-23 month mortality rate	57.9 deaths per 1,000 children of this age group per year
24-59 month mortality rate	11.0 deaths per 1,000 children of this age group per year

source: derived from data in Table IV.5.

These age-specific rates are used to calculate the estimated probability of death in the control program sites before age five years using the cohort and crude under-five mortality rate methods described previously. One can see in Table IV.7 that the estimated probability of death before age five using the cohort method is 0.182. The number of deaths on which this probability is based is 25. Using Table IV.1 again, we multiply the probability of death (0.195) by 0.38 to obtain a 95% confidence interval. This turns out to be 0.121-0.269. Using the under-five mortality rate method, we estimate the 95% confidence interval for the probability of death before age five to be very similar 0.130-0.290.

TABLE IV.7.

Estimates of the Probability of Death Before Age Five in ARHC's Newly Established "Control" Program Sites

cohort method

age group	mortality rate	# of deaths to be expected in a cohort of 1,000 live births	cohort size at end of age period
0-12 months	116.7	116.7	883.3
12-23 months	57.9	51.1	832.2
24-59 months	33.0*	27.5	804.7

estimated percentage of live-born infants surviving to age five = 80.5%

estimated probability of death between birth and age five = 1 - 0.805 = 0.195

95% confidence limits for the estimated probability of death = 0.195 +/- 0.074
= 0.121 - 0.269

under-five mortality rate method

deaths observed: 25
under-five population: 596

annual probability of death for children under 5 = 0.042
five year probability of death (i.e., probability of death prior to age five) = 0.042 x 5 = 0.210

95% confidence limits for the estimated probability of death = 0.210 +/- 0.080
= 0.130 - 0.290

* The annual 24-59 month mortality rate (11.0) was multiplied by three since this age period covers three years of life.

source: Ancoraimes and Sipe Sipe birth and death registries and annual census

Estimates of Child Survival for Other Areas of Bolivia

There have been a number of recent estimates of infant and child mortality rates in Bolivia for the country as a whole as well as for specific geographic areas (see Table IV.8). Few of these studies, however, have reported mortality rates through the the first five years of life or have assessed mortality rates for different social groups.

TABLE IV.8.

Recent Estimates of Infant and Child Mortality Rates in Bolivia

	infant mortality rate estimates	0-23 month mortality rate estimates	under-five mortality rate estimates
Bolivia nationally			
	89 (UNICEF, 1993)	213 (MPC, 1983)	126 (UNICEF, 1993)
	110 (Rance, 1988)		
	168 (Morales, 1988)		
rural Bolivia			
	120 (Rance, 1989)	253 (valleys) (MPC, 1983)	
	232 (Altiplano) (Morales, 1968)	275 (Altiplano) (MPC, 1983)	
		183 (lowlands) (MPC, 1983)	

The 1989 Demographic and Health Survey of Bolivia (Sommerfelt, et al, 1991), however, did measure age-specific mortality for the first five years of life for various regions and social groups. Although there is reason for questioning the accuracy of these estimates since they are based on a single household visit from a person unknown to the interviewed family member, they do represent a conservative estimate of under-five mortality in Bolivia.

The probability of death before age five for specific subgroups in Bolivia as estimated by the DHS survey is shown in Table IV.9. These subgroups are comparable to ARHC's program sites in a number of respects. The three ARHC program sites are located in the Altiplano (Carabuco), valley (Mallco Rancho), and lowland (Montero) areas. Virtually all of the inhabitants in ARHC's program sites speak Aymara or Quechua, indigenous Indian languages. Two of the three program sites are rural, and the third, although periurban, is composed mostly of families who have recently migrated from rural areas. An earlier study showed that migrants to Montero had mortality patterns higher than those for long-term residents (Foxman, Frerichs, and Becht, 1984). Virtually none of the mothers in any of the program areas have over five years of education, and the great majority of fathers are agricultural workers.

We have calculated in Table IV.9 the overall average of the various probabilities of death before the age of five for these specific groups, which is 0.161. That is to say, 16.1% of the children are estimated to die before the age of five.

These data are based on an overall sample size of 7,923 women 15-49 years of age who were interviewed in 1989. The document describing the survey findings does not give the actual number of deaths recorded, nor does it provide a confidence interval for these rates. For the sake of the present discussion, using the method cited in Table IV.1, we have assigned a 95% confidence interval of +/- .02 to the above, assuming that the number of deaths on which these rates are based is around 400.

The DHS report does not provide the number of deaths used in calculating mortality rates, but 400 appears to be a conservative estimate because of the following rationale. If one assumes that only half of the mothers in the survey were in one of the social or geographic groups listed in Table IV. 9, and these mothers had only one child (both conservative estimates), then 634 deaths would have been reported by these mothers (7,923 x 0.5 x 0.161 = 634). If we again estimate conservatively the probability of death of 0.161 is based on 400 deaths, then according to Table IV.1 the 95% confidence interval will be +/- 0.10 x rate = 0.161 +/- 0.10 x 0.161 = 0.161 +/- 0.016 = 0.145 -0.177.

Thus, we would estimate with 95% certainty that the

percentage of children in Bolivia in areas similar to those in which ARHC has its program areas who die before the age of five is somewhere between 14.5% and 17.7% according to the DHS data.

TABLE IV.9.

Bolivian 1989 Demographic and Health Survey Estimates of the Probability of Death Before Age Five in Bolivia, 1979-1988

subgroup of children	probability of death*
living in rural areas	0.168
living in the altiplano area	0.142
living in the valley area	0.159
living in the lowlands	0.120
speaking a native Indian language	0.186
mother's education less than six years	0.172
father's occupation agricultural	0.177
overall average	0.161

estimate of the 95% confidence interval for the calculated probability of death .= 0.161 +/- 0.016

= 0.145 - 0.177

* based on a cohort method identical to that shown in Tables IV.4 and IV.7.
** see text for description of methodology

source: Sommerfelt, et al, 1991, p.8.

It should be noted that these data are for a ten year period, 1979-1988. One might argue that because of the overall improvements in mortality rates in Bolivia over time, using data for earlier periods would be inappropriate. These differences are slight, however. For Bolivia as a whole, the probability of death between birth and age five was 0.152 for the 1979-1983 period and 0.131 for the 1984-1988 period according to the DHS data.

Comparisons of Child Survival in ARHC's Established Program Sites With Similar Areas

Since ARHC's established program sites had well-developed programs before it became possible to measure mortality rates through routine systematic home visitation, it is not possible to determine what the baseline probability of childhood death was in the program areas prior to beginning the program. Our case for mortality impact, therefore, must rest on comparisons with similar areas. The geographically adjacent new program sites appear to be comparable since they share common cultural, ecological, and socioeconomic characteristics. Furthermore, routine systematic home visitation was established from the beginning in pilot areas in these two new program sites. Thus, the observed rates are actual baseline rates, although they are from relatively small populations. The rates estimated in these two new program sites may be relatively conservative since they are based on the newly established home visitation program and the families still may be reluctant or suspicious about sharing all mortality information at the time of home visits.

The Demographic and Health Survey data for estimating probability of death before age five are based on an average of probabilities for areas similar to those of ARHC's program areas. Again, these are likely to be conservative estimates since they are based on a single household survey by someone unknown to the household member and since they are based on recall of the previous 10 years.

Table IV.10 as well as Figure IV.1 compare the probabilities of death before age five for these three sites. These comparisons demonstrate that the 95% confidence intervals do not overlap when comparing the results of either Method 1 (the cohort method) or Method 2 (overall under-five mortality) for the established program areas with the DHS data for the rest of Bolivia. The confidence intervals barely overlap when comparing the established program areas with ARHC's "control" areas using methods 1 and 2. It would appear that with continued registration over time of more deaths in control areas, a statistically significant difference will soon be seen (if the mortality rates in the newly established program areas do not drop too quickly as a result of program interventions).

TABLE IV.10.

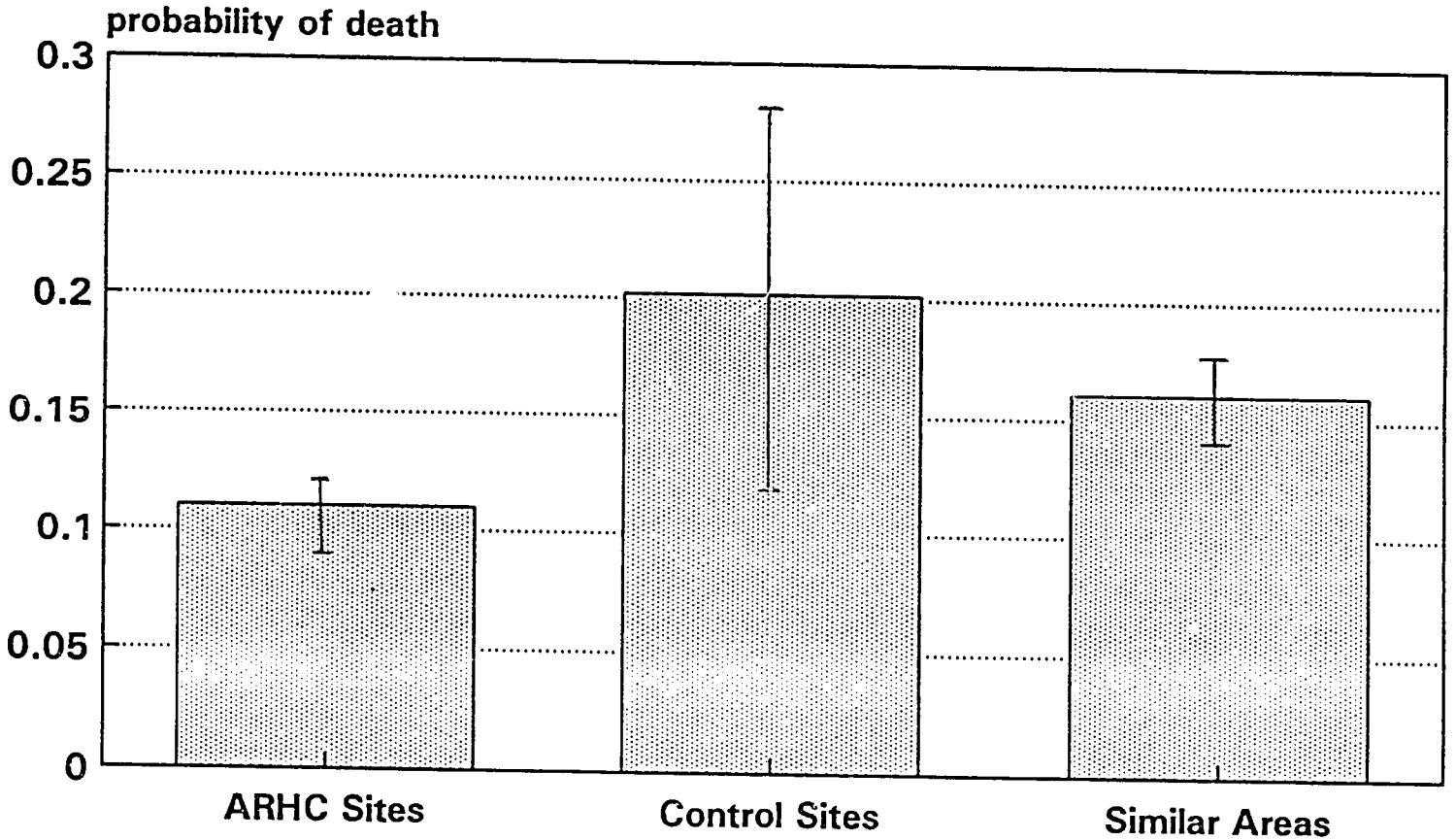
Probability of Death Before Age Five in ARHC's Established Program Areas Compared to that for Control Areas and for Similar Areas in Bolivia

population	estimated probability of death before age five	95% confidence interval	95% confidence limits
ARHC's established program areas (Carabuco 1990-2; Mallco Rancho 1991-2; and Montero, 1992)			
method 1	0.111	+/-0.020	0.091-0.131
method 2	0.110	+/-0.020	0.090-0.130
ARHC's newly established "control" areas (Ancoraimes and Sipe Sipe, 1992)			
method 1	0.195	+/-.074	0.121-0.269
method 2	0.210	+/-.080	0.130-0.290
similar areas elsewhere in Bolivia (1979-1988)			
method 1	0.161	+/-0.016	0.145-.177

method 1: based on the cohort method as described above
method 2: based on overall under-five mortality rate

source: see text

Figure IV.1.
Probability of Death Between Birth and Age 5, ARHC Programs Versus Other Sites



See Table IV. 10 and text for further details. Averages of methods 1 and 2 taken for control site calculations.

These findings indicate that the overall probability of death before the age of five in the established ARHC program areas is 32 - 46% less than that observed for control areas or for similar areas of Bolivia (see Table IV.11). When comparing the program results with those for similar areas of Bolivia, they reach statistical significance at the 0.05 level. When comparing the program results with control areas, they come very close but do not quite reach statistical significance.

TABLE IV.11.

Improvements in Child Survival Estimated for ARHC's Program Areas

population	estimated probability of death before age five	improvement in child survival relative to comparison groups
ARHC program areas	0.110	-
ARHC control areas	0.202*	46% $\frac{(.202-.110)}{0.202}$ x100
similar areas in Bolivia	0.161	31% $\frac{(.161-.110)}{0.161}$ x100

* this is the average of the rate calculated with the cohort method (0.195) and with the under-five mortality rate method (0.210)

source: see Tables IV.7, IV. 9, and IV.10.

Conclusions

Taken as a whole, these data provide highly suggestive evidence that child survival has been favorably affected through ARHC's application of the CBIO approach in its established program areas. However, we have not "proven" that ARHC's programs have improved child survival. The small numbers involved resulted in relatively large confidence limits, especially for the control areas. Further, there has been no randomization of the program intervention, so we cannot prove that the control areas used here are equivalent to the intervention areas. Finally, we cannot be absolutely sure that the lower childhood mortality rates observed in the program areas are a result of program interventions rather than some other unknown influence. As we saw in Chapter III, however, we do have evidence of substantial differences in coverage of child survival interventions between established program areas and new control areas.

The mortality data obtained for ARHC's program areas are based on routine systematic home visitation carried out by health personnel who are known to the families and who are part of a stable health program working in the area for several years. This method is a "gold standard" for mortality assessment in developing countries, and represents as accurate an assessment of mortality rates as can be obtained under the circumstances.

The mortality data from ARHC's control areas and from the DHS survey for similar areas are likely to represent a conservative estimate of actual mortality. In ARHC's two control areas, routine systematic home visitation had been underway for twelve months. It is quite likely that not all deaths were captured at this early point in the development of these two new programs. Furthermore, the DHS household survey data are also likely to represent an underestimate since they are based on a single household visit from a stranger who asks sensitive personal family questions regarding the past 10 years. Thus, one could argue that the observed differences between ARHC's program areas and the comparison areas would be greater if the mortality data for the comparison areas were collected in the same way the mortality data were collected in the ARHC program areas: through routine systematic home visitation over the course of several years, using prospective rather than retrospective data, in similar sized populations as those in the intervention areas, and in control areas in which child survival interventions were not being provided.

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CHAPTER V. COST, COST-BENEFIT, AND SUSTAINABILITY

The issues of program cost and sustainability of child survival programs are of great concern to everyone working in this field. It is obvious that inexpensive programs can be developed and operated, but that does not necessarily mean the program is effective, has a favorable cost-benefit ratio, or is financially sustainable. Furthermore, a program can be effective in terms of vaccination coverage or some other parameter of child survival technology effectiveness and still not necessarily improve child survival. A program which is sustainable with local resources would most likely need to have a predominately curative orientation and therefore not necessarily improve child survival.

As we review the financial aspects of the CBIO approach, it is important to bear in mind that the first criterion on which to judge the CBIO approach is its effectiveness, not its cost. If the model is in fact effective, then it becomes necessary to determine if the costs of implementing the model are sustainable in the longer run or how the cost of implementing the model can be reduced with minimal reduction in the effectiveness of the approach. One development specialist in Bolivia has stated the issue in this way:

> I believe that the criticism that the [ARHC] pilot program [CBIO approach] cannot be easily replicated nor sustained is both directed at the wrong party and very premature. It seems that it is necessary to first construct a model that works, and then formulate a plan to make it economically feasible, and not the other way around (Leonard, 1991).

Unfortunately, there is limited published data available about the cost of either comprehensive or selective primary care. Consequently, it is difficult to compare the cost-effectiveness of the CBIO approach with other primary care approaches.

With these thoughts in mind, we will summarize our findings regarding the cost, cost-benefit, and the financial sustainability of the CBIO approach as ARHC has developed it in Bolivia.

Cost

The costs of primary care activities for the program sites were analyzed for the 1992 fiscal year (March, 1992 - February, 1993). All identifiable local program costs were included (Over, 1989, p.30). Included among these were depreciation, continuing education, training, purchase of initial stocks of supplies, maintenance and repair, and identifiable costs borne by the Ministry of Health (MOH) for program operations. The calculated costs do not include the costs of operation of the La Paz or Lake Junaluska, North Carolina administrative offices nor the value of some medicines and supplies which had been donated for program operations.

Since the annual recurring costs included depreciation of capital investments, our analysis emphasizes the estimated recurring costs rather than the total program costs including capital investments.

Costs were broken down into cost categories as well as into functional program components. At each program site, an estimate was made of the program effort for each area of program activity. This was based on discussions with program staff about the relative amounts of effort given to specific program activities. Then costs per capita were assigned on the basis of population data tabulated through the programs' own census activities.

All recurring expenses were broken down into five categories. In Table V.2, the percentage breakdown for each program area is shown along with an average for the three program areas. Sixty percent of recurring expenses are for personnel. The remaining expenses are virtually equally divided between administration, transportation, supplies, and infrastructure. The administrative costs shown in Table V.2 do not include personnel costs of administration. These were included in the personnel category. These findings are also shown graphically in Figure V.1.

Table V.2.

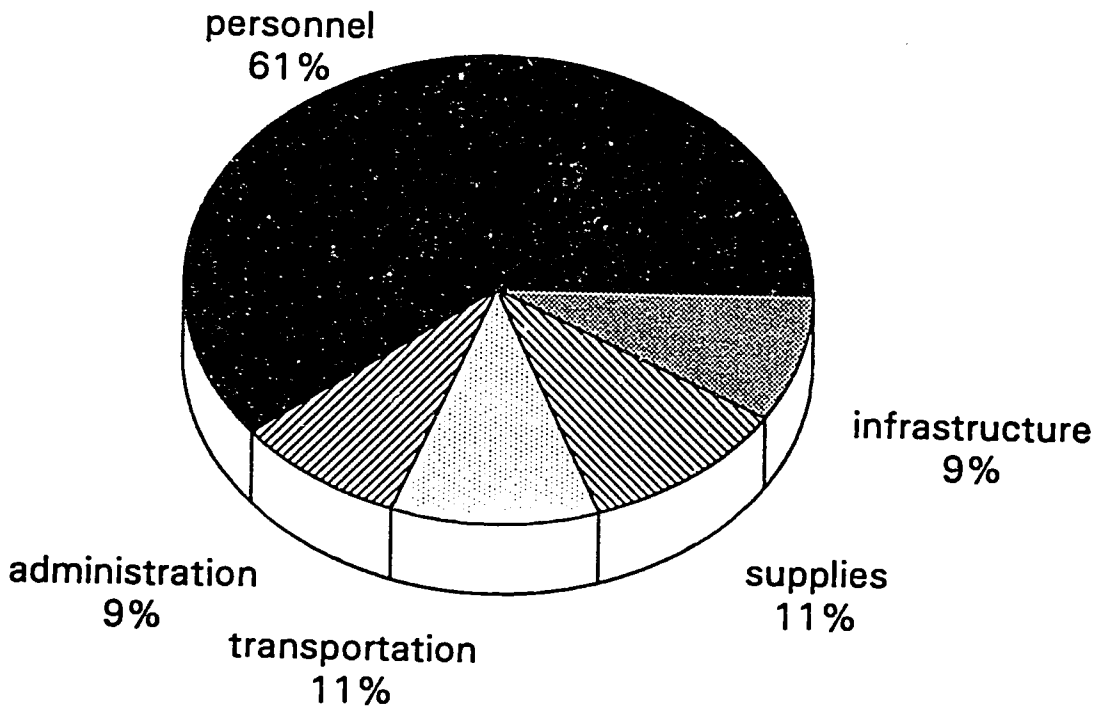
Cost Categories for Each of ARHC's Three Established Program Sites in FY 1992

	Carabuco	Mallco Rancho	Villa Cochabamba/ Montero	Average
personnel	61%	61%	59%	60%
administration	11%	8%	7%	9%
transportation	13%	12%	7%	11%
supplies	4%	10%	19%	11%
infrastructure	10%	9%	8%	9%
Total	99%	101%	100%	100%

source: local program financial records

Figure V.1.

Breakdown of Total Recurring Costs for ARHC's Established Programs, 1992



source: local program financial records

In order to estimate the cost of various functional elements of the program, it was necessary to determine the program effort which went into each function. These determinations were carried out through discussions with program staff. The percentages used for these calculations are shown in Table V.3. For all three program areas taken together, 71% of program effort was devoted to child survival primary care activities. Immunizations and nutrition were the most time consuming child survival interventions, followed by home visitation. Twenty-nine percent of program activities were devoted to non-child survival primary care activities which include adult curative primary health care as well as those components of childhood primary care not included as one of the child survival interventions. Figure V.2. shows these results in graphic format.

Table V.3.

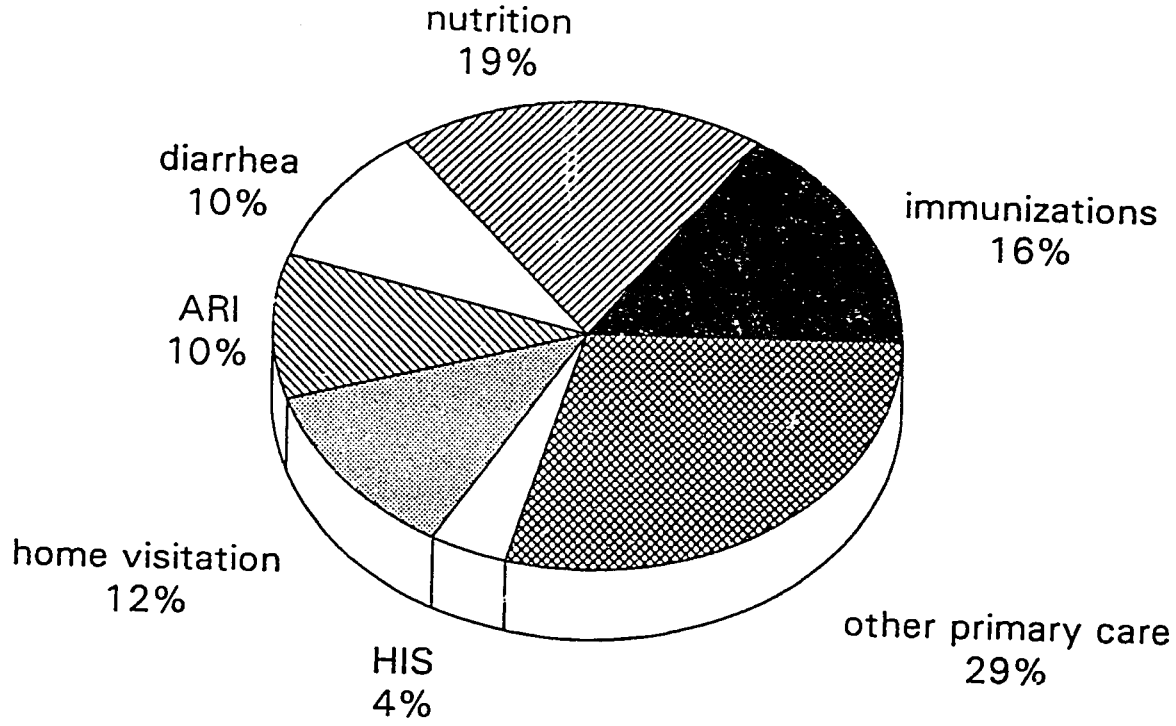
Estimated Distribution of Primary Care Program Effort According to Functional Program Category

	Carabuco	Mallco Rancho	Villa Cochabamba/ Montero	Average
child survival				
immunizations	16%	18%	17%	17%
nutrition	24%	18%	15%	19%
diarrhea	9%	11%	9%	10%
acute respiratory infection	9%	11%	3%	8%
home visitation	17%	11%	12%	13%
health information system	5%	4%	3%	4%
non-child survival primary care	20%	27%	41%	29%
Total	100%	100%	100%	100%

source: local program staff estimates

Figure V.2.

Breakdown of Primary Care Program Effort for ARHC's Established Programs, 1992



source: local program staff

Recurring costs were broken down in several different ways. Program costs were divided into child survival costs and other primary care costs. The non-child survival activities were quantified and assigned a relative value based on staff time and effort. The cost per unit of service was an average of $1.30 (see Table V.4). An outpatient consultation, for instance, was assigned a relative value of 2, and thus cost an average of $2.60. The overall cost per capita of the non-child survival primary care component was $3.09 per person per year.

Child survival expenses were calculated on a per child basis for all three programs and found to be on average $44.26 per year. When mothers were included as beneficiaries, the per capita expense dropped to $18.38. The recurring cost of the overall program, including the child survival and the other primary care components, was $8.57 per person per year when the costs for the three program areas were averaged (see Table V.4).

How do the costs of program implementation using the CBIO approach compare to other data for child survival and primary health care? Compared with the other Latin American programs of US-based PVOs receiving USAID support from the PVO Child Survival Program in Washington, ARHC's programs are moderately expensive. The calculation of cost per beneficiary in terms of AID grant support ranked ARHC fourth out of 15 PVO country projects (PVO Child Survival Support Program, 1993) Thus, ARHC's costs for program operations are not out of line with other PVO operations even though ARHC's costs are toward the upper end of the scale. The AID data do not include matching funds provided by the PVOs but they do, however, include headquarters costs which have been covered with AID funds. The costs of ARHC programs cited in the earlier tables are local program costs only.

According to a recent AID report (Martin et al, 1992), the per capita expenditure of the MOH in Bolivia in 1987 was $6.59 per year. This per capita MOH expense includes the cost of secondary and tertiary facilities which are concentrated in urban areas (Perry, 1988) and thus are not fully representative of what the MOH actually spends on child survival activities, particularly in rural areas. Based on data in Chapters IX-XI and Appendix V, we estimate the actual per capita amount spent by the MOH in ARHC's established program areas to be $0.12 in Villa Cochabamba/Montero, $1.07 in Carabuco, and $1.14 in Mallco Rancho. Thus, a combined primary care/child survival program in Bolivia costing $8.57 per person per year may be difficult to sustain in the long run without a greater commitment from the MOH, greater income from locally-generated sources, as well as long-term external financial support.

Table V.4.

Annual 1992 Recurring Costs of Child Survival Primary Care and Other Primary Care Activities for ARHC's Three Established Program Sites*

	Carabuco	Mallco Rancho	Villa Cochabamba/ Montero	Average
cost of child survival program per child	$66.35	$46.34	$20.10	$44.26
cost of child survival program per child/mother	$27.21	$19.13	$ 8.81	$18.38
cost of non-child survival primary care per service	$ 1.49	$ 1.11	$ 1.29	$1.30
cost of non-child survival primary care per capita	$ 2.32	$ 3.40	$ 3.56	$3.09
cost of overall program per capita	$ 9.70	$ 9.66	$ 6.31	$ 8.57

* includes: depreciation of buildings, equipment, and vehicles; training and continuing education but not La Paz, Bolivia, and Lake Junaluska, NC, office expenses nor the value of some donated supplies and equipment

source: local program financial information and annual census

The same AID report by Martin cited above describes the cost of child care for an AID-supported primary health care program (PROSALUD) and adjacent MOH health centers. These costs averaged to be $11.04 per child per year, considerably less than the $44.26 per child for ARHC's programs. These data, however, are for urban programs. The coverage of child survival services in the populations for which these programs are responsible is not assessed in Martin's AID report. Another study found that primary care/child survival costs in Bolivia ranged from $1.99 to $6.49 per person. These were a sample of urban and rural private and governmental programs (Cisneros, 1992, p. 20).

There are limited additional data available which can be used for comparison purposes. Patel (1989) cites data for the per capita costs of five combined child survival and primary health care programs. These vary from $3.00 to $5.50 per person per year. Patel's data are from the late 1980s. The geographic locales of these projects was not provided. Thus, in comparison, ARHC's cost of $8.57 is beyond the upper range reported by Patel, but nevertheless not totally unreasonable.

One report of almost a decade ago (Grosse and Plessas, 1984) calculated the per capita annual cost of seven primary health programs around the world. There were three large-scale programs serving from 651,000 to 12 million people and four small demonstration projects serving from 11,000 to 22,000 people. The annual per capita costs as reported in 1984 were $0.60 to $2.70 for the large scale projects and $6.10 to $15.40 for the smaller demonstration projects. Interestingly, one of the demonstration projects included in their study was in Montero, Bolivia, which had an AID-supported project in the late 1970s. The annual per capita cost was $15.40. In 1991, this would have been far greater than the $5.66 per capita spent by ARHC for its Montero program. Walsh and Warren (1979) reviewed a number of primary care programs and calculated that the median per capita cost at that time was $2.00.

Thus, the cost of the CBIO approach as ARHC has applied it is at the upper end of the scale of per capita costs and will be difficult to sustain without further efforts to reduce costs and foster local recurring income generation. This does seem feasible, however.

Cost-Effectiveness

We will limit our discussion here to the mortality benefit estimated for ARHC's programs. In Chapter IV, we estimated that the probability of death for children in ARHC's established program areas was 0.11 while for children in similar settings in Bolivia it was 0.16 and for children in sites adjacent to the established program sites it was 0.20. We will assume for the current discussion that the probability of death for children similar to those in ARHC's established program areas who receive conventional MOH-type services is 0.18.

We will assume that the CBIO approach costs $50 per child per year, and the conventional MOH services cost $5 per child per year. We will also assume that 1,000 children are cared for from birth to five years of age in each of the two programs- the ARHC program and the MOH program. The total cost for five years to ARHC would be $250,000 and to the MOH, $25,000. The difference in costs would be $225,000.

According to recent UNICEF data, the average life expectancy at birth in Bolivia is 60 years (UNICEF, 1993). If we assume that each child death occurs at age two (a conservative estimate), then each death would result in 58 years of lost life. If, for 1,000 children receiving care from ARHC, the probability of death is 0.11, then 110 children would die before the age of five. For the MOH program, 180 children would die. Thus, there would be a net difference of 70 more deaths with the MOH program than with the ARHC program. These 70 hypothetical children would have lived 4,060 years (70 x 58). The overall additional cost of the ARHC program is $225,000. Thus, for a $225,000 investment, 4,060 years of life are gained. This results in a cost of $55.41 for each year of life saved as a result of the CBIO approach.

The cost per infant or child life saved through the application of the CBIO approach is $3,214 ($225,000/ 70). In Walsh and Warren's review of 1979, they estimated a cost of $700 per infant and child death averted through basic primary care compared to $200-$250 through selective primary care. Exactly what these costs would be now, 15 years later, has not been calculated, but it would appear they would be in the same general range as we are calculating for ARHC's programs.

Sustainability

Sustainability of health programs is a simple idea on the surface, but multifaceted and difficult to measure. While sustainability of health programs is usually thought of in financial terms, it is in fact a much broader concept. In addition to non-external financial support, long-term sustainability requires local political support, local technical

support, community support, and local professional/staff support. Prior to focusing exclusively upon financial sustainability, some comments regarding the nonfinancial aspects of sustainability might be appropriate.

From the standpoint of local community political support, ARHC's programs have a strong potential for sustainability. There is strong community support from individual families and from local political leaders. The linkage of the child survival component to other primary care activities makes this possible. If ARHC's programs were purely child survival, it is doubtful that they would have enough local community political support to make them sustainable in non-financial terms.

From the standpoint of broader political sustainability, it is necessary to consider the role of the Bolivian Ministry of Health. Unfortunately, the MOH has been in a process of retreat in financing of local health services for the poor, particularly in geographic areas where there is a PVO presence. While ARHC has been able to maintain or perhaps increase slightly the contribution of the MOH to its field programs, this has been as a result of great effort and persuasion on the part of ARHC's program leadership in Bolivia. It was noted by Mr. James Becht, who conducted the Mid-Term Evaluation for ARHC's Child Survival grant in the summer of 1992, that the staffing patterns for ARHC's programs are generally within the norms established by the MOH for its own programs (Becht, 1992). One exception to this has been the number of auxiliary nurses in Carabuco. This number has since been reduced within the past year and will probably be reduced further to bring it into line with MOH norms.

In terms of professional/staff sustainability, it appears that the work load and leadership required to implement this approach is sustainable. All programs are led by Bolivian health professionals and are staffed by local people along with midlevel staff who are recruited from within the country. Staffing requirements are sustainable, although ARHC does foresee the need for special training for newly incorporated staff since the CBIO approach is quite different from more traditional modes of work.

Technical sustainability is not an issue. Only very basic technology is utilized in ARHC's health programs.

Let us turn now to financial sustainability. In general, ARHC's programs try their very best to recover the cost of drugs and recover a fee for each curative service which is provided. Patients are not refused treatment if they are unable to pay, however. The capacity of patients to pay for the care they receive varies significantly. Families in the Carabuco Program Area have very little, if any, disposable income. Receiving payment for services is a very difficult proposition. In the Villa Cochabamba/Montero Program Area, on the other hand,

families have more disposable income available even though it is the poorest area of the city of Montero. The families in the Mallco Rancho Program Area are in a middle position compared to the other two program areas in terms of their ability to pay for the services they receive.

Table V.5 shows the amount of funds which have been generated locally from program operations. The amount generated in Carabuco has been relatively constant since 1986, varying between $1,018 and $2,538. Locally generated funds account for only 3% of recurring program operations there.

The Mallco Rancho Health Program generated $6,133 in local contributions for primary care activities in FY 1992, amounting to 11% of the cost of primary care program operations. The Villa Cochabamba/Montero Health Program, on the other hand, generated $15,457 in local funds, which represents 23% of the recurring costs of the primary care program. The average percentage for the three programs of annual recurring primary care program costs supported by locally generated funds is 12%.

Table V.5.

Locally Generated Funds for Primary Care Program Operation, 1992

program site	amount of local funds generated	percent of recurring costs
Carabuco	$ 2,538	3% ($2,538/$95,906)
Mallco Rancho	$ 6,133	11% ($6,133/$56,333)
Villa Cochabamba/ Montero	$15,457	23% ($15,457/$67,033)

source: local program financial information

The percentage of recurring local program costs that are covered by the MOH for each program site is shown in Table V.6., and is on average 8%. Adding MOH support to locally generated support for Carabuco results in 14% of recurring program costs being met by local revenue or the MOH. In Mallco Rancho, 21% of recurring program costs are met by local revenue or the MOH while in Villa Cochabamba/Montero, it is 25% (see Figure V.3.).

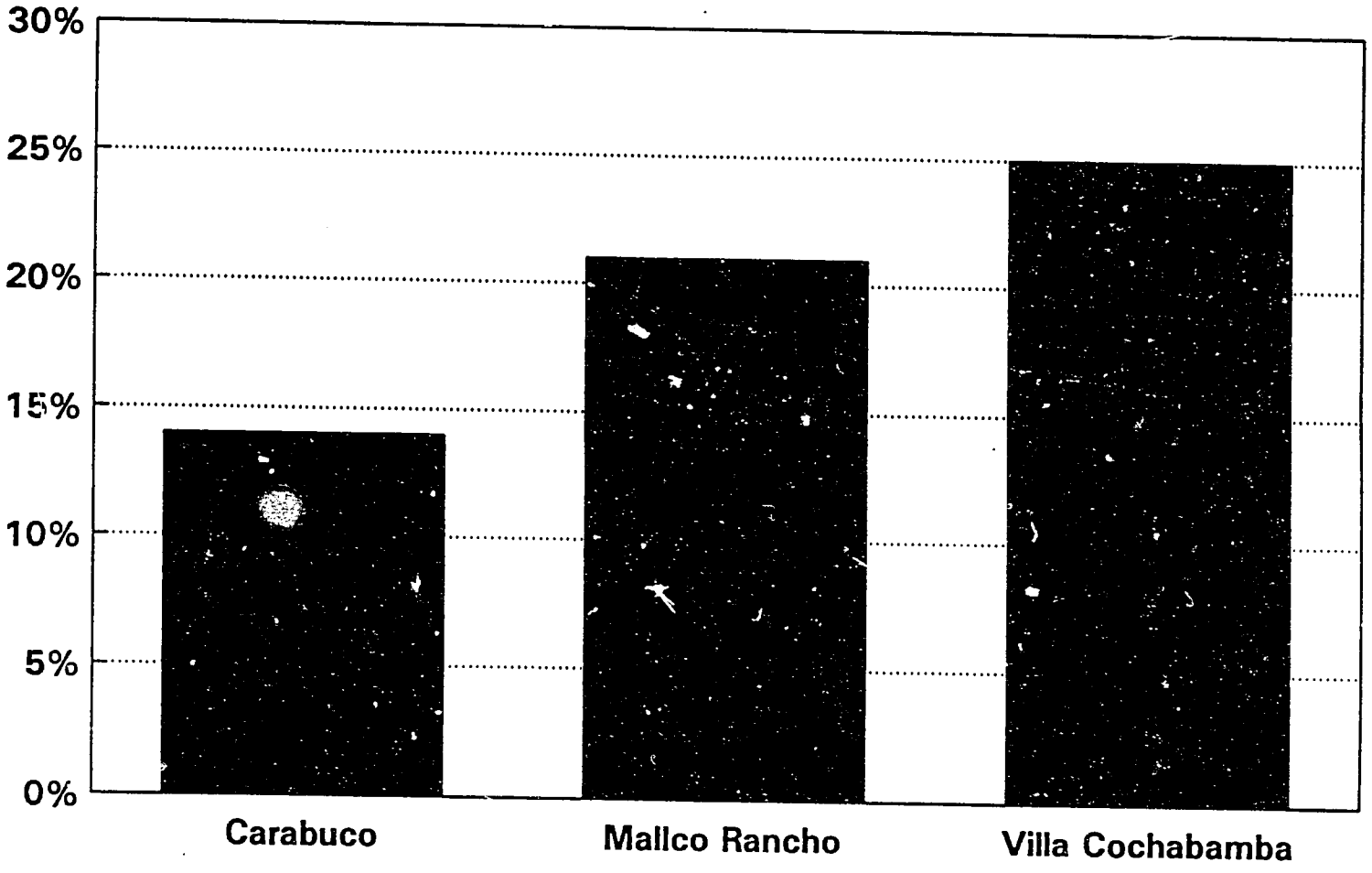
Table V.6.

Percent of Recurring Program Costs Provided by the MOH, 1991

program site	estimated value of MOH support	percent of recurring program costs
Carabuco	$10,545	11% ($10,545/$95,906)
Mallco Rancho	$ 5,633	10% ($5,633/$56,333)
Villa Cochabamba/ Montero	$ 1,500	2% ($1,500/$67,033)

source: local program financial information

Figure V.3.
Percent of Recurring Program Costs Met From Local and MOH Sources



source: local program financial records

It is difficult to compare these data with those for other programs. First of all, there is limited data for other programs and, secondly, it is hard to know if the data are comparable. In one review of primary health care clinics operated by a large PVO in Haiti, it was determined that, on average, 20% of the total operating costs of the PVO were recovered from user fees (Setzer and Boulos, 1992). The best estimate at the moment is that approximately 12% of ARHC's total operating costs are recovered from user fees.

Conclusion

There is no doubt that the costs of the CBIO approach as ARHC has applied it are relatively high compared to other PVOs working in child survival and compared to other primary care programs in Bolivia. We estimate the cost of saving a child's life through the CBIO approach to be $3,214, and the cost per year of life saved for infants and children to be $55.41 per year.

At present, approximately 12% of recurrent program expenses are obtained from user fees, and 8% of expenses are obtained from MOH support. Thus, four-fifths of recurrent expenses are met from external ARHC sources.

Costs of program operations could be reduced through economies of scale (operating larger programs for a smaller per capita cost) and through streamlining the approach (as will be discussed in Chapter VII). In addition, one obvious approach to lowering costs in addition to these is to substitute lower paid staff for more highly trained (and paid) staff. Another related approach is to incorporate primarily lesser paid staff as programs expand, thus achieving the same net result over a period of time.

Approximately 60% of recurring local program costs are for personnel. A heavier reliance on lesser paid staff could lead to substantial cost savings. Since ARHC's experience with volunteers so far has not been favorable, it would not be wise to shift the burden of program operations at this point on to volunteers. However, if an effective means of building program operations upon a volunteer staff could be developed as has been done at Jamkhed, India, (Arole, 1987), then the reduction in costs would be dramatic. Additional effort at local cost recovery through higher user fees will be necessary along with streamlining program operations if ARHC's application of the CBIO approach is to achieve long-term sustainability.

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CHAPTER VI. REGIONAL VARIATIONS IN THE DETERMINANTS OF CHILD MORTALITY WITHIN ARHC'S PROGRAMS IN BOLIVIA

One of the assumptions of the CBIO approach is that it is necessary to make a local community diagnosis of the most frequent, serious preventable or treatable diseases and a local determination of those at greatest risk rather than rely on data derived from other locations, nationally or internationally. This assumption is similar to the premise of the Essential National Health Services Research (ENHSR) approach (Commission on Health Research for Development, 1990).

The ENHSR approach encourages countries to gather health information from within its borders to guide national programs rather than relying on global data or data from other countries. One of the premises of the CBIO approach is that each local area is different, and information about health problems needs to be obtained from local communities before designing an effective health program. Obviously, this argument can be carried to an extreme, but at least it should be recognized that among different ecological areas and among different socioeconomic groups, the community diagnosis of health priorities may vary significantly. If each local program is going to be able to improve health, then the nature of the interventions needs to be adjusted, particularly in light of the extremely limited resources available for most health program activities.

It is this premise which will be explored here for ARHC's three established program areas reviewed in this document. As has been previously indicated, the Carabuco Health Program Area includes almost exclusively Aymara people involved in farming and other agricultural work in a relatively isolated rural area at

13-15,000 feet elevation. The Mallco Rancho Program Area includes Quechua people in mixed agricultural/commercial activities in a rural setting at 8,000 elevation feet which is near a major urban area. The third setting involves both Quechua and Spanish descendents, many of whom have migrated from the highlands to a periurban low-income area of the city of Montero in a semitropical lowland environment. This area, called the Villa Cochabamba Health Area, is densely populated and has major problems because of a lack of clean water and sanitation as well as because of high rates of bottle feeding. These problems are not encountered to the same degree at the other program sites. The Villa Cochabamba residents are involved in the commercial life of the city in some way, although many work as seasonal agricultural laborers.

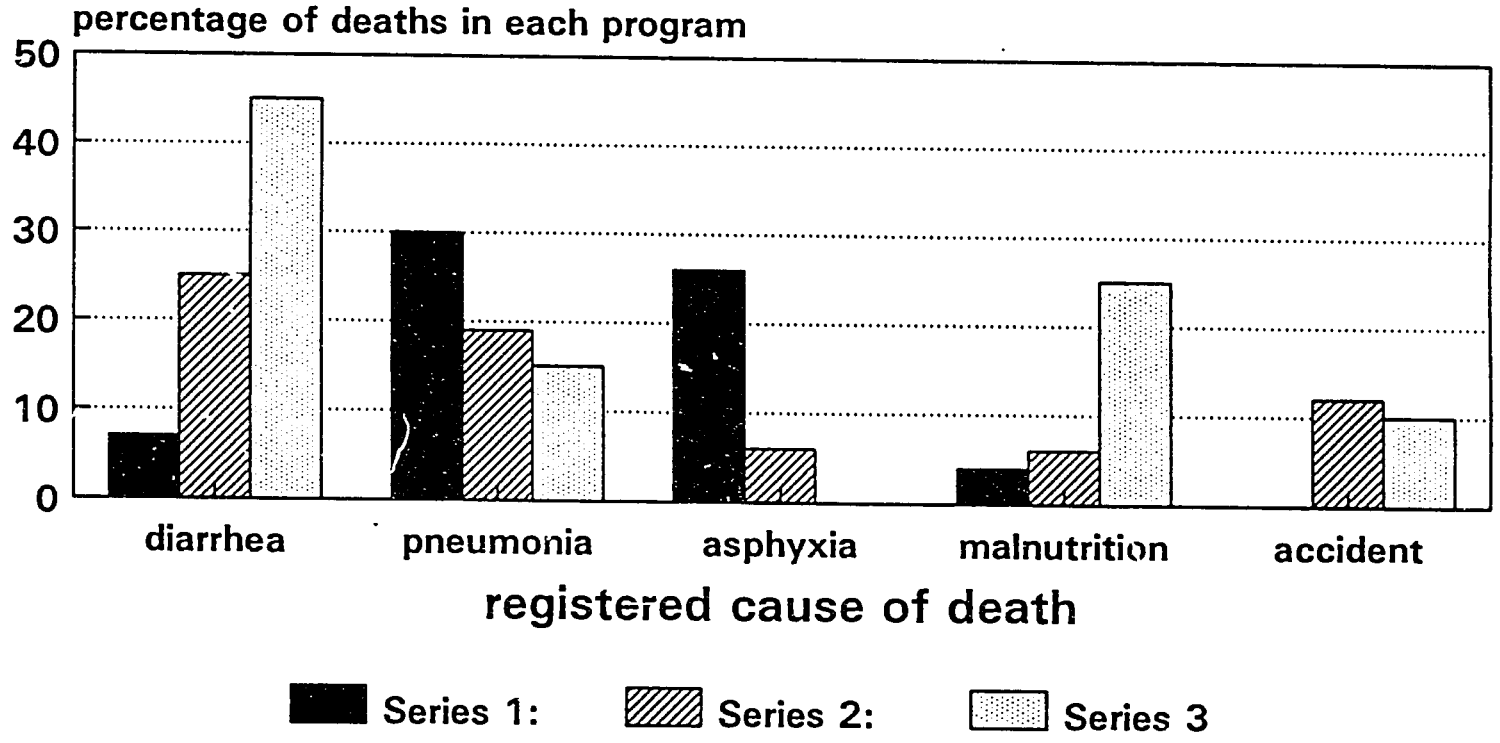
The data reported here are comparisons of causes of childhood death and age at death for these three program areas. These data are described in more detail for each program area in Chapters IX - XI. For this discussion, data have been limited to 1990-1992 for Carabuco, 1991-1992 for Mallco Rancho, and 1992 for Villa Cochabamba/Montero. The Villa Cochabamba/Montero data described here are for approximately one-third of the program population in which routine systematic home visitation (RSHV) was conducted throughout 1992. It is during these years that the registration of births and deaths on the basis of RSHV is sufficiently reliable and worthy of further analysis.

Comparisons Between Programs by Cause of Death

Figure VI.1 shows the percentage of deaths in each program area by assigned cause of death. It is readily apparent that the percentage of a program's childhood deaths due to diarrhea progressively increases as one moves from Carabuco, in the highland area, to Mallco Rancho, in the mountainous valley area, down to Montero in the semitropical lowland areas. The percentage of childhood deaths due to pneumonia is slightly higher in Carabuco than in the other two program sites. Asphyxia is a much more common cause of death in Carabuco, where it accounts for almost 20% of the childhood deaths, than in Mallco Rancho, where it causes only 8% of the deaths. In Villa Cochabamba/Montero, asphyxia was not registered as a cause of even a single death. Malnutrition was listed as a cause of death in almost one-quarter of the deaths in Villa Cochabamba/Montero and in only 5% of the deaths at the other two program sites. In Carabuco, both pneumonia and asphyxia were more frequent causes of death than diarrhea.

Malnutrition was a clinical diagnosis based on physical examination or history rather than actual height and weight measurement. Asphyxia was also a clinical diagnosis based on a history of a sudden unexpected cessation of respirations without

Figure VI.1.
Percentage of Childhood Deaths in Each Program Area by Cause



Series 1: Carabuco, 1991
Series 2: Mallco Rancho, 1992
Series 3: Montero/Villa Cochabamba, 1992

prior symptoms.

These findings are noted slightly differently in Table VI.1. Here, each death is listed only once. The classifications created for cause of death allow for more than one diagnosis. With mutually exclusive categories, it is possible to carry out a Chi Square test for statistical significance. One can see that the probability that the differences observed for the three program areas are due to chance is less than 0.005.

Comparisons Between Programs of Age at Death

Figures VI.2-4 show the distribution of ages at death for the childhood deaths registered in Carabuco in 1990-1992, in Mallco Rancho in 1991-1992, and in the Villa Cochabamba neighborhood of the Villa Cochabamba/Montero Program for 1992. A very different pattern is readily apparent in each of the three areas.

In Carabuco, there is a marked concentration of children who died before the age of three months. Over half of the childhood deaths registered occurred within the first three months of life. After three months of age, there continues to be a small percentage of deaths occuring throughout the first four years of life.

In Mallco Rancho there is also a relatively high percentage of childhood deaths occurring during the first three months of life (42%), although it is less than in Carabuco. However, there is a considerably higher percentage of children dying after three months of age, particularly in the 3-21 month age period, compared to Carabuco.

Finally, in Montero, we see a strikingly different pattern, with two peaks in the age periods at which childhood deaths were recorded most frequently: one at 3-6 months of age and a second at 15-21 months of age. The low percentage of deaths in the first three months of life in Montero compared to Carabuco and Mallco Rancho is of particular note.

The data for each program area have been collapsed into two categories in Table VI.2. The numbers of children dying during the first year of life are compared to those dying after completing the first year of life. Three-quarters of the children in Carabuco died during the first year of life compared to two-thirds in Mallco Rancho and less than half in Villa Cohcabamba/Montero. These differences have a probability of less than 0.02 of being due to chance according to Chi Square calculations.

Table VI.1

Numbers of Deaths by Diagnosis Among Children in Carabuco, Mallco Rancho, and Villa Cochabamba/Montero*

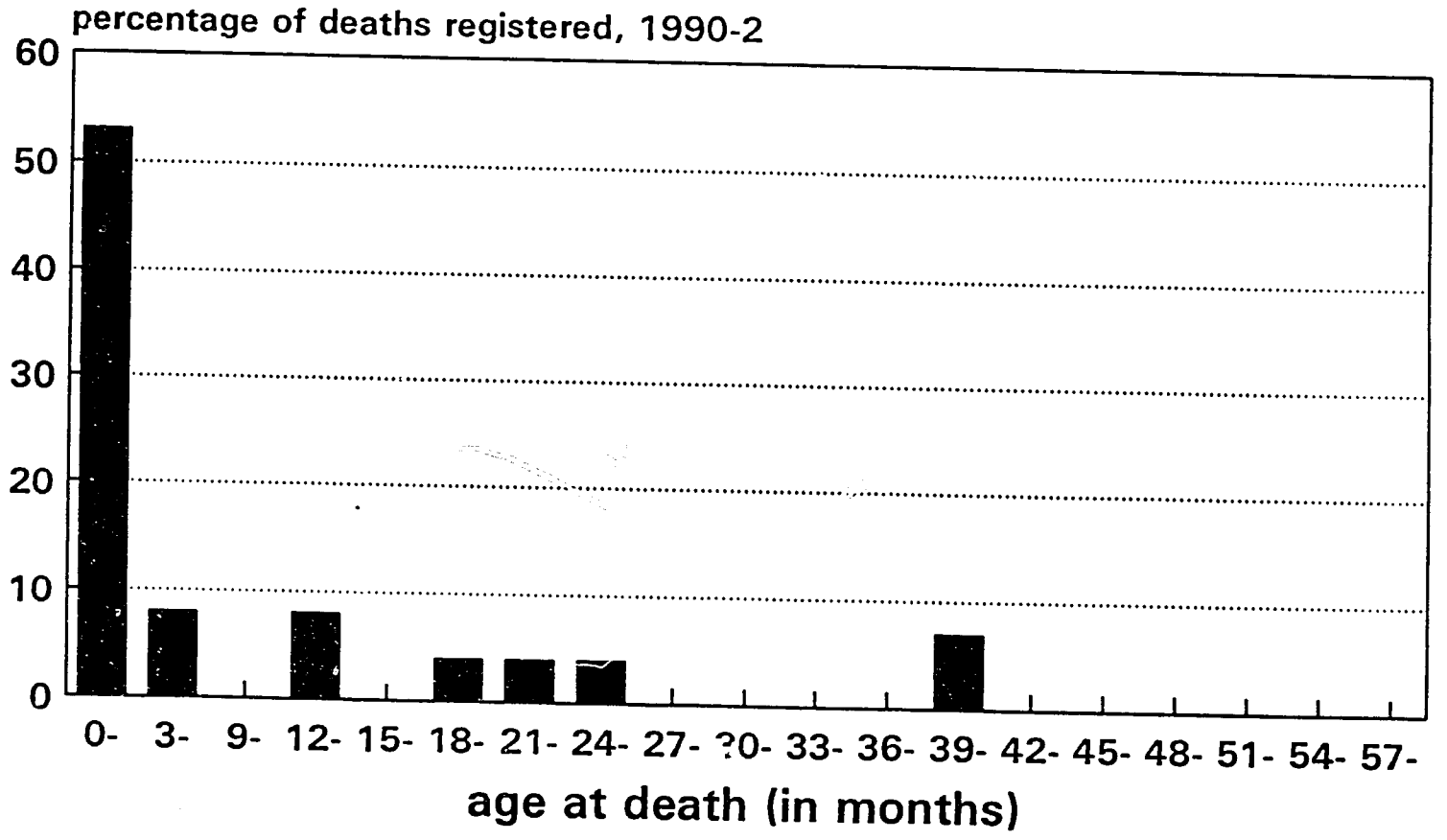
cause of death	program site: Carabuco	Mallco Rancho	Villa Cochabamba Montero	Total
diarrhea/acute respiratory infection	0	1	1	2
acute respiratory infection	12	4	2	18
asphyxia	9	3	0	12
diarrhea	2	12	6	20
malnutrition	4	2	3	9
diarrhea/malnutrition	0	0	2	2
trauma	6	4	2	12
other	16	11	4	31
Total	49	37	20	106

Chi Square = 31.34
df = 14
p = .005

* The data for Carabuco are for 1990-2, for Mallco Rancho 1991-2, and for Villa Cochabamba/Montero 1992. The Villa Cochabamba/ Montero data are for one neighborhood ("barrio") comprising one-third of the overall program area.

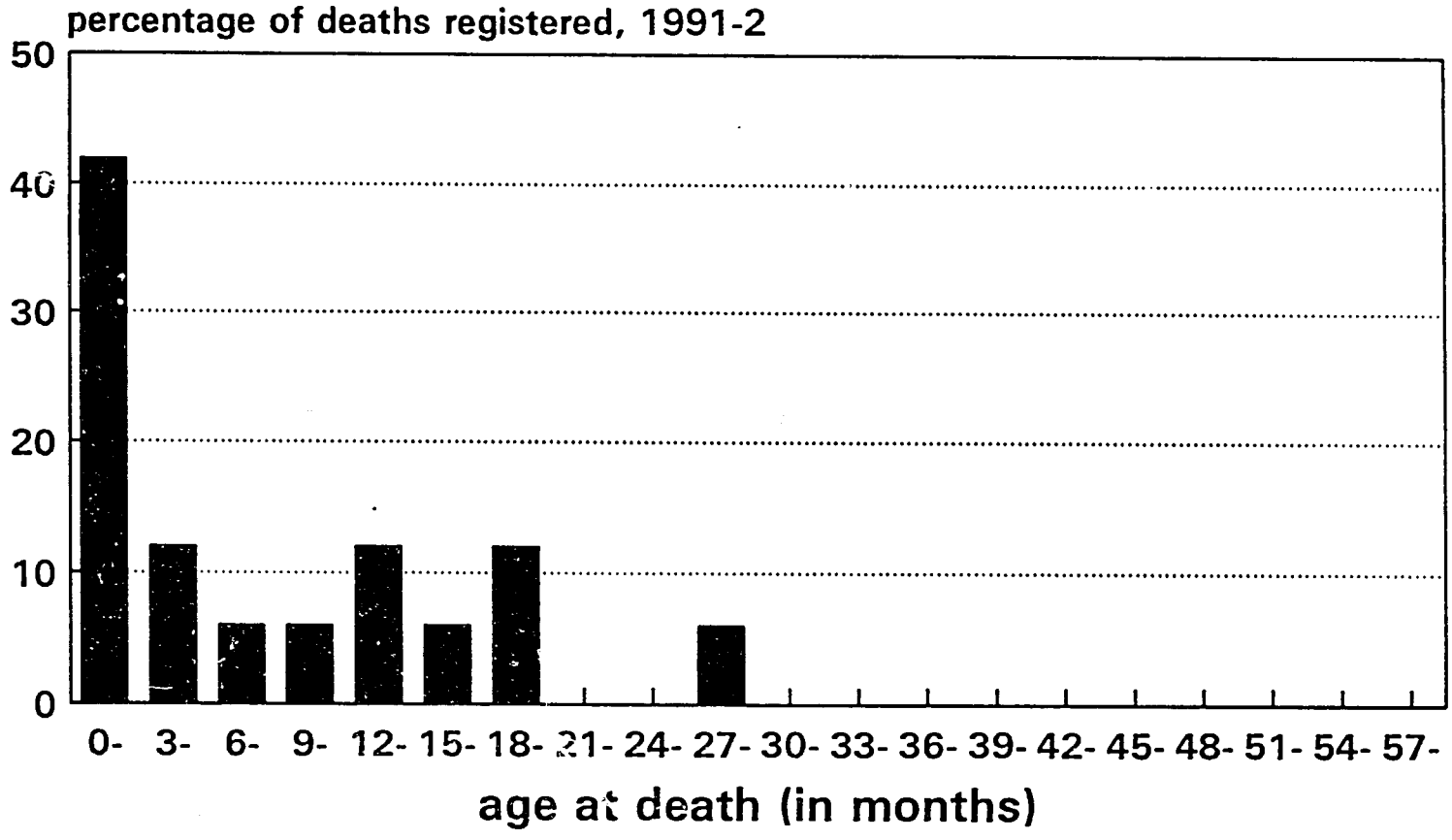
source: program death registries

Figure VI.2.
Percentage of Childhood Deaths in Carabuco by Age at Death



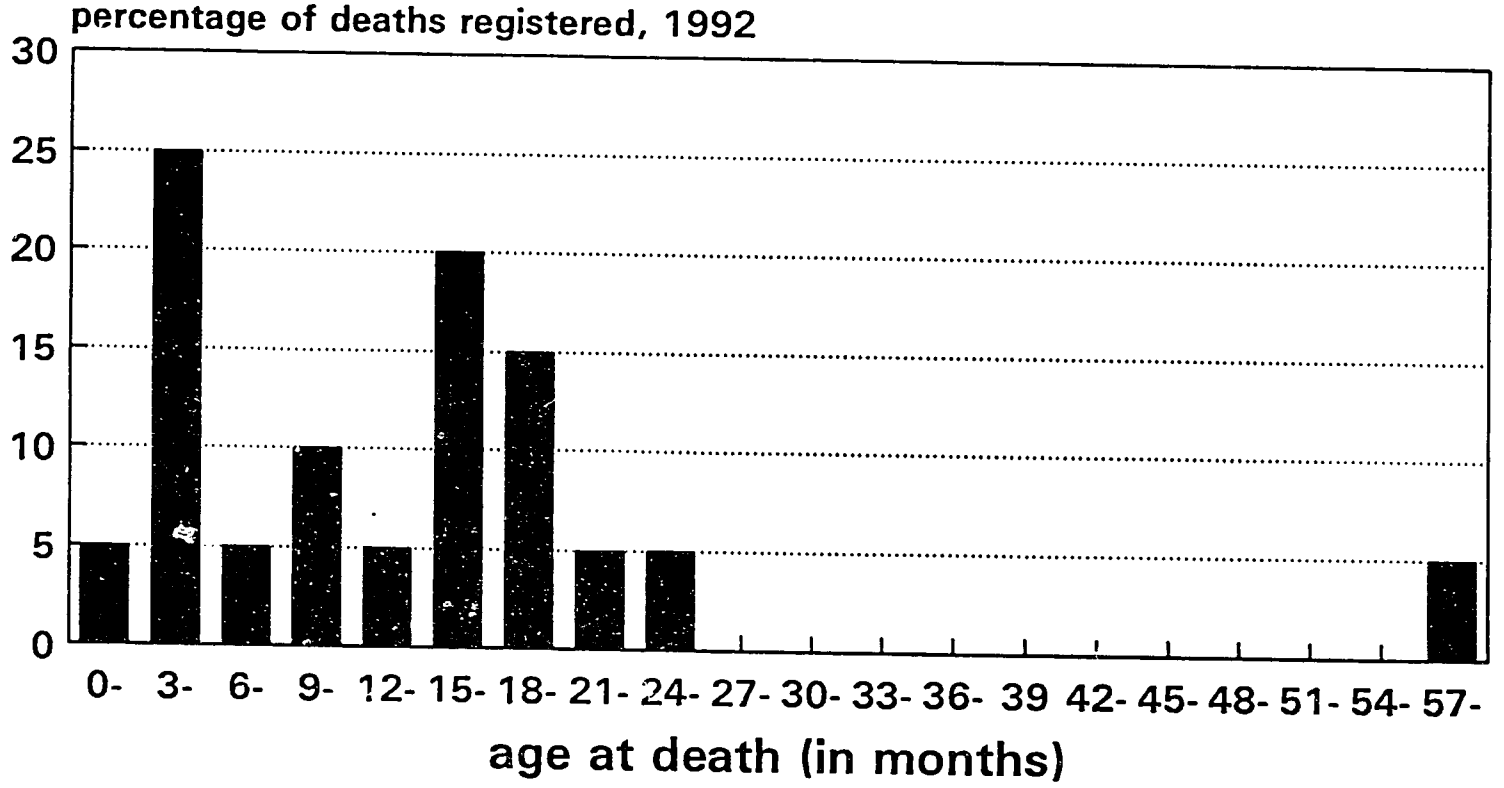
source: Carabuco death registry

Figure VI.3.
Percentage of Childhood Deaths in Mallco Rancho by Age at Death



source: Mallco Rancho death registry

Figure VI.4.
Percentage of Childhood Deaths in Montero by Age at Death



for the Villa Cochabamba "barrio" only
source: Villa Cochabamba/Montero death registry

Table VI.2.

Numbers of Childhood Deaths According to Age at Death in Carabuco, Mallco Rancho, and Villa Cochabamba/Montero*

	program site		
age at death	Carabuco	Mallco Rancho	Villa Cochabamba/ Montero
under 12 months	57 (76%)	22 (59%)	9 (45%)
12-59 months	18 (24%)	15 (41%)	11 (55%)
	75 (100%)	37 (100%)	20 (100%)

Chi Square = 8.03
df = 2
p = 0.020

* The data for Carabuco are for 1990-2, for Mallco Rancho 1991-2, and for Villa Cochabamba/Montero 1992. The Villa Cochabamba/ Montero data are for one neighborhood ("barrio") comprising one-third of the overall program area.

source: program death registries

Further analyses have been carried out to determine other risk factors for childhood death. The preliminary results of case-control studies are included in Chapters IX - XI and also Appendix IV. The point to be made here, however, is that knowing the precise age periods at which children are at greatest risk of death gives the program a powerful diagnostic tool which is readily operationalized to guide its "therapy" of prevention and treatment to high-risk groups. Perhaps illnesses occur at similar frequency at other age periods but are not associated with the same mortality. These epidemiologic criteria give a basis for the program concentrating its efforts on those children who are at the highest risk of death. I have discussed at greater length elsewhere possible reasons as to why some of these differences have been observed (Perry, 1992).

Conclusions

Analysis of death data for infants and children dying at ARHC's established program sites reveals distinct patterns in the age at death and the cause of death. In the Carabuco (high altitude) program, deaths in the first three months of life and deaths from respiratory causes predominate. In the lowland program of Villa Cochabamba/Montero, deaths at 3-6 months and 15-21 months and deaths caused by diarrhea and malnutrition predominate. In Mallco Rancho (mountainous valley area), most deaths occur under 15 months of age and are concentrated under three months of age, but not to the same degree as in Carabuco. The leading cause of death in Mallco Rancho is diarrhea. The CBIO approach provides local programs with powerful diagnostic information so that resources can be targeted to high-risk groups with the aim of reducing the numbers of deaths from preventable or treatable causes and optimizing staff effort.

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Commission on Health Research for Development. Health Research--Essential Link to Equity in Development. New York: Oxford University Press, 1990.

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CHAPTER VII. FURTHER COMMENTS ON THE APPLICABILITY OF THE CENSUS-BASED, IMPACT-ORIENTED APPROACH FOR CHILD SURVIVAL ACTIVITIES

Two issues of the CBIO approach's applicability for further child survival activities will be briefly discussed in this chapter. The first issue to be addressed is "what are the specific components of the CBIO approach as ARHC has applied it which are essential to the successes achieved?" The second issue is "how can this approach be further evaluated or replicated as one means of improving the efficacy of child survival in developing countries?

Prior to addressing these questions, it should be pointed out that the CBIO approach has been applied in three very different program settings in Bolivia in somewhat different ways, and in all three cases positive results have been achieved AND the local program staffs have all developed on their own a deep commitment to this approach. Two of these settings are in rural areas and the other one is in a periurban slum setting. The applicability of the CBIO approach in diverse settings gives some credence to the robustness of the model. The fact that ARHC's staffs in all three locations find this approach professionally appealing and workable gives even further credence to the strength of the approach.

CBIO APPROACH Chapter VII.

Critical Elements of the CBIO Approach

The CBIO approach has been implemented by a PVO in Bolivia with its own unique organizational climate. ARHC's programs are led by a highly competent Bolivian staff with a deep concern for improving the health of the people served by ARHC's programs. To a significant degree, the achievements of ARHC's programs reflect this organizational climate.

Nevertheless, it has been ARHC's experience that the CBIO approach has proven to be a powerful motivating conceptual force for the entire staff once they have fully understood and experienced the approach on their own. Their enthusiasm for this approach is one of the important reasons to consider the CBIO approach for child survival activities in other settings.

The critical elements of the CBIO approach are described below.

Phase 1: Community Diagnosis

The critical elements of Phase 1 (as described in Chapter II) include a census of the program population; household enumeration on village maps and on the front of each house; and the listing in a family folder of all the inhabitants in a given household. This cannot be carried out until the practitioner has established a relationship of trust with the community. Thus, it is implied that the practitioner has been present previously and is known to the community, and the community is known to the practitioner. Once the census as described above has been completed, routine systematic home visitation (RSHV) is the next step in making a community diagnosis. Through RSHV it is possible to establish baseline mortality rates and determine the most frequent preventable or treatable causes of death in the community.

It may not in theory be necessary to visit each and every home on a regular basis as the concept of RSHV implies. Some method possibly could be envisioned in which groups of neighbors come together for some form of meeting. This could enable a health worker to determine more quickly what vital events had occurred in the family since the last contact and what the causes of death were. This approach would be suitable so long as it could be ascertained which families did not attend the meeting. Later contact with the non-attenders through a home visit could be carried out. It is those persons who "slip through the cracks" of a delivery system based on concentrations of villagers or clinic attendance who are at high-risk of death and therefore need somehow a regular contact with the health program. This is the real strength of RSHV.

Health priorities as defined by the community become apparent through the spontaneous demand for services as well as through the many interactions which the practitioner has with the community. ARHC has asked at the time of household surveys what health priorities specific individuals have. Analysis of this data has not provided any new insights that the staff did not already possess regarding the community's perceptions of its health priorities, although it did provide a way of quantifying those priorities.

In essence, community diagnosis as the initial phase of the CBIO approach cannot be readily streamlined. One issue, when thinking of applying the CBIO approach to larger populations, is whether the community diagnosis could be carried out in a small pilot area either randomly selected or somehow assumed to be representative of the entire program area. This could be carried out as one effort of "streamlining" and reducing the overall cost of the CBIO approach.

Phase 2: Program Planning

As ARHC has applied the CBIO approach, Phase 2 has not received as much attention as it should have. The definition of the resources available and the budget has always been given considerable attention (Step 1 of Phase 2), but the program priorities, as determined by the community diagnosis (Step 5 of Phase 1) and the program workplan (Step 2 of Phase 2) have not always been given as much attention as needed, especially from the whole staff. For the CBIO approach to achieve maximal effectiveness, it is necessary for the entire program staff together with the community to review critically the information arising from the community diagnosis and to formulate a workplan based on the determined health priorities and on the available resources.

ARHC is currently strengthening local staff problem analysis and planning skills through the introduction of a quality assurance process. This process is anticipated to result in a more standardized approach to program planning such as the development and use of program forms and manuals. These documents will be used by the staff to formulate health priorities, identify resources available, and create an annual work plan. We anticipate that two to three years will be needed to fully implement this process. Currently, program directors present a proposed budget and workplan each fall to the National Director of ARHC. These are reviewed and discussed in detail at an annual national meeting of program leadership staff, but thus far, the criteria for evaluating budgets and workplans are not always heavily influenced by community diagnoses.

Phase 3: Program Implementation

It is in the phase of program implementation that we can begin seriously to deal with certain elements of the CBIO approach which might be less essential than others. One aspect of the approach which all ARHC staff seem to recognize as critical is the capacity to respond in some way to the acute health needs of the people in the communities where the program is operating. Exactly how a response is made, what resources are used in providing a response, and the quality of care arising as a result of that response are all major issues which need very careful review both before program implementation begins as well as after it is underway.

Nevertheless, the critical issue is that some type of response to "calls for help" from the local community needs to be built into the program operation. This includes first aid and dependable referral of more seriously ill patients to the closest hospital as well as the provision of treatment, when appropriate, by program staff using resources which are within the limits specified by the budget and workplan. At the very least, the acute curative services must be readily available, be carried out with compassion, and cause no harm.

In addition to readily accessible primary care services, an indispensible part of the CBIO approach as developed by ARHC is the provision of basic services to treat or prevent conditions which have been determined to be epidemiologic priorities. This does raise the interesting issue of vaccine preventable diseases in the context of the CBIO approach. If no deaths, significant illness, or disability have been identified as a result of vaccine preventable diseases such as measles, why devote a major effort to the vaccination program? This also raises the question of whether an adequate "herd immunity" is being sought or whether every person is equally at risk for the particular disease.

The case for a strong immunization program rests on the fact that children remain susceptible to diphtheria, whooping cough, and measles if they are not vaccinated. Where the care of the umbilical cord of newborn children is such that neonatal tetanus occurs, then these newborn children are susceptible to neonatal tetanus if their mothers are not immunized. The efficacy of BCG against tuberculosis is still not well established, so we will leave the issue of BCG vaccination aside. Polio has been nearly eradicated from the Western hemisphere, so we will leave the issue of polio vaccination aside for the moment as well.

The question then becomes, if children are not dying from vaccine preventable diseases in the program area, how much emphasis should be given to achieving a high level of immunization coverage? How does this priority compare to the priority of devoting program resources to problems in the program

area which are responsible for most of the preventable or treatable deaths?

How does a program decide on the nature and mix of the child survival interventions which it chooses to undertake. Heretofore, programs such as ARHC's have accepted the externally-generated child survival "imperatives" and tried their best to provide immunizations, education about and provision of ORT, growth monitoring, and early treatment of ARI to all children in the program areas.

But in order to target limited resources more effectively, it is necessary to find out why children are dying, at what ages, and what are the underlying as well as the immediate causes of death. Furthermore, it is necessary to determine what other characteristics besides age constitute risk factors for death. Thus, the more precise the community diagnosis has been, the more streamlined can be the program intervention without loosing efficacy. If anything, the concept of streamlining and reducing the cost of the CBIO approach as ARHC has applied it may call for even more emphasis on Phase 1 (community diagnosis).

The answer to the issue of how important the immunization program is relative to other interventions depends partly on the relative importance of immunizations as a vehicle to health improvement compared to other interventions and the relative costs of these interventions. Thus, it depends upon the local circumstances. However, if the program does give a relatively high priority to immunization, it seems necessary to try to approach a coverage level of 100% at as early an age in life as possible because children may later be in different geographic settings where vaccination coverage levels are low and therefore be unprotected by herd immunity.

An obvious question at this point is how critical is home visitation to the delivery of whatever interventions are designed? The answer to that really depends on how effective other approaches are in reaching targeted high-risk groups. If another approach is relied upon primarily (such as a rally or concentration of some sort), there needs to be included in the work plan some way of providing services to those who are at high-risk who do not attend such group meetings.

On the other hand, one could make a strong case for routine systematic home visitation (RSHV) to all homes in the program area regardless of other circumstances. This is because of the trust and confidence which RSHV engenders between the practitioner and the community, the enhanced mutual understanding between staff and families which results, and the registration of vital events made possible through this process. Families are much more knowledgeable about the program, and staff understand the community and its members much better as a result of home

visitation (see Perry and Sandavold, 1993). If one accepts the thesis that all homes should be included in the visitation program, the question then becomes, what is the minimum frequency of RSHV which will not eliminate its effectiveness? Another issue is also whether RSHV might be broken down into components which could reduce the overall cost of the program. Might local informants, either volunteer or paid, be able to carry out some of the RSHV function at a lower cost than is now being borne by ARHC? These are all important questions which need further exploration.

Phase 4: Evaluation and Community Rediagnosis

Monitoring mortality impact as a result of program implementation is one of the key features of the CBIO approach which is essential to maintain. As ARHC has implemented the approach, it has used RSHV to identify and register vital events and thereby to be able to follow mortality rates over time. There are ways of maintaining periodic contact with all families in a program area other than through periodic home visitation, but it is hard to imagine that any of them would have the degree of coverage that can be achieved through RSHV. As mentioned above, it might be possible to envision other methods of home visitation that are less costly than those used by ARHC such as less frequent visitation or use of less costly staff. But somehow, at least for a sample portion of the overall program area, there needs to be ongoing contact with all persons along with registration of their vital events so that mortality rates can be calculated at different points in time. Exactly how large a population needs to be monitored depends on the level of the mortality rates as well as the precision with which rates need to be determined.

The goal of monitoring changes in mortality and in causes of death is only partly to assess program impact. As we mentioned in Chapter III, the interpretation of changes in mortality rates in a given program area is not a straightforward process, since changes could be due to factors other than the program itself and since changes may be due to random variability rather than any true change. Even so, redefinitions of the most serious preventable or treatable diseases, of those high-risk groups (partly as defined by mortality rates), and of the causes of death are critical to a community rediagnosis and a replanning of program activities.

The critical elements of the CBIO approach are summarized in Table VII.1.

Table VII.1

Critical Elements of the Census-Based, Impact-Oriented Approach

1. Establish a relationship of trust between the community and the practitioner
2. Carry out a census to identify and locate all residents
3. Communicate with community residents so that staff can learn what are the community's health priorities
4. Establish prospective regular interactions with all or a selected sample of families to establish baseline death rates, to determine the most serious, frequent preventable or treatable diseases in the community, and to determine causes of death
5. Determine program priorities by combining epidemiologic priorities and the community's priorities
6. Formulate a workplan based on program priorities and resources available
7. Provide readily available first aid, acute and ongoing primary care, and referral services
8. Ensure that basic services for priority epidemiologic problems reach a high proportion of the program population, presumably through home visitation
9. Identify as precisely as possible the immediate and underlying causes of death along with the characteristics of those at greatest risk of death
10. Provide essential services to all individuals at high-risk of death and ensure that those who do not seek out services are offered them at home
11. Visit routinely all homes or at least a representative sample of homes in the program area
12. Monitor changes in mortality rates for at least for a segment of the program area and redefine high-risk groups as well as causes of death after program implementation has been underway

How Can the CBIO Approach be Further Validated?

There are several ways to consider how the CBIO approach might be further validated. Of overriding concern, of course, is the issue of whether this approach in fact does result in lowered mortality rates for infants and children. Our analysis of mortality impact has shown that there are several problems with a decisive conclusion about whether the approach has in fact improved child survival. First of all, the approach would need to be applied in a considerably larger population, probably of at least 50,000 people. Secondly, there would need to be comparison groups which are somehow randomly determined. In these comparison groups, the CBIO approach would not be implemented, but mortality rates would be measured in a similar fashion as in the program area (i.e., through ongoing routine systematic home visitation). Another value of considering the application of the CBIO approach on a larger scale is to determine what the costs would be. It would also be possible to apply the CBIO approach at varying levels of intensity to determine the impact and the cost-benefit tradeoffs at each level.

A larger scale quasi-experimental implementation could be readily developed at each of the three regions where ARHC's programs are located. Each program site is located within a MOH district. Structures and relationships are now in place which would make "upscaling" the CBIO approach to the district level a smooth process relative to what might be experienced in an entirely new program setting. Of course, trying the CBIO approach in an entirely new setting on a large scale as a controlled field experiment is one option which could be considered.

Another means of further validating of the CBIO approach is to work with other health programs or communities which are interested in applying this methodology. This would make it possible to determine if the CBIO approach can be readily applied in other settings not associated with ARHC. Presumably, any efforts along this line would require fairly close coordination between individuals responsible for the new program with persons experienced in the CBIO approach as applied by ARHC. As the experience with the CBIO approach grows in a variety of settings, new lessons will undoubtedly be learned which can improve the overall process of implementation.

Conclusion

Further experience with the CBIO approach might yield a somewhat different set of critical elements from those I have outlined above. It is important to realize that this approach is highly flexible in its application. ARHC's application is only one of many possibilities. Determining local health priorities and carefully targeting program efforts toward all those at greatest risk will always remain central elements along with a careful evaluation of program impact. Applying this approach on a larger scale will provide many opportunities to learn how it can be streamlined without losing efficacy.

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