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AFRICA CHILD SURVIVAL INITIATIVE

COMBATTING CHILDHOOD COMMUNICABLE DISEASES

(ACSI-CCCD)

IMMUNIZATION IN 12 AFRICAN COUNTRIES 1982-1993

MPLEMENTATION EXPERIENCE
2 AFRICAN COUNTRIES
URUNDI, CAR, CÔTE D'IVOIRE,
UINEA, LESOTHO, LIBERIA, MALAWI,
IGERIA, RWANDA, SWAZILAND, TOGO, ZAIRE

N COLLABORATION WITH
ORLD HEALTH ORGANIZATION (WHO)
NITED NATIONS CHILDREN'S FUND (UNICEF)
OTARY INTERNATIONAL

USAID

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
Africa Regional Project (698-0421)

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
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IMMUNIZATION IN 12 AFRICAN COUNTRIES 1982-1993

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Preface

Dedication

This monograph is dedicated to four groups of people: 1) African health officials, program managers, and health workers for their planning and implementation of EPI; 2) political leaders at global, national, district, and community levels whose advocacy for EPI has been critical to the increase in immunization coverage; 3) fathers and mothers, many of whom have walked long distances and waited many hours, for their partnership in immunization, child survival, and child health; and 4) CDC and A.I.D. staff and their many collaborating partners who have labored for social justice and improved survival and health of the African child and 5) to the memory of Brian Fitzgibbon, the author of chapter 4, for his service to the people of Africa.

Future

Should reviewers in the year 2000 judge this manuscript as a historical record of what happened in EPI in 13 African countries in the 1980s, this volume would have been a failure. If on the other hand, it helps in a small way to provide decision makers of the 1990s the vision of the possible, the confidence that EPI can work in Africa, and a sense of reality that global cooperation can make available one basic health right to all the children of Africa, it has succeeded.

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The work reported in this monograph reflects the toil of all those involved in the implementation of the Expanded Program on Immunization in Africa.

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Chapter 1
Introduction

Africa communities, health care systems, and governments, technical assistance agencies, and international organizations are individually and collectively challenged with ensuring immunizations for the 25 million children born in sub-Saharan Africa each year. An estimated 1 million of these lives are at risk of death from four diseases preventable by immunization: neonatal tetanus, pertussis, measles, and tuberculosis. An additional 500,000 children are at risk of disability: blindness from measles, malnutrition from measles and pertussis, and paralysis from poliomyelitis. During the 1980s, immunization coverage in African children in the first year of life increased from 20% to 70%. Currently it is unclear whether the gains of the 1980s will be sustained or whether the visionary goals set at the 1990 World Summit for Children will be achieved.

Four World Summit goals relate specifically to immunization.

- Maintenance of a high level of immunization coverage (at least 90% coverage of children under 1 year of age) by the year 2000
- Reduction by 95% in measles deaths and reduction by 90% of measles cases compared with pre-immunization levels by 1995
- Elimination of neonatal tetanus by 1995
- Global eradication of poliomyelitis by the year 2000

This monograph is being written at a critical time. Immunization programs, with significant partner (donor) inputs, have been successful in increasing vaccination coverage and in reducing disease-specific morbidity and mortality in Africa. Countries have made major political and resource commitments to immunization. Families and communities recognize that deaths from neonatal tetanus and measles are preventable. At a time when program needs are expanding, availability of both internal and external resources, especially for the poorest countries, is shrinking. Some major donors are shifting resource allocation priorities away from immunization to other aspects of health, such as HIV, and to other sectors, including education and the environment.

This monograph has been written for national and international decision makers, with two objectives: 1) to share the experience of the Africa Child Survival Initiative (ACSI) - Combatting Childhood Communicable Diseases (CCCD) Project in working with 13 African countries in their implementation of immunization programs from 1982-1993; and 2) to identify immunization issues critical to child survival and the continued development of Africa.

As this monograph will be utilized by different partners in the immunization team (policy makers, planners, program managers, implementers, evaluators, and researchers); the value and relevance of individual chapters will vary. The following synopses by chapter will assist readers in targeting their review to those sections that will be most useful.

Chapter 2. Diseases Preventable by Immunization

Chapter 2 provides an overview of the epidemiology of the diseases preventable by immunization. Based on an April 1993 presentation at an International Union for the Scientific Study of Population meeting on Potential Health Impact of Immunization at Belo Horizonte, Brazil, the chapter outlines key aspects of the EPI diseases and the vaccines used to control them. It includes an extensive bibliography of key EPI articles relevant to Africa.

Chapter 3. Evolution of Immunization in Africa

Chapter 3 provides a historical overview of immunization in Africa dating from the colonial epidemic control teams, to mobile immunization, to campaigns, to current facility-based immunization.

Chapter 4 - EPI Implementation in Togo

Chapter 4 is a case study of one country, Togo, and its implementation of EPI. Written from the perspective of the implementer, it outlines policy and implementation issues for a country that increased its coverage from 10% to 80% in a 10-year period. It illustrates many of the basic principles and essential components of immunization described in chapter 6.

Chapter 5 provides a brief summary of immunization in 12 of the 13 countries that participated in the CCCD program. Congo, dropped from the program largely due to Ministry allocation of limited health resources to a tertiary care facility, is not included.

Chapter 6. Critical Elements in EPI Implementation

Chapter 6 provides a summary of the basic elements of immunization: policy, strategy, logistics, training, implementation, monitoring, and evaluation. Read together with Chapter 4, it provides a good overview of issues in EPI i nplementation.

Chapter 7. Strengthening Programs and Disease Control through Applied Epidemiologic Research

Chapter 7 presents summaries of 10 applied research projects supported by CCCD which were utilized to solve operational problems. Three relate to measles, one to neonatal tetanus, three to poliomyelitis, two to improving vaccination coverage through reducing missed opportunities for immunization, and one on the potential effectiveness of providing mothers bringing their children for EPI the opportunity to receive famity planning services. This chapter illustrates the importance of targeted applied research in program implementation.

Chapter 8. Immunization in Africa: Achievements, Challenges, Resources

Chapter 8 is an adaptation of an Agency for International Development Africa Bureau policy paper on immunization in Africa. It expands beyond the CCCD project to issues of immunization for all of Africa. It addresses issues of policy, strategy, sustainability and funding.

Chapter 9 - Conclusions, Issues, Recommendations

Chapter 9 attempts to pull together the key points and recommendations. In the words of one reviewer: "My favorite! It says it all. If you could only send someone three pages about immunization in Africa, I would recommend these." All readers may want to start with these three pages.

Chapter 2
Diseases Preventable by Immunization

Each year, 25 million children are born in sub-Saharan Africa. An estimated 5 million of these children die before their fifth birthday. Approximately 20% of these deaths, one million, are associated with diseases preventable by the vaccines advocated by the Expanded Program on Immunization (EPI): tetanus toxoid; BCG; diphtheria, pertussis, tetanus; and measles. Additional children are disabled from disease complications, including blindness from measles, and paralysis from poliomyelitis. Table 1 provides WHO estimates of the burden of the EPI diseases in the absence of immunization in Africa.

When using large numbers, it is easy to lose touch with the human factor, the grief and loss experienced by families and communities, and the economic cost in terms of lost earnings, money spent on care (often ineffective), and burials. The cost of the EPI diseases can perhaps be better understood by considering 200 newborns. Among 200 infants unprotected by immunizations, 2 would die of neonatal tetanus, 2-4 of pertussis, 6-10 of measles, and 1 would be paralyzed by poliomyelitis.

This chapter outlines some of the key epidemiologic features of the EPI diseases. It will not review vaccines used outside of the EPI: yellow fever, meningococcal or Hepatitis B.

Neonatal Tetanus

Most neonatal tetanus cases occur at home and go unreported; WHO estimates that only 2% of cases were officially reported in 1991 (WHO/EPI/GAG 1992). Country and global estimates of neonatal tetanus incidence have been primarily obtained through population surveys for neonatal deaths meeting the standard case definition ("ability to suck during the first two days of life, followed by cessation of sucking, stiffness, spasms, and death within the first month of life") (Steinglass, Brenzel, and Percy 1993). Steinglass et al. review 28 surveys carried out in Africa that provide estimates of neonatal tetanus incidence rates per 1,000 live births ranging from 0 in Lesotho to 18 in Côte d'Ivoire.

Most neonatal tetanus deaths are associated with home delivery by untrained attendants. Case control studies have been useful in identifying factors associated with protection or risk. For example, Leroy and Garenne (1991) identified a number of factors that were protective: 1) hands of person "catching baby" washed with soap ($p = 0.0001$), 2) cord dressed by trained birth attendant ($p = 0.0124$), 3) mother >18 ($p = 0.0277$), and 4) prenatal care before delivery ($p = 0.0231$).

Table 2.1

Health Burden Of EPI Diseases If No Immunization
25 Million Children Born In Sub-Saharan Africa In 1993

Disease	Morbidity (Cases)	Mortality (Deaths)	Disability
Neonatal Tetanus	250,000 - 500,000	200,000 - 400,000	
Pertussis	16,000,000	250,000	Undernutrition
Diphtheria	?	?	
Measles	22,500,000	675,000 - 1,125,000	Blindness Pneumonia Otitis Media Malnutrition
Tuberculosis	150,000	75,000	
Poliomyelitis	250,000	25,000	Paralysis 125,000

Strategies to reduce the incidence of neonatal tetanus include immunization of fertile age and pregnant women and the upgrading of delivery practices. Immunization of pregnant or reproductive-aged women will also eliminate maternal mortality related to tetanus complications of abortion and delivery.

Childhood Tetanus (Non-neonatal)

Stanfield and Galazka (1984) estimate that 50% of tetanus deaths are non-neonatal. On the basis of data from Dakar, Senegal, (Rey and Tikhomirov 1987) showing that 17% to 25% of non-neonatal tetanus cases occur in children less than age 10, African non-neonatal tetanus incidence, in the absence of immunization, is estimated at 50,000 - 100,000 deaths per year.

In view of the high level effectiveness of tetanus toxoid and its long term protective effect, non-neonatal tetanus incidence can be expected to fall as infants and reproductive-aged women immunized by EPI represent increasing proportions of groups at risk for tetanus.

Tuberculosis (BCG Vaccine)

Tuberculosis is the number one infectious cause of death in the world; 6 to 8 million people are infected annually, 12 to 16 million have the disease, and 2 to 3 million die annually (Styblo 1989, Rodrigues and Smith 1990, Sudre, ten Dam, and Kochi 1992). With the increased risk of disseminated disease associated with HIV infection, these numbers are expected to increase over the next decade. Approximately 15% of new tuberculosis cases occur in children younger than age 15 (Murray, Styblo, and Rouillon 1990). Of these cases, 90% are extrapulmonary. The severer forms, TB meningitis and miliary TB, are, without treatment, fatal. Murray et al. (1990) estimate that in children younger than age 15, one million TB cases and 175,000 TB deaths occur annually. Difficulty in diagnosing TB, especially its extrapulmonary forms, together with a general lack of capacity in TB diagnosis, limit our understanding of TB epidemiology in Africa.

BCG is the most controversial of the commonly used vaccines. Studies to assess vaccine effectiveness have yielded figures ranging from 0% to 80% (Rodrigues and Smith 1990). Results of 35 BCG effectiveness studies have been summarized (Rodrigues and Smith 1990, Fine 1989, Fine and Rodrigues 1990). For childhood TB, Murray et al. (1990) estimate BCG effectiveness at 40% to 70%. Even at this level of effectiveness, continued use of BCG is recommended.

Tuberculosis control requires a dual approach: 1) the active detection and treatment of pulmonary tuberculosis, and 2) the immunization of infants with BCG.

Pertussis

In the absence of vaccination, 80% of African children surviving to age of exposure are expected to be infected with pertussis by their fifth birthday. WHO estimates that 1% of those infected will die of pertussis and its complications. The basic epidemiology of pertussis in the developing world is best provided by community studies reported from Nigeria (Morley, Woodland, and Martin 1966), The Gambia (McGregor 1964), and Kenya (Voorhoeve et al. 1978). Case fatality rates were 7.6, 3.2, and 1.26%, respectively. Morley et al's. observations were important in establishing the prolonged effect of pertussis infection on the health of infected children. In that study, cough was persistent (5 weeks [43%], 10 weeks [16.5%], 15 weeks [5.8%], and 20 weeks [2%]); and nutritional status was adversely affected (57% of children lost 5% or more of body weight). Weight loss was attributed to the combined effects of chronic cough, associated vomiting, and anorexia.

Immunization is the primary strategy for controlling pertussis. The standard regimen is three doses of DPT (6, 10 and 14 weeks). Effectiveness rates of the traditional whole cell vaccine have ranged from 60% to 90% (Fine and Clarkson 1987, Wright 1991).

Diphtheria

In the developing world, diphtheria is primarily a sporadic epidemic disease. Epidemiologic data are few. CCCD experience with diphtheria has been limited to one small outbreak in Lesotho.

Poliomyelitis

Up until the 1970s, the magnitude of the poliomyelitis problem in the developing world was not recognized. The development of survey techniques to assess the prevalence of residual paralysis (lameness surveys) provided an effective tool both for epidemiologic surveillance and for advocacy (LaForce et al. 1980).

In areas with circulating polio viruses, almost all children will be infected with one or more of the three types of polio viruses. Using an average lameness survey estimate of 1 case of paralysis per 200 children, an estimated 125,000 cases of residual poliomyelitis paralysis and 25,500 poliomyelitis deaths would occur annually in Africa in the absence of immunization.

The age of infection will be determined by the risk of exposure to the predominantly fecal-oral routes of transmission. Early infection is most probable in densely populated areas with poor sanitation. In Ibadan, Nigeria, children living in the central city, where environmental sanitation is poor, had increased risks of infection as compared with peripheral areas where sanitation was better (Onadeko and Familusi 1990). In the core area, children were infected at a younger age (40.1% before age 1) than the children in peripheral areas (6.7% before age 1).

The current polio goal in Africa is the control of polio as a public health problem. As will be described in Chapter 7, Oral Polio Vaccine (OPV) is only 70% effective in the tropics. A number of factors have been identified as responsible for low levels of seroconversion to oral poliomyelitis vaccines, including vaccine potency, vaccine formulation, vaccine stability,

vaccine administration, and interference from vaccine and other enteric virus infections (Patriarca, Wright, and John 1991, Deming et al. 1992).

In 1988, WHO committed itself to the global eradication of poliomyelitis by the year 2000 (Wright et al. 1991). Disease transmission has been eliminated in the western hemisphere. Plans are moving ahead for a phased regional approach in Europe and eastern Asia, moving to the Asian subcontinent and the Middle East and finally to Africa. Polio eradication will provide a considerable challenge to Africa.

Measles

Almost all children unprotected by immunization and surviving to a time of exposure will be infected with measles. Age of infection depends on population density, the size and age composition of the pool of susceptibles, the amount of disease in the community, and the probability of contact between infected cases and susceptibles (Foster, McFarland, and John 1993).

Measles is both an acute and a chronic disease. Acute illness is characterized by high fever, cough, conjunctivitis, and rash. Case fatality rates in Africa range from less than 1% in well nourished urban populations to 50% among severely malnourished refugees. Factors increasing case fatality rates include low socio-economic status, young age at infection, exposure in the home, vitamin A deficiency, and delayed and inadequate medical care (Aaby 1993, Foster et al. 1993). Acute causes of death relate primarily to respiratory and gastrointestinal complications. Delayed mortality, mortality after 1 month of disease onset, is associated with chronic diarrhea, malnutrition, and immunosuppression.

In 1981, studies from Kasongo, Zaire (Kasongo Project Team) suggested that deaths prevented through measles immunization were replaced by other subsequent childhood diseases (diarrhea, pneumonia, malaria, malnutrition). If measles vaccination did not have an overall positive effect on health status and child survival, the appropriateness of allocating scarce health resources to immunization could be questioned. Epidemiologic data from five studies in four countries have now conclusively shown that measles immunization is not only effective in decreasing measles-specific morbidity and mortality but is also effective in increasing child survival, often in excess of that predicted by measles mortality estimates (Aaby, Pedersen, and Knudsen 1989, Clemens, Stanton, and Chakraborty 1988, Garenne and Cantrelle 1986, Koenig, Kahn, and Wojtyniak 1990, Holt, Boulos and Halsey 1990). The best African data come from Guinea Bissau where children seroconverting to immunization had a lower mortality at age 3, 4.6%, than those who failed to seroconvert, 13.2% (Aaby et al. 1989).

The current measles goal is that of control, the reduction of morbidity and mortality. The World Summit for Children established 1995 targets for coverage (90%), mortality reduction (95%) and morbidity reduction (90%) (UNICEF 1990). These targets cannot be achieved with the current strategy of a single dose of Schwarz vaccine at 9 months of age (vaccine efficacy 80%). While researchers continue to search for an effective vaccine that can be delivered at 6 months of age, a two-dose schedule with the current Schwarz vaccine, as described in Chapter 7 for Lesotho, can achieve and sustain significant reductions in measles morbidity. Mortality reduction will require a combined strategy of immunization and case management.

Conclusion

Diseases preventable by immunization are a major cause of morbidity, disability, and mortality for African children. Technologies are available that can significantly reduce the disease burden in African children. As described in Chapters 4 and 5, the ACSI-CCCD experience has documented African capability to achieve significant reductions in EPI disease morbidity and mortality.

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Chapter 3
Evolution of Immunization in Africa

Before 1980

Colonial Period

Immunization in Africa dates back to the pre-independence era when mobile teams were used to provide mass vaccination to control epidemics due to smallpox and yellow fever. These teams, known as Medical Field Units in anglophone countries and Les Services des Grandes Endemies in francophone countries, were also involved in control of other endemic diseases such as sleeping sickness and yaws. The high public demand for injections in Africa has been attributed to the yaws campaigns where penicillin mass treatment was used; these injections dramatically cured a wide range of infectious disease-related problems including sexually transmitted diseases (STDs), pneumonia, and infertility.

Measles Era — the 1960s

In 1960, a visit to the Division of Biological Standards (now Food and Drug Administration) by the Minister of Health of Upper Volta provided an opportunity to test the newly developed Edmonston B measles vaccine. A field test of 600 children in 1961 was followed by mass vaccination of 700,000 Voltan children in 1962 and 1963 (Ogden 1983). The incidence of measles, a disease that killed 5% to 10% of African children, was dramatically reduced. On the basis of the scientific, humanitarian, and political success of the campaign, in 1964 the Agency for International Development (A.I.D.) allocated 1.5 million dollars to expand measles immunization to the Organisation de la Coordination et de Cooperation pour la Lutte Contre les Grandes Endémies (OCCGE) group of French West African countries. However, without the supervisory support provided by the National Institutes of Health (NIH) in Upper Volta, the rapid expansion was plagued by a wide range of technical and logistic problems. In 1964, three CDC staff, including the eventual first director of the Expanded Program on Immunization (EPI) for WHO, were detailed to A.I.D. to solve problems in implementation.

West African Smallpox Eradication Measles Control Program (1966-1972)

In May of 1965, President Lyndon Johnson announced that the United States would make a major contribution to the WHO global smallpox eradication program through support to the 19 countries of west and central Africa. With funding from A.I.D. and technical implementation by CDC, mobile teams using jet injectors simultaneously administered smallpox (all ages) and measles (6 months to 6 years) vaccines. Over 100 million injections were administered. Coverage in many areas exceeded 90%. When smallpox was found to spread among the 10% unvaccinated (e.g., a religious group in Abakaliki, Nigeria that refused vaccination), the smallpox strategy was changed in 1969 from mass vaccination to surveillance (the identification of cases through intensified active village to village searching) and containment (the control of outbreaks through patient isolation and contact vaccination). The last case of smallpox in the 19 country area occurred in the spring of 1970. A.I.D. continued to support the program through 1972.

Although the mass campaigns were successful in reducing measles incidence (transmission was interrupted in The Gambia for 2 years), the mobile strategy was unsuccessful in providing measles vaccine to new susceptibles on a continuing basis. Research carried out by the Smallpox Measles program helped lay the foundation for the future EPI. A study in Nigeria documented the feasibility, safety, and efficacy of administering multiple vaccines at the same time (DPT, polio, measles, yellow fever) (Ruben 1973).

1972-1975

During the early 1970s, immunization programs experienced ups and downs and were largely dependent on donor interest and support. Immunization programs during this period used three strategies: 1) epidemic response to outbreaks of yellow fever, meningococcal meningitis, or measles, 2) mobile

immunization campaigns, especially in the francophone countries, and 3) the establishment of procedures to administer vaccinations at fixed facilities.

Leadership during this period was provided by France through the Association pour la Promotion de la Médecine Préventive (APMP). This included the development and testing of vaccines and vaccine combinations, the promotion of mobile teams using jet injectors, and support to country programs.

WHO Expanded Programme on Immunization (EPI) 1974

The Expanded Program on Immunization (EPI) was initiated in 1974 by the World Health Organization (WHO). At that time, immunization coverage in Africa was less than 10%. WHO provided global leadership in the areas of 1) advocacy, 2) vaccination policy and technical guidelines, 3) the development of training strategies and materials, and support for regional and in-country training, 4) the development and testing of cold chain and sterilization equipment, 5) the development of a global information network, 6) monitoring and evaluation, and 7) the dissemination of technical knowledge and program information.

A.I.D. Strengthening Health Delivery Systems (SHDS) 1976-1982

From 1976-1982, A.I.D, through its SHDS Project and a PASA with CDC, supported the development of Immunization and Health Information Systems in The Gambia, Côte d'Ivoire, Cameroon, and Burkina Faso. These programs focused on developing vaccine delivery at fixed facilities (supplemented as necessary by outreach teams), training and supervision, coverage as measured by sample surveys, and surveillance to monitor program impact.

The 1980s - The Decade Of Immunization

During the 1980s, immunization became a global health priority of African countries, international agencies (WHO and UNICEF), and bilateral technical assistance agencies.

A.I.D. "Twin Engines," Child Survival, and Development Fund for Africa 1982-1992

A.I.D. has provided global advocacy and support for immunization through three major initiatives: "Twin Engines" (EPI and ORT) (1982), the Child Survival Initiative (1985), and the Development Fund for Africa (1986). Support utilized Private Voluntary Organizations (PVOs), bilateral, regional (CCCD), and global projects (REACH). Funds were also used to support WHO and UNICEF.

Africa Child Survival Initiative (ACSI) - Combatting Childhood Communicable Diseases (CCCD) 1981-1993

In 1981, A.I.D. approved a regional project in Africa to: "Strengthen the Africans' ability to: control six communicable diseases (measles, polio, tuberculosis, diphtheria, pertussis [whooping cough], and tetanus) through the Expanded Program on Immunization (EPI); control diseases of local importance such as yellow fever, and yaws, and possibly malaria at some time in the future; and provide simple treatment for the Control of Diarrheal Diseases (CDD)"

CCCD, as the project was known, had two basic goals: 1) the strengthening of African family, community, health provider, and government capacity to improve child health and survival, and 2) to decrease under-5 morbidity and mortality. Capacity-building used six support strategies; implementation involved three technical strategies:

Support Strategies	Technical Strategies
Health Information	Expanded Program on Immunization (EPI)
Training	Control of Diarrheal Diseases (CDD)
Health Education	Control of Malaria
Health Care Financing	
Applied Research	
Sustainability	

Between 1981 and 1993, CCCD, funded by A.I.D. and with technical direction by CDC, worked with 13 African countries for periods ranging from 4 to 10 years. In all 13 countries, immunization became a health priority and a collaborative undertaking of national authorities, WHO, UNICEF, bilateral technical assistance agencies (including A.I.D.), and non-governmental organizations.

UNICEF Child Survival and GOBI - 1982

In 1982, UNICEF made immunization an agency priority. In addition to its traditional roll as a provider of commodities, UNICEF became a major advocate, funder, and in some countries implementer of immunization programs. The initiative was expanded to focus on four child survival priorities: Growth Monitoring, Oral Rehydration, Breast Feeding, and Immunization (GOBI).

Universal Childhood Immunization (UCI) Target-1990

Universal Childhood Immunization (UCI), defined as 80% coverage by 1990, became a global standard to which almost all countries ascribed and by which all countries were assessed. This 80% coverage target, 75% in Africa, was unambiguous, an effective advocacy tool, and was understood by all levels (polit-

ical, health, and community). The UCI target facilitated the mobilization of national and international resources and was a key factor in the 1990 increase of coverage levels in Africa (81% for BCG, 58% for Polio 3, and 58% for measles) and globally (88% for BCG, 84% for Polio 3, and 80% for measles). Some of this increase, however, was achieved through high visibility, one-time campaigns.

Poliomyelitis and Rotary International

During the last 10 years, Rotary International has raised over $250 million dollars to support the global eradication of poliomyelitis. Funds have been used to provide OPV and cold chain equipment and to support social mobilization. In addition, local Rotarians have provided direct in-kind support to EPI especially in the area of social mobilization.

National Programs and Local Implementation

As suggested by the above chronology, immunization programs in Africa have been assisted by international agencies and organizations in developing programs and in providing vaccines, supplies, and equipment requiring foreign exchange. Implementation has, however, been carried out at the local level by government, voluntary, and private health services. WHO estimates that 30% to 60% of the cost of immunizing a child, ($10 to $15 per capita) has been provided at the country level in personnel and operating costs.

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Chapter 4
EPI Implementation in Togo (A Case Study)

Introduction

Togo, a small country located on the west coast of Africa, occupies 56,781 km^2 and is bordered by Ghana to the west, Benin to the east, Burkina Faso to the north and the Gulf of Guinea to the south. The climate is subtropical with temperatures ranging from 20 to 30 degrees Celsius. Annual precipitation rates vary from the drier north to the humid wooded coastal areas and range from 800 to 1,700 mm. The rainy season runs from April through September.

Administratively, the country is divided into five regions. From north to south these are Savanes, Kara, Centrale, Plateaux and Maritime (figure 4.1). These regions are divided into 30 prefectures or districts. The capital, Lomé, is treated as a separate administrative entity. The majority of the population is rural and subsistence agriculture is the primary occupation.

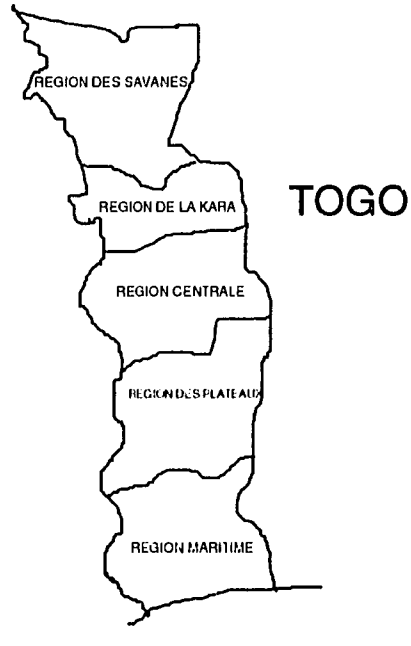


Figure 4.1

Population

Togo's population is estimated at approximately 3.5 million inhabitants, based on projections from the 1981 census. There are approximately 150,000 live births per year, and annual population growth is estimated to be 3.5%. Infant mortality, according to government statistics and largely confirmed by surveys, is 88/1000 live births.

MOH Organization

The Ministry of Public Health is centrally organized into one administrative and seven operational divisions. The Division of Epidemiology is responsible for EPI and for vector-borne and other infectious disease control programs.

Responsibility for program implementation lies primarily with the health services in the prefectures.

Togo is relatively well equipped with health facilities. There are five regional hospitals including the University Teaching Hospital in the capital, Lomé; 21 prefecture hospitals, staffed by at least one physician; 34 primary health centers with limited hospitalization capacity staffed by a physician or a physician's assistant; and 324 secondary health centers or dispensaries providing limited curative services and MCH services and staffed by a state-certified nurse. The parastatal exclusive drug distributor, Togopharma, has an extensive network of pharmaceutical depots throughout the country serving both public and private facilities. There are also private practitioners in Lomé and some missionary-run facilities in rural areas. Most health personnel are trained at one of the state medical or paramedical training institutions. Some physicians are trained abroad, mostly in France, Russia, and eastern Europe.

Public Health Priorities

The Togolese Division of Health Statistics cites infectious and parasitic diseases, especially malaria, as the primary causes for medical consultation. The top five causes of pediatric deaths are malaria, diarrheal diseases, acute respiratory infections, malnutrition and trauma (figure 4.2).

History of EPI

Togo received its independence from France in 1960. Prior to independence, immunization activities focused on periodic, single antigen mobile sweeps through the country. These

mobile tours were conducted by French military teams based in neighboring Upper Volta (now Burkina Faso) and concentrated mainly on identifying and treating cases of trypanosomiasis (sleeping sickness) and providing yellow fever vaccinations. Immunization was mandatory and some coercion was used to ensure compliance.

From 1960 to 1979, this mobile approach to immunization was largely continued, and a division of endemic disease control (Grandes Endemies) was created within the MOH. From 1966 to 1971, Togo participated in the A.I.D.-funded West African Smallpox Eradication and Measles control program. Mobile teams using jet injectors achieved high rates of immunization coverage. In 1969 the smallpox eradication strategy was changed from mass vaccination to surveillance containment. The last case of smallpox in Togo occurred in 1969.

In 1979, Togo adopted the WHO Expanded Programme on Immunization (EPI) strategy as national policy. The stated goals of the program were to reduce morbidity and mortality from six vaccine preventable target diseases for children aged 0 to 47 months and to prevent cases of neonatal tetanus by vaccinating women of childbearing age. Since there were no data available to underscore the need for such a program, little donor support was forthcoming. Few activities were initiated during the first two years of the program.

The decade of immunization, the 1980s, was truly a time when the EPI underwent rapid and significant transformation to become a major public health priority for Togo. EPI developments for this period are covered in the rest of this chapter.

Hospital (CHU) Pediatric Deaths
Lome, Togo, 1989

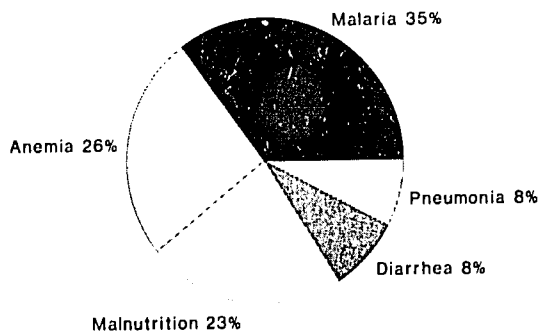


Figure 4.2

Early EPI Targets and Objectives

In 1980, the percentage of fully immunized children was thought to be zero in most areas of the country. The MOH originally targeted children 0 to 47 months of age for BCG, DPT, OPV, and measles. Tetanus toxoid was targeted for all women 15 to 44 years of age. In contrast, WHO recommended targeting children less than 1 year of age and pregnant women. Given the low or non-existent coverage, the original goal of the Togolese EPI to attain 80% to 90% coverage by 1984 was extremely optimistic.

EPI Program Strategy

In 1981, using as a model the successful Grandes Endemies mobile strategy that had eradicated smallpox, a single antigen, mobile campaign against measles was initiated. The strategy directed activities outward from the capital city of Lomé; mobile teams from the Division of Epidemiology covered one geographic region at a time. These activities were carried out by former smallpox workers who used jet injectors. Activities began in the northern region of Savanes and each year a region immediately south was to be added.

This mobile strategy proved to be cumbersome and difficult to manage because of the chronic shortages of funds, vehicles and cold chain equipment. These activities were disruptive to on-going programs, and the arrival of the vaccination teams was often not welcomed by local administrative authorities or by the population. This lack of enthusiasm and commitment limited social mobilization, which in turn limited acceptance and access by the population.

With the advent of the A.I.D. CCCD project in 1983, the first order of business was to better understand the Togo EPI by improving data collection and analysis. The first vaccination coverage surveys were conducted in May 1983 (Lomé) and August 1984 (Maritime) (figure 4.3). The results of the first surveys showed that less than 3% of the target population was fully immunized.

In addition to the coverage surveys, programmatic components of the EPI were also examined. The original mobile-measles strategy was recognized as being unworkable and unsustainable; a new strategy was needed to attain program goals and objectives. The first decision shifted the single antigen focus on measles to include all childhood immunizations. A second decision focused on a fixed center strategy with limited mobile outreach activities.

Early Program Implementation — Building the Foundation — 1983-1986

The new strategy called for improving data collection and retraining peripheral health workers. Equipping fixed centers with cold chain, sterilization, and injection equipment was allocated high priority. Developing a public information and health education plan to mobilize administrative and community sup

port was also an important part of this strategy. To accomplish this in a decentralized fashion, responsibility for program implementation was transferred to the prefectoral medical officers who were provided CCCD project vehicles for supervision and outreach activities.

Expanding the Capability of Health Facilities to Provide Immunization

After the 1983 evaluation, the creation of vaccination capacity within existing health facilities became the main program strategy. The steady expansion which followed was limited by 1) the number of facilities available, 2) availability of equipment, and 3) political and management decisions.

Cold Chain and Vaccines

Cold chain equipment and vaccines were provided largely by UNICEF. WHO furnished some vaccines and A.I.D. supplied measles vaccine. The MOH procured its own BCG vaccine and other non-EPI vaccines, notably meningitis and yellow fever which were not then included in the expanded program.

There was ample capacity for cold storage at the national level. A regional storage depot to supply the northern regions was built in Kara using CCCD and UNICEF funds. CCCD supported its installation and provided training for maintenance technicians. This was a first step in establishing a decentralized supply system whereby each level provided vaccines and supplies to the next lower level. Previous systems required travel to Lomé to pick up vaccine, a system that frequently failed to maintain adequate vaccine supplies in the field.

With little or no electricity in rural Togo, kerosene refrigerators were installed in the peripheral facilities. Although these installations enabled extension of activities to more remote areas, kerosene refrigerators proved fragile, needed clean fuel, and required maintenance. Refrigerator maintenance and repair became important elements in peripheral health worker training. Freezers and electric refrigerators with larger storage capacity were provided at district levels, which in turn served their peripheral facilities. A.I.D. and UNICEF provided most of this cold chain equipment.

Vaccination Coverage of Children 12-23 Months
Lomé Commune, 1983 and Maritime Region, 1984

Region	N*	Card	BCG	DPT 1	DPT 2	DPT 3	POLIO 1	POLIO 2	POLIO 3	Measles	CV*
Maritime	211	3	33	3	3	3	3	3	3	3	0
Lomé	210	63	73	29	25	21	23	18	15	8	5

MOH Surveys Epidemiology Division
* CV Completely vaccinated

Figure 4.3

Injection Equipment

While useful in earlier mass campaign efforts, jet injectors posed significant problems under the fixed center strategy; the numbers needing vaccination at any point in time were small, the injector mechanisms broke and spare parts were seldom available. Initially the program used a variety of donor-provided reusable and disposable syringes and needles.

A "sterilization practices" survey was conducted in 1986. Approximately 80% of injections were given with a sterile needle. Less attention was paid to guaranteeing sterility of syringes. This serious problem was addressed through further training.

The Togo EPI eventually chose reusable standard injection needles and syringes. This choice was based entirely on financial and sustainability issues. With proper cleaning and sterilization, needles and syringes could be used many times over. Concerns about transmission of Hepatitis B, HIV, and other infectious agents through improperly sterilized vaccination equipment led to the adoption of the WHO recommended steam sterilization equipment. A.I.D. and UNICEF supplied these.

Outreach

In addition to vaccination activities at fixed centers, the peripheral health workers were expected to organize vaccination sessions in villages in a 15 km. radius around their centers. Two hundred bicycles were purchased. Workers were also provided with portable thermal vaccine carriers and other supplies for their outreach activities. The majority of peripheral health workers, preferring some form of motorized transport, were not happy with bicycles. Resistance to bicycles was so strong that UNICEF eventually replaced them with motorbikes despite concerns about the recurrent costs of fuel and maintenance.

Training and Supervision

The rapid increase in the number of fixed facilities providing immunization services and the growing pressure from outside donors and senior MOH staff to increase and improve the quality of immunization services increased the priority for training of health workers. Initial training used the standard WHO EPI modules during a 1 week period.

In 1984, a training of trainers (TOT) course was conducted for the district medical officers and national program managers with assistance from the International Children's Center in Paris (CIE). Togo-specific training materials were developed. The district medical officers then returned to their posts and in turn conducted training for their peripheral health workers. Early sessions included training on program management, cold chain maintenance, vaccine and vaccination techniques, sterilization practices, health education, and record keeping. Training participants in the peripheral centers included nurses and mid-wives.

In 1985, an evaluation team recommended that diarrheal disease and malaria control activities be integrated into future EPI training sessions. The CIE developed these materials and a second round of training was conducted. District medical officers received training in management and planning; out-of-country training was provided for program managers and refrigerator repair technicians.

Major changes in peripheral health worker training followed CCCD's introduction of "Training Needs Assessments" or "Facility Needs Assessments." These were systematic evaluations of health center activities which included observations of health worker performance, exit interviews with mothers, record reviews, and inventories of supplies and equipment. These assessments enabled planners to focus training on real needs and problems. Health education was also included in the training.

Implementation of effective decentralization to the prefecture level was largely dependent on the provision of vehicles for outreach and supervision. A.I.D. purchased a fleet of Peugeot 404 pick-up vehicles and distributed one vehicle to each prefecture. These vehicles accommodated only three people in the cab. A tarpaulin-covered truck bed was available for additional people and supplies. Medical officers complained of the lack of space for additional staff. Eventually UNICEF provided larger double cab Mitsubishi pick-ups.

Health Education

Within Togo's MOH is a national health education service responsible for providing support to all ministry programs by developing and promoting priority messages for public information. Before the CCCD project, health education activities were limited to production of posters and other print media. The CCCD project integrated health education into training programs, developed mass media activities, tested materials, and defined priority messages and activities promoting EPI. These activities had limited impact. In 1985, CCCD began collaborating with Peace Corps in a community health education project. Two trained volunteers were assigned to the central health education office and volunteers were posted (one in each prefecture) to conduct community health education for EPI and the other CCCD priority interventions: CDD and malaria. A new pragmatic approach to the problems of public education was developed, replacing the former more theoretical approach. This is further described below in the health education and promotion section.

Health Information Systems

Initially information on vaccine preventable diseases and progress toward EPI goals and objectives was poor to non-existent. At the district level, medical officers sent telegrams twice monthly about cases of cholera, measles, meningitis, and a few other diseases considered important for immediate notification. They also reported monthly on a list of over 100 diagnoses seen in outpatient services.

The early EPI reporting system was based on a four page form completed monthly by centers providing immunization services. Information collected on the forms included doses administered by age, status of the cold chain; number of personnel working in EPI, and number of syringes available. Filling out the form was extremely cumbersome and time consuming. The monthly reports, which were sent to the national level for manual compilation by central EPI staff, were an even greater problem. Little analysis and even less action resulted from these data. The data were incomplete, inaccurate, and feedback, if provided at all, was often delayed as much as 3-5 years. Improvement of the EPI reporting system became a major goal for CCCD.

Program Development and Evolution - 1986-1993

After several years of static and inadequate EPI coverage levels, evaluation findings and international interest in EPI prompted major program changes and developments. Two of these changes included special immunization days and mass vaccination campaigns.

UNICEF

UNICEF became a major EPI partner with its adoption of a commitment to Universal Childhood Immunization (UCI). An increased share of the EPI budget came from this initiative. UNICEF supported a continuation of some mobile team activity to quickly achieve the 1990 target of 80% coverage. The MOH was insistent that resources also be provided for fuel, cold chain equipment, and vehicles. Priority was, however, given to accelerated strategies to increase coverage.

Action Vaccination Be

Supported mainly by UNICEF, the original campaign in Togo focused on a low-income urban zone of the capital city Be. The campaign, called "Action Vaccination Be" after the name of the zone, included special activities for social mobi

lization and health education, additional resources for mobile outreach, and the establishment of temporary vaccination sites in schools, markets, and community centers.

These accelerated activities began in 1986 and utilized three special immunization days per month for four months. On these days public information was intensified and additional vaccination sites opened.

The Be program, evaluated in March 1987, resulted in a substantial increase in vaccination coverage from 30% to 50% completely vaccinated (figure 4.4). The acceleration activities were deemed successful and consideration was given to using a similar strategy throughout the country.

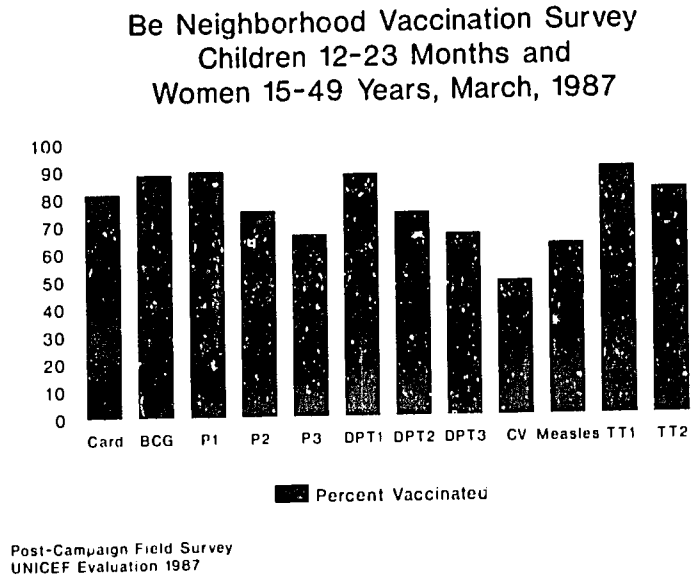


Figure 4.4

Action Vaccination Togo

The June 1987 international evaluation and national vaccine coverage surveys found that only 32% of Togo's children were completely vaccinated (figure 4.5). Although these results were a vast improvement over the less than 10% coverage rates of 1983, they were still below country targets. The MOH thus decided to undertake an acceleration of immunization activities by organizing a national vaccination campaign based on the experience in Be.

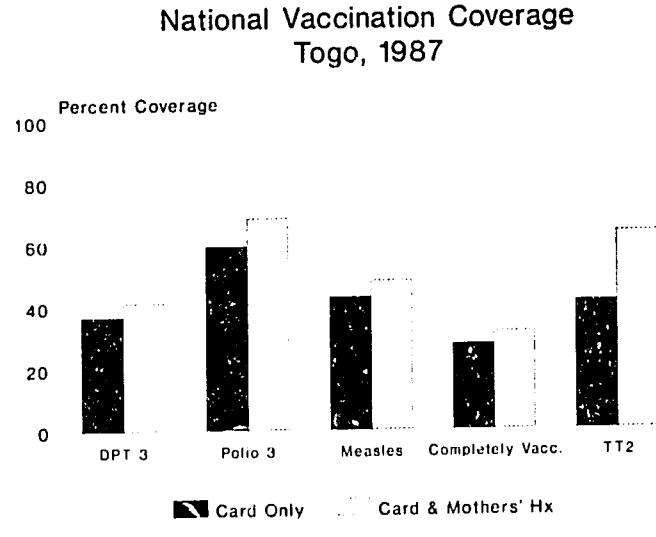


Figure 4.5

Equipping New Centers

The campaign, Action Vaccination Togo (AVT), placed emphasis on social mobilization and public information. The EPI took advantage of the available additional resources to equip the remaining health centers as fixed vaccination sites. Cold chain, sterilization and injection equipment were furnished to an additional 46 health centers, bringing the total number of fixed vaccination centers to more than 340.

Training

Health staff in the new fixed vaccination centers and personnel in previously existing centers were trained in new vaccination policies and techniques using new standardized training materials developed with assistance from CCCD-A.I.D., the CIE, and UNICEF. Over 1200 peripheral health workers received technical training before the opening of the vaccination campaign.

Health Education and Promotion

In an effort to increase and enhance public awareness and participation, more than 1,200 people (including primary school teachers, religious and community leaders, members of cooperatives and women's organizations) were trained in techniques of social mobilization to encourage parents to bring their children for vaccination. Trainees were provided with posters and other visual educational aids developed by the national health education service and assisted by UNICEF and CCCD.

The campaign was officially opened in February 1988 with the Minister of Health administering a symbolic dose of vaccine at a health center on the outskirts of the capital. The campaign continued for 3 months to allow for the administration of the triple dose antigens.

Problems

The most serious problem with the campaign resulted from health workers' noncompliance with the campaign's target age group of 0-23 months. This resulted in overcrowded health centers and led to careless technical practices as well as shortages of vaccines. This problem and others were identified during a series of supervisory visits by central level staff and the Minister of Health. These supervisory findings

resulted in a meeting for all district medical officers to evaluate the campaign's progress and to address some of the problems encountered.

Evaluation

An internal evaluation was held in July 1988 to measure the effect of the AVT and AVB campaigns on vaccination coverage. The results were generally considered satisfactory, with individual antigen coverage increasing by an average of 30%. The rate of completely vaccinated children increased from 32% to 48% (figures 4.6). In addition, 72% of women surveyed had received at least two doses of tetanus toxoid (figure 4.7).

To measure the effect of the various messages on coverage and to determine the most effective means of communication, questionnaires were administered to mothers of children in the target age group, testing their knowledge about immunization issues and correlating that to actions taken. It was found that many women did not know how many times to bring their children for vaccination.

The evaluation, in addition to the coverage surveys, examined the quality of service delivery and health worker performance. The methodology developed in collaboration with CCCD for conducting facilities needs assessments was used to assess current needs of health workers in the areas of technical training, management and commodity procurement. Using part of this methodology with the regular coverage survey, the evaluation identified problems with cold chain, sterilization, and other issues. Problems identified included failure to focus on the target age group, non-compliance with the minimum time intervals between multi-dose antigens, failure to target children under 1 year of age, technical problems with maintaining a cold chain, and faults with vaccine administration. This information was used in the design of future EPI training activities.

Vaccination Coverage of Children 12-23 Months by Antigen and Region, Togo, 1988

Region	N*	Card	BCG	DPT 1	DPT 2	DPT 3	POLIO 1	POLIO 2	POLIO 3	Measles	CV
Savanes	208	98	92	93	88	75	93	88	72	69	50
Kara	211	96	96	95	84	66	95	85	64	78	50
Centrale		95	95	94	84	63	94	84	63	76	52
Plateaux		92	96	92	85	66	92	84	59	77	51
Maritime		96	96	95	79	52	95	79	54	82	46
Lomé	207	86	92	82	69	53	82	69	53	55	36
Total Country	1265	93	95	92	81	62	92	81	60	74	48

Evaluation AVT

Figure 4.6

Tetanus Toxoid Vaccine Coverage of Women 12 - 45 years of Age by Region and Dose

Regions	Females	Cards	Tetanus Toxoid 1	Tetanus Toxoid 2	Tetanus Toxoid 3
Savanes	222	83%	83%	66%	23%
Kara	223	95%	93%	82%	39%
Centrale	221	92%	92%	77%	39%
Plateaux	222	93%	90%	32%	40%
Maritime	223	95%	94%	83%	33%
Lomé	229	83%	76%	59%	37%
Total Country	1340	90%	83%	72%	33%

Source - Evaluation AVT

Figure 4.7

Post Campaign

Post-campaign activities focused on consolidating the gains made during the accelerated program. Fixed facilities remained the foundation of the program, given the expense and complicated logistics of mobile strategies. A second phase of acceleration was planned that took into account coverage results by regions. In regions with high coverage, supervisory activities aimed at strengthening fixed center capacities to maintain coverage and to provide more effective outreach services. Special activities were designed for areas with low coverage, concentrating on health education and social mobilization. Given that the lowest coverage after the campaign was found in Lomé, a special urban strategy was developed to raise coverage there.

Sustainability

The social mobilization activities resulted in long term permanent gains in parental awareness on the importance of immunization. Surveys identified health workers as the most important source of information about immunization. However, needs assessments documented that communications were in general poorly carried out. This performance problem was addressed though in-service training. Media, particularly radio, was only an important communication channel in large urban areas.

Despite rapid and significant gains in immunizations coverage, AVT was not sustainable because of high monetary costs

and its domination of health resources. "Action Vaccination Togo" (AVT) was relatively costly. UNICEF spent $2,650,000 on vaccine alone. The vaccination campaign had the additional effect of disrupting other health services during almost half a year.

Training and Supervision

Concern regarding the issues of sustainability, limited capacity to effectively absorb resources, and personnel motivation caused the MOH to conduct additional needs assessments and to insist that health education and community mobilization activities be given high priority. The training needs assessments allowed the MOH to focus training on the actual needs of the fixed facilities (figure 4.8). They fostered better EPI integration with other programs and assured that immunization activities continued after the campaigns ceased.

Post-campaign activities have included additional health worker training. Problems identified during the surveys such as failures to comply with vaccine schedules, missed target groups, and non-compliance with dosage intervals significantly lowered coverage. An extensive training program for nurses and other peripheral health workers in 1990 based its curriculum on the specific points identified during the evaluation and coverage surveys.

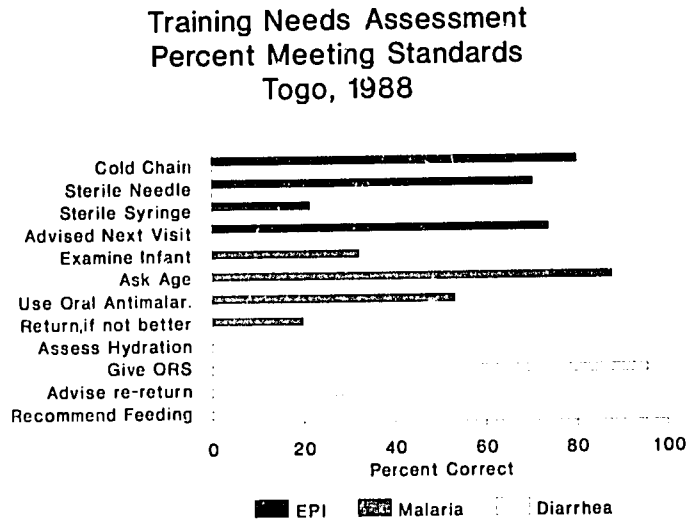


Figure 4.8

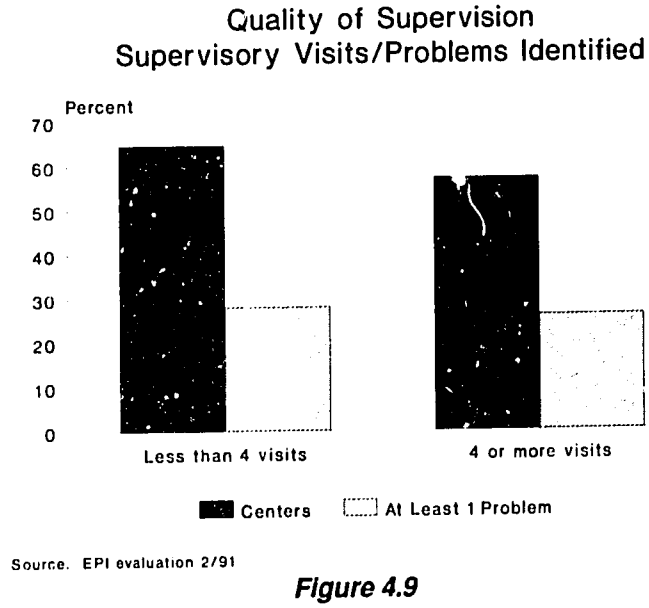


Figure 4.9

The EPI was evaluated again in 1991. Training was seen to vastly improve service delivery with fewer of the errors that had previously lowered coverage rates. Increased attention was also given to supervisory activities. Results of a 1991 survey indicated that 95% of facilities had received at least one supervisory visit by the district medical officer during the year and almost 50% received more than three supervisory visits. However, as can be seen in the graph, centers regularly supervised were found to have problems as often as those receiving little or no supervision (figure 4.9). Supervisory skills training was identified as an important program priority.

EPI Reporting System

As indicated above, the EPI reporting system consisted of a relatively long and cumbersome form completed monthly by health workers. The mothers of children vaccinated were provided cards with their child's immunizations recorded. In the health centers, large registers were kept to track persons immunized at the centers. These systems were time consuming and little used. The vaccination campaign prompted a new focus on the EPI information system and the first of several modifications to the various collection instruments. The cards were made more graphic for improved comprehension, the report was shortened and made more usable, and discussions on the health center register and its use were initiated.

CEIS

Togo continued to use the Computerized EPI Information System (CEIS) as recommended by WHO. This program allowed for rapid, accurate, and timely analysis of data and for estimates of coverage based on doses of vaccine administered. The routine reporting system had a tendency to overestimate coverage for most antigens with the exceptions of measles and tetanus toxoid (figure 4.10). Since BCG coverage estimated by survey approximated 96%, the 1991 evaluation recommended use of the number of BCG doses administered as the EPI denominator. When used as a denominator, the BCG cov-

erage estimate, based on routine reporting, approximated those obtained by survey.

The CEIS enabled program staff to monitor vaccination coverage and disease incidence at any point during the year. The system identified regions experiencing problems with specific antigens and quality of service delivery. By monitoring the percentage of vaccinations administered to children under 1 year of age and by calculating the drop-out rates between DPT1 and DPT3, problem regions were identified. These data were then used to correct and modify activities. Additionally, district level program managers used these data to evaluate their districts. A decentralized management system enabled the program to respond better to regional problems and needs and to help "fine tune" activities.

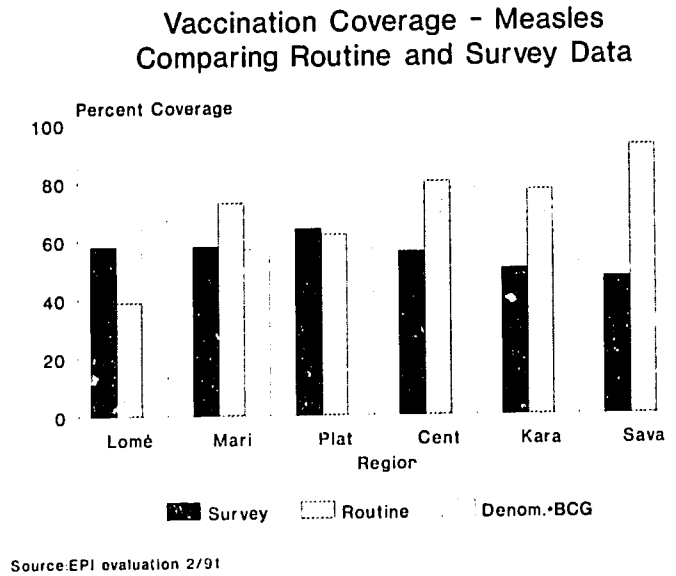


Figure 4.10

Impact

Coverage

The Togo EPI has been successful in increasing coverage (figure 4.11).

Data on coverage since the peak of acceleration activities indicate that Togo has to date been able to largely maintain coverage levels achieved in 1989. Coverage for antigens requiring multiple doses (DPT, OPV) has, however, been less successful.

Disease Incidence

The general health information system has been strengthened and improved. The data show an impressive tendency toward control of once common childhood illnesses such as measles. Morbidity and mortality from vaccine-preventable disease have decreased.

Prior to the initiation of EPI, Togo experienced seasonal epidemics of measles every year. As vaccination coverage rates increased, epidemics decreased to a 2 year cycle. The age of children with measles also changed, with cases of measles tending to be among older unvaccinated children and in some pre-vaccination age children.

Measles reduction has been the most notable impact of the Togo EPI. Three distinct sources corroborate this impact. First, routine surveillance documents decreased morbidity (figure 4.12). Secondly, health workers report fewer cases at their facil-

Figure 4.11

Comparison of coverage By Study of Children from 12 to 23 months of age for the years 1987 - 1992

	1987	1988	1989	1990	1991	1992
BCG	53	95	91	96		
DPT 1	59	92	84	93	89	71
DPT 2	45	81	74	87		
DPT 3	37	62	55	73		
Polio 1	59	92	84	93		
Polio 2	44	81	75	87		
Polio 3	35	60	55	73	72	52
Measles	43	74	62	78	51	48
CV	27	48	43	64		

Source: 1990 EPI Internal Evaluation

ities and thirdly, the general population appear to recognize the connection between immunization and the reduction of measles cases in the community. The EPI's best publicity may well be the people's recognition of the efficacy of measles vaccination.

As polio vaccine coverage increased, there was a marked decline in the reported number of polio cases (figure 4.13). When the eradication of poliomyelitis became a declared program goal for EPI, Togo incorporated special activities into its EPI. A plan for eradication was developed during a WHO EPI managers meeting in 1991. The main additional activity was enhanced surveillance for the identification and investigation of cases of acute flaccid paralysis (AFP). Togo is fortunate in having the reference laboratory for the subregion in neighboring Ghana at the Noguchi Memorial Institute for Medical Research (NMIMR).

Samples from the first nine suspected polio cases were delivered to the NMIMR; one of the eight was confirmed positive for polio virus (Type I). Seven of the nine suspected cases were located for further follow-up. Recent figures show a slight increase in the number of reported cases of polio but this may have resulted from improvements in the surveillance system. The incidence of polio remains low.

As tetanus toxoid vaccine (TT) coverage has increased, there has been a marked reduction in the incidence of neonatal tetanus (figures for tetanus in children younger than one year of age were used to estimate the incidence of neonatal tetanus) (figure 4.14).

The other disease specific activity promulgated by WHO is neonatal tetanus elimination. Activities in Togo have been limited to increased surveillance, the very important separation of neonatal from other forms of tetanus on the national disease reporting forms, and an inventory of traditional birth attendants for training.

Although the sensitivity and specificity of the clinical diagnosis of pertussis is low, reported incidence has fallen dramatically as coverage with DPT has increased (figure 4.15).

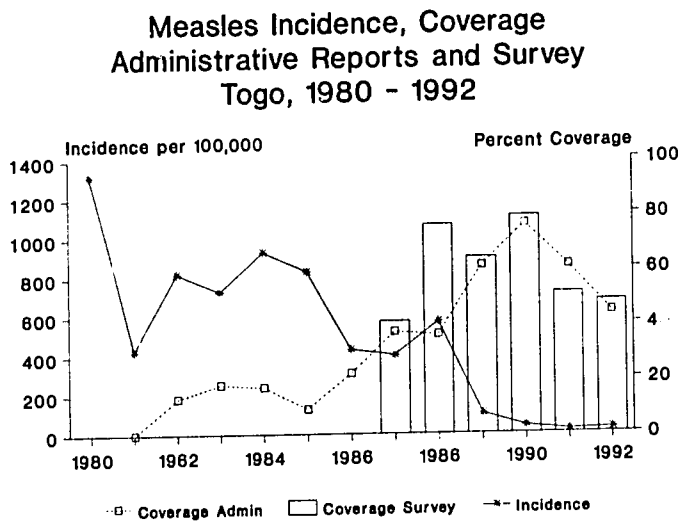


Figure 4.12

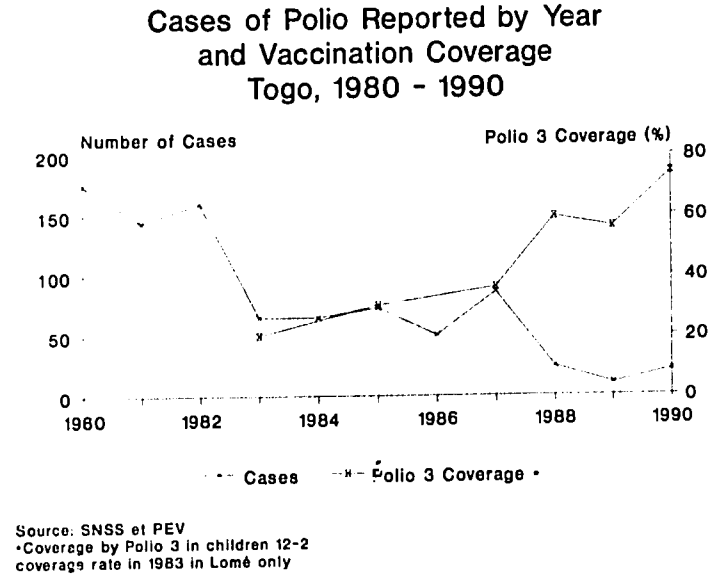


Figure 4.13

Lessons Learned

It is undeniable that the unique convergence of political will, international interest and technological capacity contributed to the program's success. UNICEF and others are to be credited for raising awareness about immunization, engaging the political leadership in a commitment to the program and finally, in providing sufficient resources. The Minister of Health gave a symbolic dose of vaccine. The president of the country gave a symbolic dose of vaccine. There was political engagement at the highest levels. The public became involved.

Although attributing one individual element to the success of the Togo EPI is difficult, certain factors seem to have been key. In informal discussions, as well as in structured interviews with national program managers, district medical officers and donors, certain characteristics of success seemed to emerge.

1. The first of these would be the improvement of the data collection process and the use of data collected about the policy and implementation of the program. Improving routine surveillance and conducting regular coverage surveys and program reviews have been critical in enabling program managers to identify areas of strength and weakness and to make

appropriate decisions about allocation of time, energy, and resources. The CCCD project was largely responsible for the information system's improvement. UNICEF and WHO also assisted in the development of the CEIS.

2 A second oft-mentioned element was the presence of high quality outside technical assistance. The national program managers and other EPI staff continually expressed satisfaction with both the long and short term technical assistance. Both CCCD and UNICEF had resident technical advisors. When there was a hiatus of full-time technical assistance from CCCD, the MOH was insistent on a replacement. Significant amounts of short-term technical assistance were also furnished by CCCD, WHO, CIE and UNICEF. It was generally believed that the quality of technical assistance was high and contributed significantly to the program's success. Much attention was taken to insure the inclusion of national managers in all aspects of the work of consultants in order to facilitate the transfer of skills and knowledge.

3. Another important element in the success of the EPI in Togo was the excellent coordination among the donors. The MOH went to great lengths to ensure that there was little overlap in responsibilities and that each partners' role was clear. In addition to the larger donors (WHO, UNICEF, and CCCD), the smaller agencies such as CUSCO, the US Peace Corps, and Cathwel were given specific mandates within programs or regions by the MOH in order to avoid duplication. This coordination proved critical to program success.

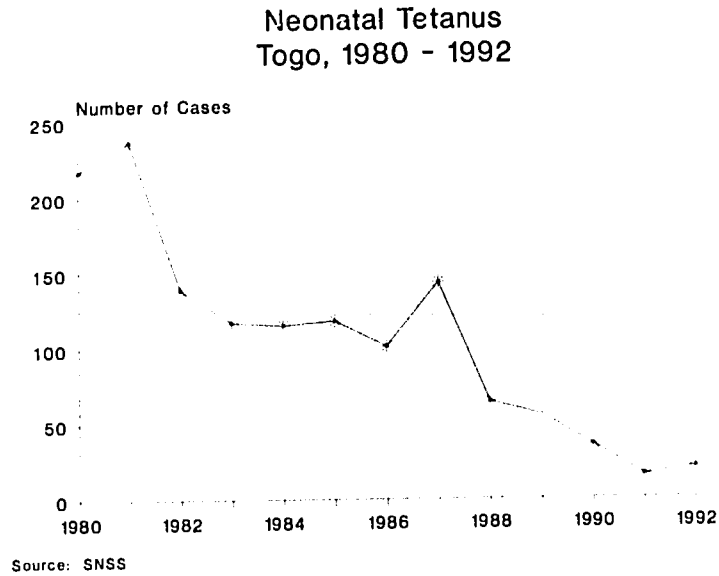


Figure 4.14

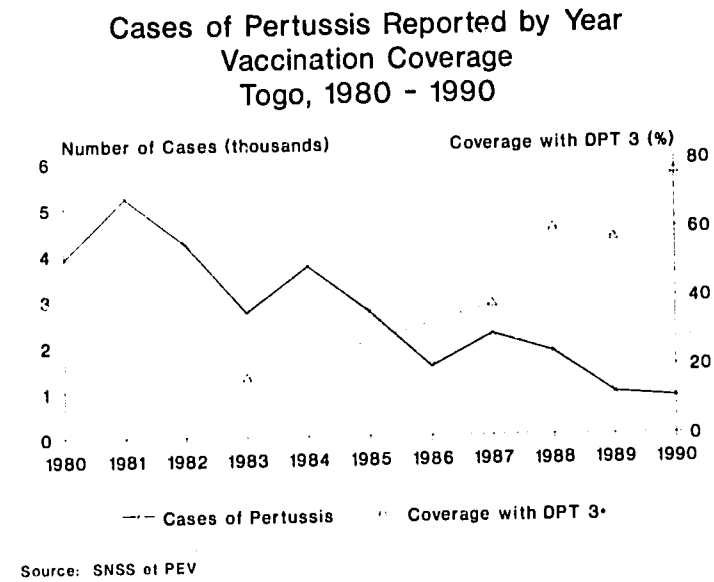


Figure 4.15

4. Operational research was also important. As the EPI was in fact "imported", it was important for the Togolese to take it and make it their own program. This development of ownership and participation was in part fostered through participation in operational research studies dealing with a number of EPI issues. Studies were conducted on such subjects as measles vaccine efficacy and the number of TT doses required for protection. These studies added to the body of international knowledge but they also provided Togo with the "how to" for program implementation. Studies on measles seasonality, mothers' knowledge and practices, community acceptance of immunization, and cost of the program resulted in policy modifications and changes in strategy and resource allocation. This use of data for decision making was an important achievement of the Togo EPI.

Future Directions

The single most important issue for the future of the Togo EPI is sustainability. The program has benefitted from significant amounts of outside financial and technical assistance which has had the effect of relieving the MOH from some of its responsibility for continuing program support. Donor fatigue and new donor priorities may further reduce EPI donor support. The Togo MOH will likely face important decisions about priorities in the near future.

Commodities

The first sustainability issue is that of replacing cold chain and other equipment as the old commodities begin to fail. Some

commodities have been in the field for over a decade and will need replacement. A 1991 survey showed that 12% of refrigerators were not functioning properly (figure 4.16). Assuring a continuous supply of vaccine in the future, a supply guaranteed almost exclusively by donors in the past, will be another substantial future challenge.

Funding

Some of the recurrent costs such as fuel for supervision, repairs and fuel for vehicles used in outreach, and kerosene for refrigerators have also, at various times, been supported by donors. Production of vaccination cards and other materials related to the information system were also donor supported.

Costs related to the development and production of health education and social mobilization materials have been the exclusive purview of outside donors. The training of health workers and operational research also received heavy donor subsidies.

Clearly, the MOH will have to take an increasing share of the responsibility for the financing of the EPI. The options for achieving this goal are limited but viable. The MOH will need to negotiate with donors and determine levels of future support. Agreements to continue support in vaccine procurement and other commodities which donors obtain at competitive prices will be important. The MOH and the government will need to establish a detailed line item budget for payment from general MOH resources for some of the recurrent and program costs. Careful thought to cost saving innovations such as better integration and sharing of system resources with other programs and ministries will also be important.

There are program areas which could be trimmed to achieve some cost savings. Formal training could be less frequent with more emphasis placed on in-service on-the-job training. District medical officers should improve supervision and use these regular monthly contacts to train peripheral workers on new EPI policy changes and program developments. Decentralization would be more cost effective with more resources and responsibility directed to the districts. Integrated services could also achieve some savings.

Self-financing could also provide additional support from the recipient population. Certain district medical officers and peripheral health workers have attempted charging fees for vaccination cards and for vaccine series. These funds were then used to purchase fuel for the kerosene refrigerators and for supervisory and outreach activities. There are currently no national policies on health financing. This is another area for the MOH to explore and develop.

Considerable interest exists for auto-financing activities in Togo, not only for the EPI but for general curative care and for other services. EPI has always been in the vanguard for innovations in implementation and could capitalize on such interest to institute standard procedures. This future direction is encouraged by donors. UNICEF's Bamako Initiative, the World Bank's conditional loan programs, and A.I.D.'s new integrated family health program all promote health care financing.

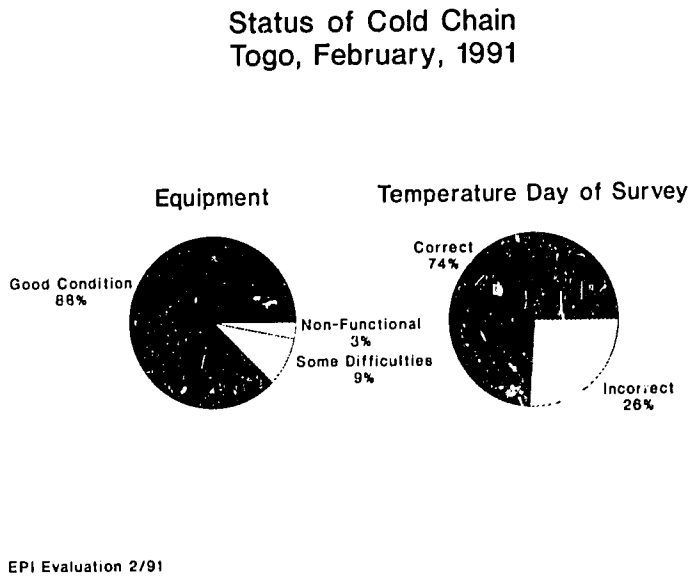


Figure 4.16

Reducing Missed Opportunities

Without large donor inputs, the campaign strategy was not sustainable. Cost effective means to raise and maintain coverage are needed. One potential strategy involves the vaccination of children every day and at every contact with the health care delivery system. This would thus reduce the considerable number of "missed opportunities" to immunize women and children.

Research studies and surveys confirm that women and their children are in health centers many times during the year. They come for postnatal consultation, for family planning services, for curative care or to accompany family members. To reduce missed opportunities, health care workers need to systematically verify the vaccination status of women and children coming to centers and, if necessary, immunize them. Many health centers offer vaccination services only once or twice a week. Health workers claim this enables better organization, use of personnel, and permits them to make appointments with women who need to return to complete the series.

WHO recommends that all target age persons (infants and women of fertile age) be screened for immunizations at every contact with the health services (preventive or curative). Persons identified as needing vaccine should be vaccinated on the spot. Reasons for considerable resistance to this strategy ranged from fear of wasting vaccine, lack of qualified personnel, and additional work for already overworked staff.

Evaluations have shown high rates of missed opportunities, especially in coastal areas. Togo, with CCCD support, conducted research to determine the applicability of implementing the WHO strategy to reduce missed opportunities. This major operational research activity was undertaken to determine the efficacy of vaccinating at every opportunity in the fixed facilities. The question of potential vaccine wastage, caused by opening multi-dose vials of vaccine for a single infant, remains unresolved. Cost effectiveness also needs to be examined.

Integration of Service

The future Togo EPI will be better integrated into the country's broader routine primary health care system. The highly vertical EPI management and implementation of the past is no longer affordable.

Different health programs should consider sharing a number of responsibilities: training of personnel, commodity distribution, and gathering and analyzing information to name a few.

A word of caution on integration. EPI is one of the stronger and better developed programs in Togo. Other programs could certainly benefit from the EPI experience and its established systems. Care must be taken not to overwhelm what is still a fragile system. There have been calls for an integrated information system. EPI information needs are well known and are being effectively met at present. Newer, less developed programs are still working on their information needs. The EPI system should not be compromised by newer evolving programs. Selective integration may be indicated in the near term with total integration as a long-term goal.

Decentralization

Decentralization to the operational or service delivery level remains an EPI goal. Central level program managers may resist assigning increasingly scarce resources to the periphery. The World Bank has encouraged other donors to promote this decentralization. The MOH has responded by creating regional health structures; the appropriateness of this form of decentralization in Togo, will need to be assessed.

Decentralization to the level of implementation, the district in Togo, may be more cost effective.

Disease Control

The future of EPI in Togo will involve programs for the eradication of polio and the elimination of neonatal tetanus. Togo has a very low incidence of polio and has been the first country in the region to use the WHO system of case confirmation. Continued surveillance will be a prime component of these programs. Togo's MOH and its EPI are particularly excited by the possibility of polio eradication in the not too distant future.

The future may bring the introduction of new vaccines such as Hepatitis B. The logistics and expenses of introducing new vaccines should be carefully studied before a policy decision is made.

As the program matures, targeting children younger than 1 year of age will become more important. For reasons of epidemiology and cost, the target age group (0 - 11 months) must truly become the program's focus.

Political Stability

A final note on the future; Togo has been experiencing serious political disturbances over the past few years. Growing numbers of Togolese are fleeing their country for neighboring safe areas. This has, of course, had a tremendous effect on civil administration and the implementation of most activities, including the EPI. Statistics indicate that doses administered are down from previous years. Despite the problems, services have continued to be delivered at a slightly lower rate. Eighty-four percent of 1992 prefectoral monthly reports were received at the central level.

Chapter 5
EPI Country Summaries

Burundi (CCCD 1985-1993)

Demographics

Population:	5.7	million
IMR:	108	
Mortality <5yrs	187	

Health Structure

15 provinces with hospitals
113 communes
177 health facilities

EPI Strategy

Maintain coverage and disease reduction targets through delivery of vaccines at fixed facilities.

Coverage

High immunization coverage achieved and maintained.

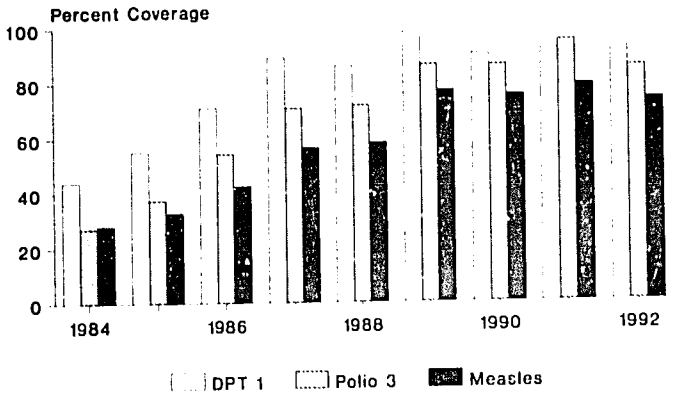
Impact

Demonstrated reduction in vaccine preventable disease morbidity and mortality.

Sustainability

Limited in the absence of continued donor support.

DPT 1, Polio 3, and Measles Vaccination Coverage Burundi, 1984 - 1992

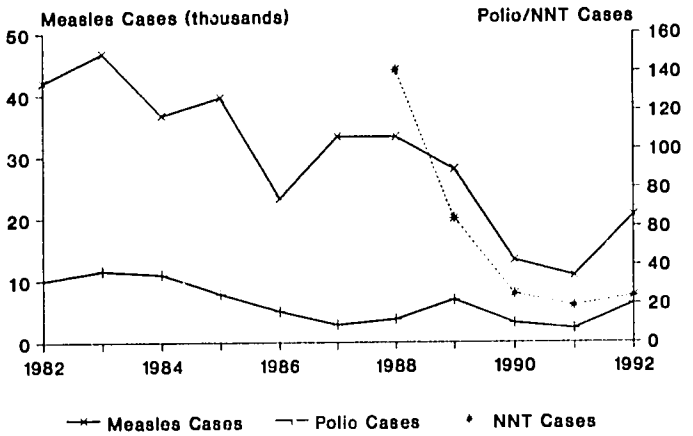


Vaccination Coverage Surveys Burundi

		DPT1	POLIO3	MEASLES
1986	MOH	75	61	57
1987	DHS	96	73	75
1988	MOH	66	49	59
1991	MOH	85	69	69

MOH/EPI Data

Neonatal Tetanus, Polio, & Measles Cases Burundi, 1982 - 1992



PEV Data

Central African Republic (CCCD 1984-1992)

Demographics

Population:	3.1 million
IMR:	106
Mortality <5yrs	180

Health Structure

Ministry decentralized to 5 health regions.
Medical Chief heads each region.
Peripheral levels: Prefecture, health center, sub-center, and health post.

EPI Strategy

Fixed center strategy with mobile teams for special "catch-up" vaccination efforts and outbreak response.
Emphasis on training and monitoring to improve quality of vaccination services.

Coverage

Coverage has decreased since 1990-91 because of strikes and economic problems. Special campaigns have helped to boost or maintain coverage in areas at risk.

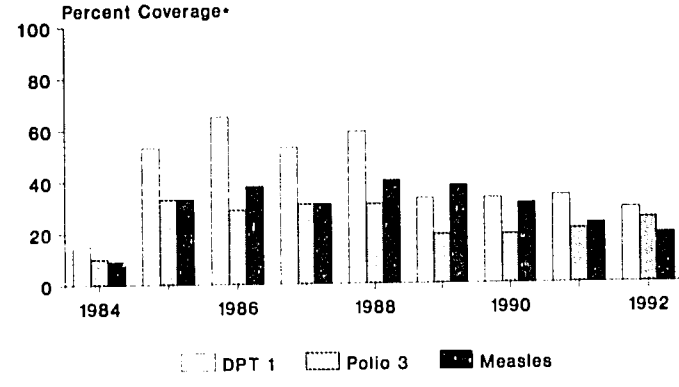
Impact

Difficult to assess, because of decreased reporting during strikes.

Sustainability

Managerial and clinical staff well trained and often well motivated. Political unrest and economic crises have slowed program implementation. Donor support is essential.

DPT 1, Polio 3, and Measles
Vaccination Coverage
Central African Rep., 1984 - 1992



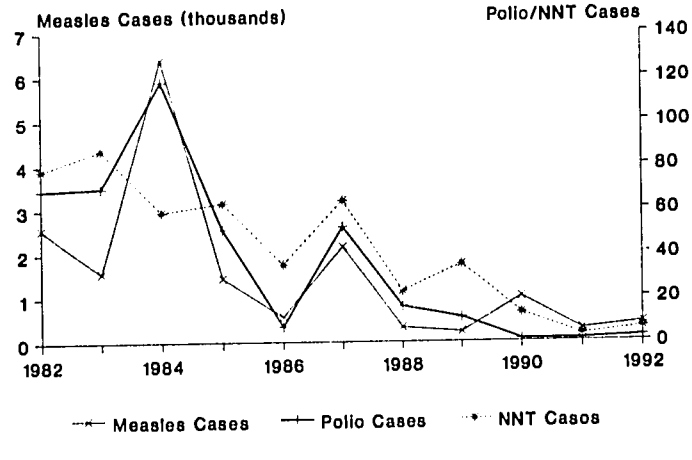
* Vacc. <1 divided by surviving infants x 100

Vaccination Coverage Surveys
Central African Republic

		DPT1	POLIO3	MEASLES
1985	MOH	34	24	na
1989	MOH	81	43	57
1990	MOH	84	57	67
1991	MOH	86	77	80
1993	MOH	79	60	89

DMPGE Data

Neonatal Tetanus, Polio, & Measles Cases
Central African Republic, 1982 - 1992



DMPGE Data

Côte d'Ivoire (CCCD 1985-1992)

Demographics

Population:	12.5 million
IMR:	93
Mortality <5yrs	127

Health Structure

Centralized and formerly curative oriented MOH now developing PHC system at the peripheral level. Parallel directorates at the central level with little coordination of activity.

EPI Strategy

Continues to rely heavily on mobile teams based at the prefecture level.

Coverage

Improved in late 1980s. Preliminary data indicate a decrease in coverage in the 1990s.

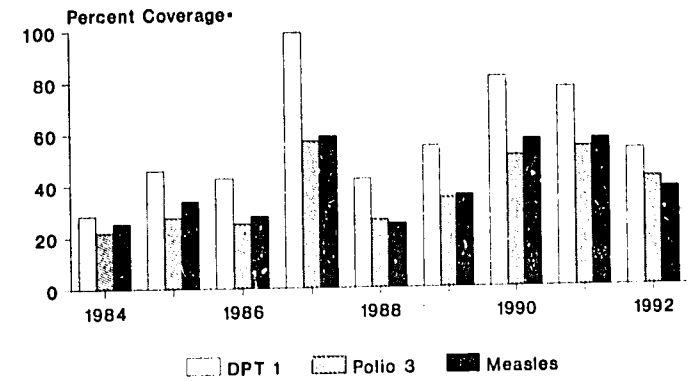
Impact

Impressive declines in measles morbidity from 1986 to 1990. Recent data not available.

Sustainability

Côte d'Ivoire is purchasing some of its vaccines. Strengthened management at central and prefecture levels and continued donor inputs will be required.

DPT 1, Polio 3, and Measles
Vaccination Coverage
Côte d'Ivoire, 1984 - 1992



* Vacc. #1 divided by surviving infants x 100

Vaccination Coverage Surveys
Côte d'Ivoire

		DPT1	POLIO3	MEASLES
1987	MOH	99	71	85
1991	MOH	77	54	57

Children 12 - 23 mos.
MOH Data

Lesotho (CCCD 1984-1991)

Demographics

Population: 1.8 million
IMR: 82
Mortality <5yrs 137

Health Structure

19 health service areas
145 health facilities
Provision of services shared by Ministry of Health and Private Health Association of Lesotho.

EPI Strategy

Fixed-center strategy with outreach.
Second dose of measles vaccine administered at 18 months (see Chapter 7)

Coverage

Maintains high coverage rates for children aged 12-23 months.
Coverage for children less than 1 year of age has declined somewhat since 1989.

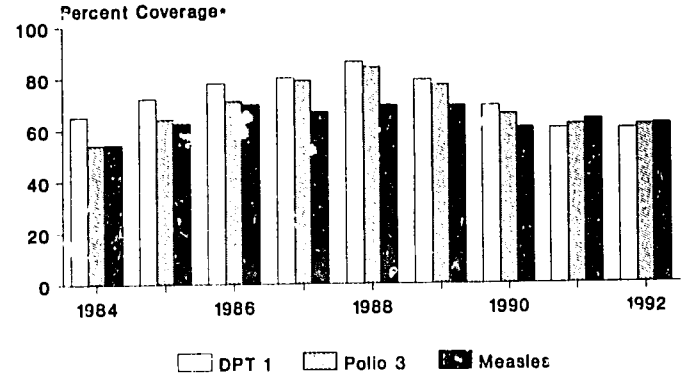
Impact

Significant decline in measles cases (76% reduction 1981-90).

Sustainability

While peak coverage levels of 1988-89 not maintained, EPI functions with strong project management and MOH commitment.

DPT 1, Polio 3, and Measles
Vaccination Coverage
Lesotho, 1984 - 1992



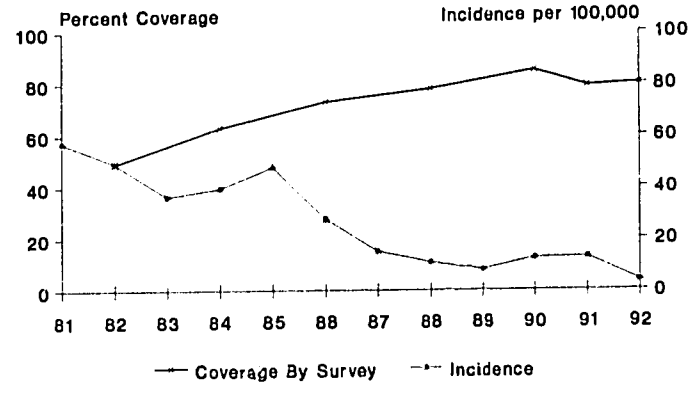
* Vacc. #1 divided by surviving infants x 100

Vaccination Coverage Surveys
Lesotho

		DPT1	POLIO3	MEASLES
1982	MOH	75	34	49
1984	MOH	83	64	62
1986	MOH	92	80	73
1988	MOH	89	78	78
1990	MOH	97	82	85

Children 12 - 23 mos.
MOH Data

Measles Incidence (all ages)
and Immunization Coverage
Lesotho, 1981 - 1992



Coverage By Survey: Children 12-23 mos.
Source: MOH Health Information System

Liberia (CCCD 1983-1990)

Demographics

Population:	2.7 million
IMR:	131
Mortality <5yrs	200

Health Structure

14	county hospitals
13	health departments
69	health centers
249	clinics

EPI Strategy

In Liberia, where less than half the population had access to fixed facilities, annual decentralized national campaigns were used to increase coverage.

Coverage

Coverage increased but at a substantially lower rate than expected.

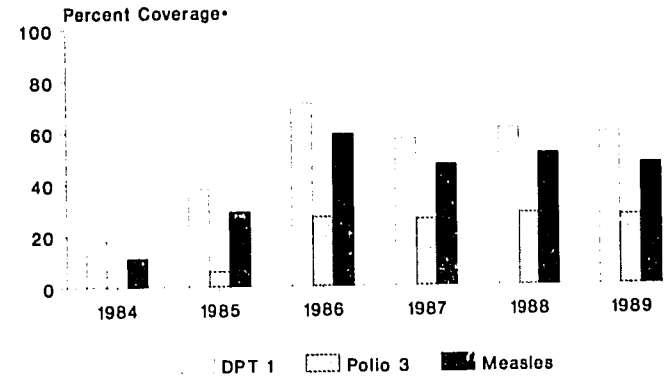
Impact

Prior to outbreak of civil war, mortality surveys in two counties documented decreased infant and child mortality.

Sustainability

Unsustainable under current civil conditions.

DPT 1, Polio 3, and Measles
Vaccination Coverage
Liberia, 1984 - 1989



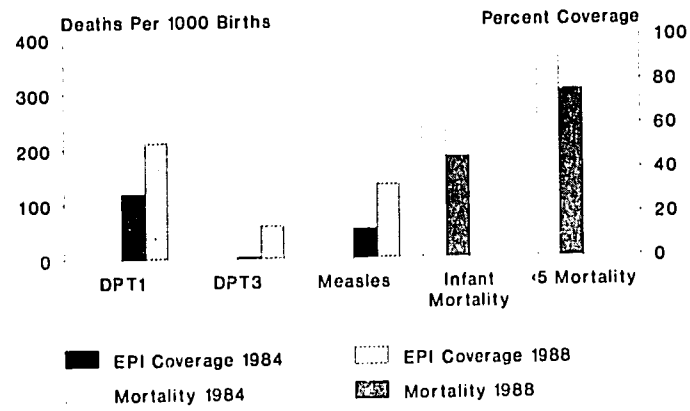
* Vacc. <1 divided by Surviving Infants x 100

Vaccination Coverage Surveys
Liberia; 1984, 1986, 1987 and 1988

	DPT1	POLIO3	MEASLES	CARDS
1984 *	29	4	13	35%
1986	47	13	39	48%
1987 **	53	17	40	59%
1988 *	68	28	55	74%

* Mortality and Use of Health Services (MUHS) Surveys
** CCCD Immunization Coverage Survey
MOH Date

Mortality and Use of Health Services
Bomi & Cape Mount, Liberia
1984 & 1988



Malawi (CCCD 1984-1988)

Demographics

Population: 9.9 million
IMR: 144
Mortality 5<yrs 228

Health Structure

Forty-five missionary managed hospitals and health centers, operated in conjunction with 222 mission dispensaries, 4 public hospitals, and 325 public dispensaries.

EPI Strategy

Fixed centers and outreach.

Coverage

Achieved high coverage of target disease in 1989 and is maintaining it.

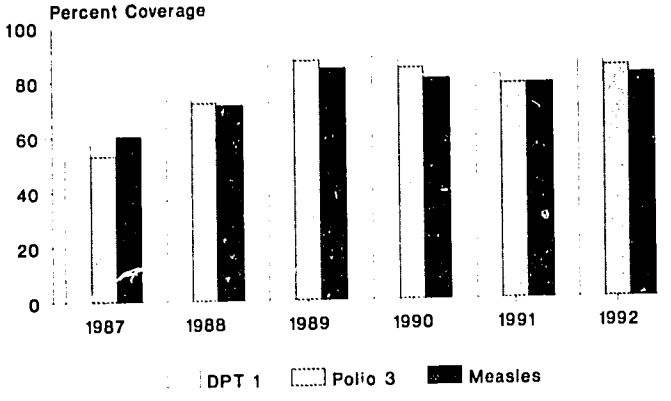
Impact

Dramatic reductions of target disease incidence.

Sustainability

Likely to be sustained with continued collaboration of government and missionary sectors.

DPT 1, Polio 3, and Measles
Vaccination Coverage
Malawi, 1987 - 1992

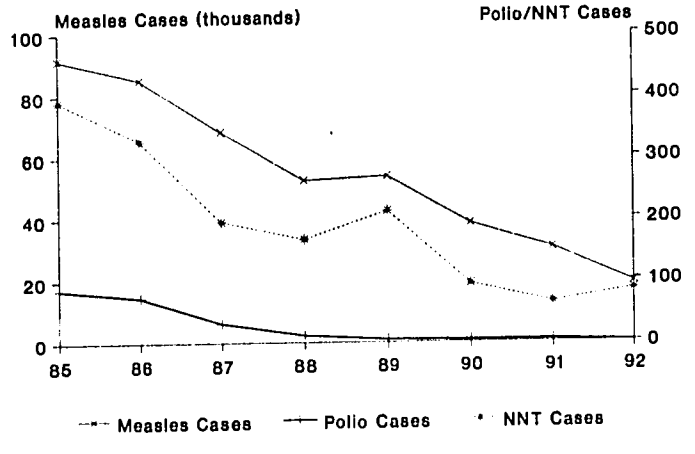


Vaccination Coverage Surveys
Malawi

		TT2	POLIO3	MEASLES
1986	MOH	45	56	85
1987	DHS	40	78	81
1988	MOH	63	72	84
1989	MOH	72	90	84
1990	MOH	76	85	81
1991	MOH	76	78	78
1992	MOH	66	84	82

MOH/EPI Data

Neonatal Tetanus, Polio, & Measles Cases
Malawi, 1985 - 1992



SNSS

Nigeria (CCCD 1988-1993)

Demographics

Population: 91.1 million
IMR: 86
Mortality 5<yrs 188

Health Structure

Federal Ministry of Health
State Ministries of Health (30)
Local Government Areas (593)

EPI Strategy

Nigeria has used a mixed strategy of vaccine delivery at fixed facilities, limited outreach, and vaccination days (national, state, or local)

Coverage

Less than half of all 1-year- old children are fully immunized. Problems in techniques and cold chain.

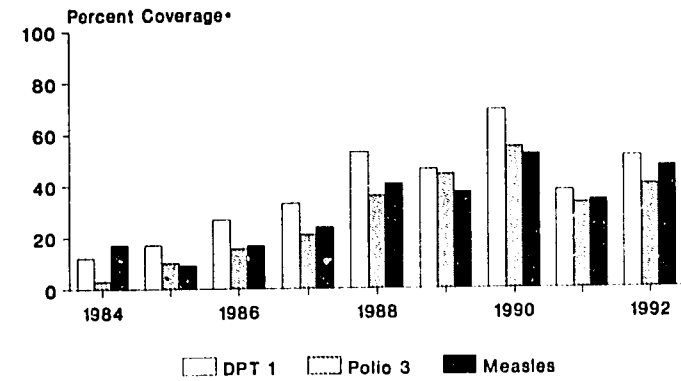
Impact

Modest decreases in EPI target disease have been noted.

Sustainability

Nigeria purchases most of its own vaccines. Sustainability dependent on political stability, national leadership, and level of donor support.

DPT 1, Polio 3, and Measles
Vaccination Coverage
Nigeria, 1984 - 1992



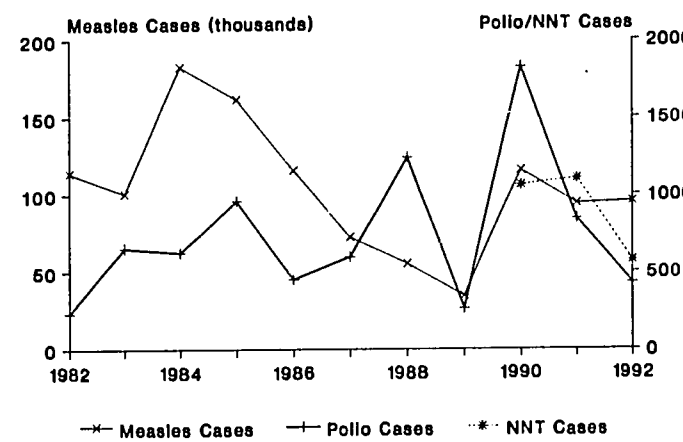
* Vacc. <1 divided by surviving infants x 100

Vaccination Coverage Surveys
Nigeria

		DPT1	POLIO3	MEASLES	CARDS
1988	MOH	NA	60%	48%	--
1989	MOH	NA	57	48	--
1990	DHS	60%	33	28	72%
1991	MOH	NA	50	48	91%

12 - 23 mos.
EPI/PHO Data

Neonatal Tetanus, Polio, & Measles Cases
Nigeria, 1982 - 1992



EPI/PHC Sentinel Data

Rwanda (CCCD 1984-1988)

Demographics

Population:	7.2 million
IMR:	118
Mortality <5yrs	189

Health Structure

EPI carried out under MOH's Directorate of Epidemiology and Health in 190 public and private health centers and hospitals.

EPI Strategy

Program for accelerated immunization launched in March 1988. Strong government support of "consolidated" (private) health facilities helped bolster the EPI.

Coverage

Program showed tremendous progress during and after CCCD. Coverage survey conducted in 1992 found coverage rates of over 80% among children ages 12-23 months.

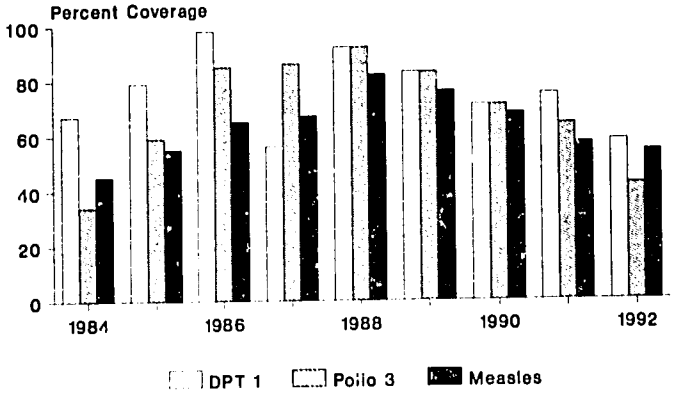
Impact

Progress in achieving and maintaining high coverage resulted in important reductions in immunizable diseases especially whooping cough, measles and polio.

Sustainability

Civil war since 1990 has weakened an otherwise well-maintained EPI.

DPT 1, Polio 3, and Measles
Vaccination Coverage
Rwanda, 1984 - 1992

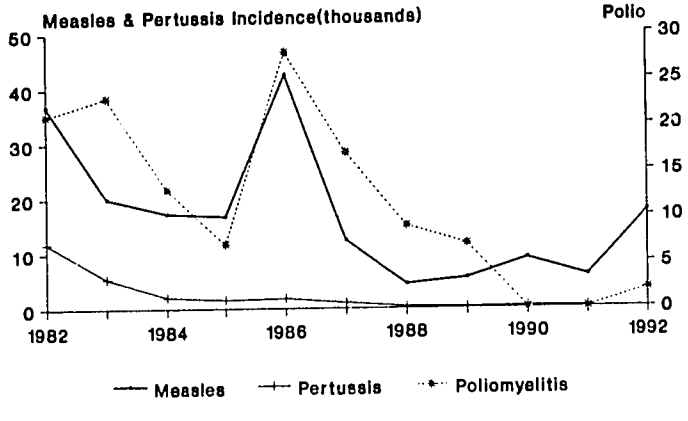


Vaccination Coverage Surveys
Rwanda

		DPT1	POLIO3	MEASLES
1989	MOH	95	78	75
1990	MOH	96	83	83
1992	MOH	97	85	81

MOH Data

Measles, Pertussis, & Polio
Incidence per 100,000
Rwanda, 1982 - 1992



Source: WHO CEIS

Swaziland (CCCD 1984-1991)

Demographics

Population: 800,000
IMR: 101/1000
Mortality <5yrs

Health Structure

Central Ministry of Health with four regional health offices.

147 health facilities.
113 outreach sites

EPI Strategy

Vaccine delivery at fixed facilities supplemented by mass vaccination of primary schools and outbreak investigation and control.

Coverage

Sustained high vaccination coverage rates, although some decline noted since peak of 1989.

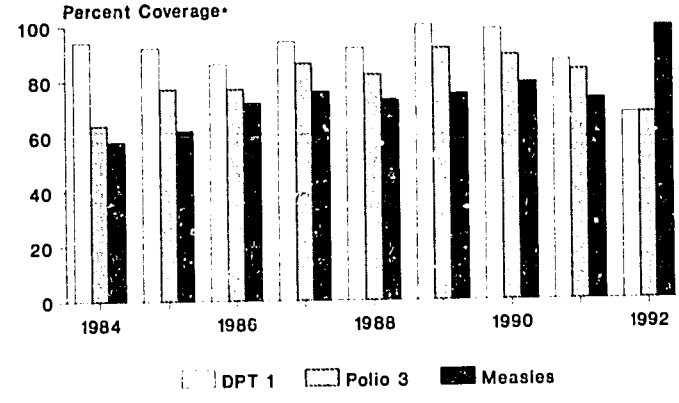
Impact

Significant decreases in reported cases of measles, NNT, and Polio.

Sustainability

Despite decreases in donor support and inadequate staffing levels, MOH commitment and program leadership are maintaining coverage and disease reduction.

DPT 1, Polio 3, and Measles
Vaccination Coverage
Swaziland, 1984 - 1992



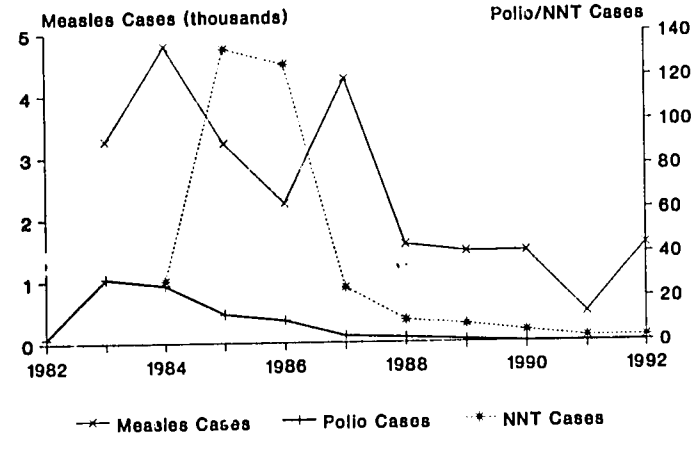
*Verified by card

Vaccination Coverage Surveys
Swaziland

		DPT1	POLIO3	MEASLES
1982	MOH	55	22	30
1983	MOH	63	39	38
1984	MOH	67	43	37
1985	MOH	74	58	42
1986	MOH	87	77	69
1987	MOH	89	74	74
1988	MOH	85	71	85

MOH/EPI Data

Neonatal Tetanus, Polio, & Measles Cases
Swaziland, 1982 - 1992



National Data

Togo (CCCD 1983-1993)

Demographics

Population:	3.7 million
IMR:	88
Mortality <5yrs	143

Health Structure

16	prefectures with hospitals
358	dispensaries
5	regional hospitals
1	University teaching hospital

EPI Strategy

Vaccination at all health facilities.

Coverage

Reached 1990 goal of 80% but declined in 1992-93.

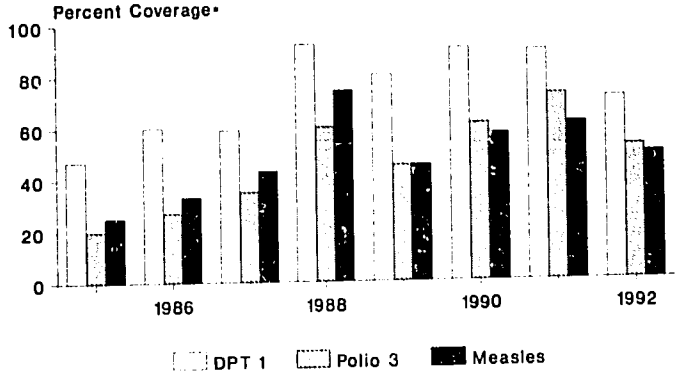
Impact

Dramatic reduction in morbidity and mortality from vaccine preventable diseases.

Sustainability

Sustainability dependent upon return of national stability.

DPT 1, Polio 3, and Measles
Vaccination Coverage
Togo, 1985 - 1992 (Sept)



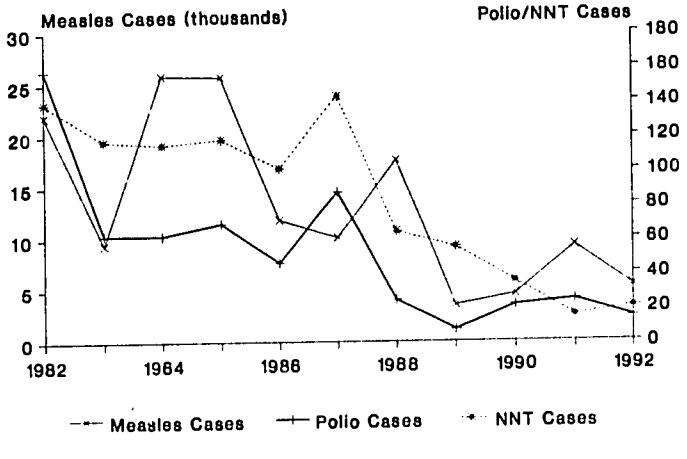
• Verified by card 1987-1991
Administrative method other years

Vaccination Coverage Surveys
Togo

		DPT1	POLIO3	MEASLES
1987	JOINT	59	35	43
1988	JOINT	92	60	74
1989	JOINT	80	45	57
1990	UNICEF	90	51	57
1991	MOH	89	72	51
1992	MOH	71	52	46

Children 12-23 months
SNSS Data

Neonatal Tetanus, Polio, & Measles Cases
Togo, 1982 - 1992



SNSS

Zaire (CCCD 1982-1991)

Demographics

Population:	38 million
IMR:	117
Mortality <5yrs	180

Health Structure

Highly decentralized with training and supervision given to 220 health zones, each with a mix of public and private facilities. 20 EPI regional "antennas" supply vaccine and other supplies.

EPI Strategy

Vaccination in all functional health zones at fixed facilities.

Coverage

Reached peak coverage in 1988 of 42% but activities have been sporadic since that time, and coverage has declined.

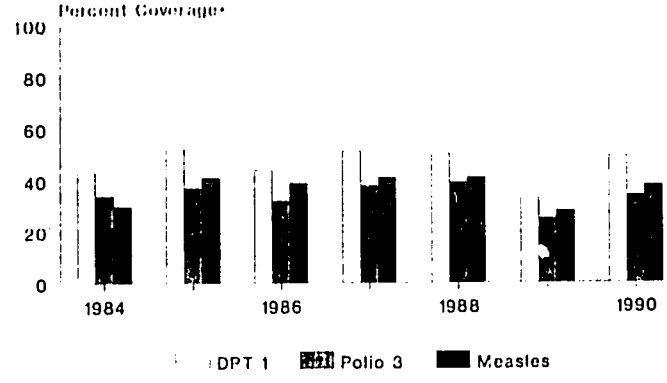
Impact

Measles incidence decreased in areas of high vaccine coverage including Kinshasa. (See Chapter 7.)

Sustainability

Unsustainable under current civil conditions.

DPT 1, Polio 3, and Measles
Vaccination Coverage
Zaire, 1984 - 1989



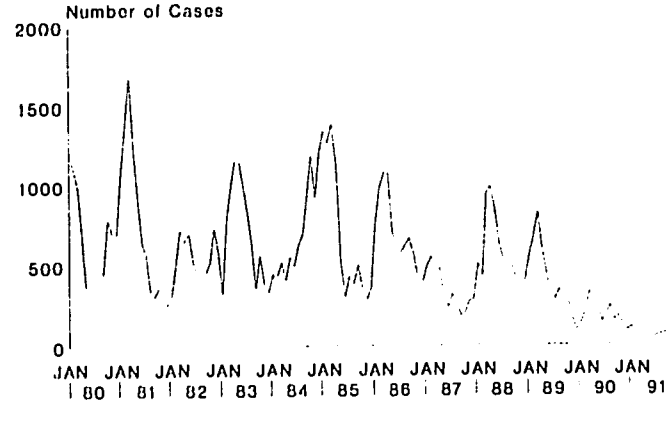
* Vacc. #1 divided by surviving infants x 100

Vaccination Coverage Survey
Zaire

		DPT1	POLIO3	MEASLES
1991	MOH	49	34	38

Children 12 - 23 mos.
PEV/CCCD UNICEF Survey

Reported Measles Cases
Sentinel Sites
Kinshasa, Zaire, 1980 - 1991



Chapter 6
Critical Elements in EPI Implementation

EPI Policy

Global Policy

Immunization policy defines the standard schedule for vaccination: who should be vaccinated, at what age they should be vaccinated, how many doses, and the interval between doses. The setting of policy requires knowledge of both disease epidemiology and vaccine immunology. Global guidelines for immunization policy are set by the WHO Global Advisory Group (GAG) which meets annually to review technical information and implementation data. When indicated, polices are revised to reflect newly available information. Table 6.1 summarizes changes in global policy that have occurred over the last decade.

Each CCCD country differed in its ability and willingness to accept and implement policy changes. In general, small countries (e.g., Lesotho) had the least problem in implementing changes. In larger countries (e.g., Nigeria, where policy change required concurrence of the National Council of Health), policy change was a slower process (e.g., the addition of a dose of oral polio vaccine at birth).

In three CCCD countries, the global policy on measles was modified in response to country specific epidemiologic data showing the failure of a single dose of measles vaccine at 9 months to achieve disease reduction targets. These changes exemplify the need to adapt global policies to specific country situations as demonstrated in table 6.2.

Other Antigens

Yellow Fever is an endemic disease in many parts of sub-Saharan Africa, especially the countries of coastal west Africa. WHO recommends the inclusion of yellow fever vaccine into EPI with administration of yellow fever vaccine simultaneously with measles at 9 months. Few countries have effectively implemented this policy, because of lack of sufficient quantities of vaccine.

In sub-Saharan Africa, Hepatitis B, a major cause of chronic liver disease and hepatic carcinoma, is endemic. Inclusion of hepatitis B vaccine, as a research project, has already been carried out in The Gambia. The main obstacle to inclusion of hepatitis B vaccine in the EPI is cost, currently $0.50 per dose.

Figure 6.1

WHO EPI GAG Immunization Schedule Recommendations

Vaccine	Initial	Revision	Reason For Revision
BCG	At birth or first contact, and revaccination at school	Primary vaccination at birth or first contact	Lack of evidence for efficacy of revaccination
OPV	2, 3, and 4 months	Birth, 6, 10, and 14 weeks	Increased efficacy of 4-dose schedule
DPT	2, 3, and 4 months	6, 10, and 14 weeks	Coverage higher in young infants, efficacy equivalent
Measles	9 months	High titer EZ Vaccine at 6 months in high density areas*	30% of measles cases in high density areas <9 months
		Return to Schwarz vaccine at 9 months	Delayed excess mortality in girls given high dose EZ at 6 months
Tetanus Toxoid	Pregnant women Two doses	Fertile-aged women 5 doses	Low TT coverage achieved when TT administration limited to pregnancy

* Never fully implemented because of shortages of vaccine and evidence of delayed mortality in female recipients

Table 6.2

Local Modification of Measles Vaccine Schedules*		
Country	Modification	Rationale
Lesotho (CCCD)	Two-dose measles vaccine schedule, 9 and 18 months	Emergence of measles as a disease of older children; serological survey showing 13.6% of school enterers as seronegative.
Swaziland (CCCD)	Mass vaccination of school children and aggressive outbreak investigation and control	Single-dose schedule was not effective in achieving disease reduction targets. School outbreaks became a major source of infection and transmission.
Kinshasa, Zaïre (CCCD)	Single dose of standard potency EZ vaccine at 6 months	High percentage of measles cases in infants under 9 months of age.

* These shifts on policy were effective in decreasing disease incidence.

While outbreaks of meningococcal meningitis occur in cycles in Africa, vaccine use is limited to outbreak control because of the vaccine's limited period of effectiveness.

Additional vaccines with potential for routine use in the future include Hemophilus influenza, pneumococcus, and rotavirus.

Coverage and Disease Reduction Targets

Building on the Smallpox Eradication Measles Control and Strengthening Health Delivery Systems Project (SHDS) experiences, the CCCD Project Paper (1981) log frame outlined five targets related to immunization. In 1987, these targets were modified to reflect changing global guidelines and CCCD implementation experience. The targets are shown in the table 6.3.

Importance of Targets

Quantitative targets, primarily those related to coverage, were the driving force behind the progress of EPI during the 1980s. Although targeted levels of coverage were usually similar, methods of data collection and use of coverage data were different at each level, table 6.4.

Strategies

Vaccination strategies reflect an amalgam of tradition, experience, and donor pressure. The objective of immunization is to provide potent vaccine to all children at risk prior to the time of exposure and at a time that the vaccine is likely to be effective. Five immunization strategies have been used in Africa: 1) mobile, 2) fixed (scheduled immunization sessions 1-3 days per week), 3) fixed (daily immunization), 4) outreach, 5) campaigns. While there has been a tendency to rate strategies as good or bad, the more appropriate task is to identify the conditions under which each of the strategies is most appropriate.

Mobile

In the mobile strategy, traditional and political leaders assist through identifying gathering points for vaccination (maximum 2 hours walking time), notifying villages of scheduled time and place of vaccination, assisting in vaccination site organization, and, on some occasions, imposing penalties for those not showing up for vaccination. In areas where traditional leadership was strong, coverage rates in excess of 90% were common. Use of semiautomatic injection devices enabled teams to vaccinate 500 to 1000 persons per line per hour. A single team could vaccinate 2,000 to 10,000 persons per day. When well equipped (vehicles, spare parts, and fuel), funded (per diem), and supervised, mobile teams were a highly efficient, cost-effective strategy for vaccinating large numbers of people in a short time. For three reasons, mobile strategies have not proved sustainable over time: 1) the high cost (transport, spare parts, petrol, and per diem) of running mobile teams, 2) the

Table 6.3

CCCD EPI Targets 1981 And 1987		
Target	1981	1987
BCG, DPTX3, OPVX3, and measles coverage by 12 months of age	50%	80%
TTX2 coverage in pregnant women**		50%
NNT incidence	-50%*	-50%*
Polio incidence	-50%*	-75%*
Measles incidence	-50%*	-50%*

*Decrease as compared to levels at beginning of program.
**Later changed to coverage in women of child-bearing age.

Table 6.4

Methods of Assessment and Use of Coverage Data at Different Levels		
Level	**Method**	**Use**
Community	Line listing of births and vaccinations	Assessment of coverage, identification of infants needing vaccination or followup
Health facility	Number of vaccinations <1 divided by estimate of population <1 X100 (Administrative Method)	Self assessment of progress toward target (monthly and annually)
District	Quarterly estimation of facility specific levels of coverage (Administrative Method)	Identification of problem facilities needing supervisory support
National (Ministry of Health)	Semiannual estimation of district and national coverage (Administrative method) National 30 cluster surveys every 2-3 years	Monitoring, reporting, and planning
National (political)	Same	Self assessment, planning advocacy, and reporting

short cycle frequency required to immunize 3-month cohorts (9-11 months for measles), and 3) the relatively small number of target-age individuals available at a given site eligible for vaccination. Mobile teams are now primarily used to control epidemics (e.g., meningitis and yellow fever) and to reach remote populations such as nomads.

Fixed Scheduled Immunization

As countries assessed alternative strategies necessary to achieve EPI coverage and disease reduction targets, high priority was given to establishing immunization as a routine service at fixed health facilities. In most African settings, a daily schedule was adopted that provided different services on different days (e.g., infant welfare on one day and antenatal care on another). Although the genesis of this approach is not clear, possibly an adaptation of a developed world practice, the fixed scheduled strategy was not convenient to those in need of services. For a pregnant African mother with a 13-month-old infant eligible for measles vaccination and a 3-year-old child sick with diarrhea, the fixed schedule strategy necessitated three separate visits in a week, often requiring foot travel of 1 hour or more in each direction. This strategy resulted in high rates of missed opportunities for immunization (see section on Missed Opportunities. Chapter 7, p 69).

Fixed with Daily Vaccination

When exit interviews documented high rates of missed opportunities (visits to a health facility where vaccine was available and was not given), WHO recommended to countries that vaccinations be administered on a daily basis. Specifically, they recommended that all target-age persons (infants and fertile-aged women) attending health facilities for either preventive or curative services be screened regarding immunization status and, if eligible, be vaccinated immediately. Such strategies have been shown to increase coverage and reduce the risk of nosocomial disease transmission. There are two main obstacles to the implementation of daily vaccination: 1) vaccine wastage, and 2) staff resistance. Although daily vaccination and "opening a vial of vaccine for just one child" are consistent with WHO global guidelines, increased vaccine wastage and the costs of vaccine procurement are cited as the main obstacles to daily vaccination. Second, health staff are reluctant to change their practices and take on daily integrated services. Whereas daily integration takes a period of adjustment for both clients and health staff, integrated services have been found to be acceptable, effective, and efficient. CCCD has had limited success in expanding immunization to a full range of preventive contacts, but has been less successful in making immunization a routine part of curative services.

Fixed Facilities with Outreach

Outreach immunizations involve the movement of fixed facility staff on foot, bicycle, motorcycle, or vehicles to population groups (e.g., rural villages, urban slums) who have no ready access to vaccination at a fixed facility. Frequency of visits depends on the size of the population without access to a fixed facility. Visits are usually once a month or once a quarter. Effectiveness (coverage and sustainability) of outreach immunization sessions is dependent on a number of factors including: 1) the regularity of services (do health staff fulfill their commitments and show up as scheduled?), 2) the quality of services, and 3) the degree to which the community is involved in plan-

ning, publicizing, implementing, and monitoring outreach activities.

Campaigns

Vaccination campaigns are special annual or semiannual events in which political, non-health sector, health, and community resources are mobilized to provide special immunization days or weeks. Donor-provided supplemental resources are frequently required. Among the CCCD countries, three campaign strategies were used: 1) national vaccination days (e.g., Côte d'Ivoire, Togo), 2) local vaccination days (e.g., Nigeria), and 3) national vaccination weeks (Liberia). Vaccination campaigns are usually media events in which the president and political leaders mobilize to support immunization, often in response to a personal visit of the Executive Director of UNICEF. These campaigns usually consist of three vaccination events spaced 1 month apart. Where campaigns have adequate logistic support, increases in coverage are frequently dramatic. As can be seen in the graph from Côte d'Ivoire, campaigns are effective in achieving increases in coverage; usually, however, the increases in coverage are short-lived (figure 6.1).

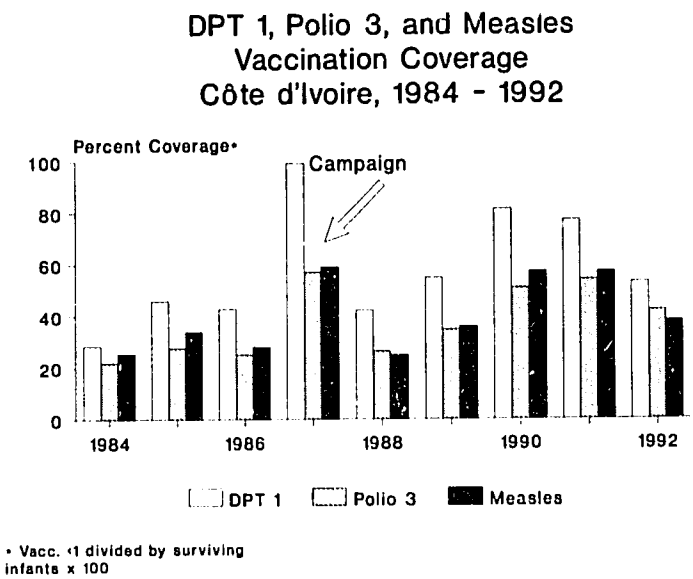


Figure 6.1

The vaccination day strategy was effective in increasing the public awareness of the benefits of immunization, of establishing immunization as a right rather than as a privilege, and in increasing coverage. On the negative side was the administration of large amounts of vaccine to older non-target age persons and a slip in quality. In Nigeria, Bryce documented problems in both cold chain and sterilization (Bryce 1990).

Perhaps the most important campaign innovation in a CCCD participating country was Liberia, which carried out annual vaccination weeks for 5 consecutive years. These campaigns were timed epidemiologically to take place during November, prior to the expected annual increases in measles. In Liberia, where access to fixed facilities was probably around 20%, vaccination coverage rates of 50% to 60% were obtained. The Liberian campaign strategy was especially notable because the planning and much of the support was done at the county level. An estimated two-thirds of rural vaccinations were provided through vaccination week activities. Unfortunately the EPI system in Liberia was destroyed by civil war in 1989.

Selection of Strategies

None of the above strategies is good or bad. Experience in CCCD showed that the selection of strategies needs to be tailored to the local situation and to the target population's access to fixed facilities with vaccine delivery capability. In areas where the population has good access to health facilities with quality services, high rates of coverage and disease reduction can be obtained and sustained with a fixed facility strategy (e.g., Burundi, Lesotho, Togo). In areas where access is low, outreach or campaigns are needed to achieve and maintain high levels of coverage in the population (e.g., Liberia, Nigeria).

Logistics

Although a good logistics system does not guarantee EPI success, the absence of good logistics guarantees failure. Critical issues include vaccines, cold chain, sterilization equipment, supplies, vaccination cards, and transport.

Vaccines

During the 12 years of CCCD, vaccine supplies were, in general, sufficient. With the exceptions of Nigeria and Côte d'Ivoire, which purchased most of their vaccines, most vaccines were provided by UNICEF (BCG-all, DPT-all, TT-all, measles-some, OPV-some), A.I.D. (measles), and Rotary International (OPV). Shortages or excess supplies (expired vaccine) resulted from management problems related to poor planning or lack of a good vaccine inventory system. The large number of doses required for national vaccination days also stressed the supply system. The development in Nigeria of a computerized vaccine inventory system that not only tracks inventory by lot and expiration date but also ties the filling of requests to actual usage has the potential to increase the efficiency of vaccine use. Such a system eliminates the traditional practice of inflating vaccine requests knowing that the issuing authority will arbitrarily cut the request. This system, developed by REACH, Management Sciences for Health and CCCD, is being adapted by WHO for global use.

Although vaccine supply was not a major issue in the 1980s, it is becoming a major issue in the 1990s.

Table 6.5

Collaboration in Cold Chain Implementation	
Agency	**Contributions**
WHO	Development of Standards Testing of Equipment Provision of Information Development of Training Materials Training
UNICEF	Development and Testing of Equipment Central Procurement Distribution Training
Bilaterals NGOs	Funding Training
Countries	Needs Assessments Allocation Distribution Training Supervision

Cold Chain

Improvements in the cold chain were one of the major successes of EPI in the 1980s. This sucess reflects the exemplary collaboration of international agencies, bilateral agencies, PVOs, and national governments, as outlined in the table 6.5.

Improvements in cold chain equipment, training, and supervision in CCCD countries were impressive. Although the baseline data are subjective, it is estimated that the percentage of injections meeting cold chain standards increased from 20% at the beginning of the project to 80% or better at the end of the project. The cold chain needs of each level in the system were defined, equipment was procured usually through UNICEF, and staff were trained in appropriate use. Listed in the table 6.6 are cold chain equipment that were used at each level. Equipment needs were determined in part by the strategy of vaccine delivery.

Appropriate equipment will not, in itself, ensure an effective cold chain. Based on 10 years of CCCD experience, the following factors contributed to cold chain improvements.

- Appropriate equipment
- Hands-on training
- Thermometer in each refrigerator
- One individual assigned responsibility for cold chain management
- Chart on wall where temperature is recorded 1-2 times per day
- Supervisor who checks at least monthly to be sure that cold chain met standards and that temperature recorded reflected that on thermometer (*In a number of facilities, workers were found to be recording expected rather than observed temperature*)

Global experience led to a number of problem-solving refinements that improved the cold chain, e.g., storing DPT and TT on lower shelves to prevent freezing, storing vaccine being used at a clinic in a vaccine carrier rather than opening the

Table 6.6

Cold Chain Equipment Used in CCCD Countries		
Level	**Type of Equipment**	**Duration of Maximum Storage**
Outreach	Vaccine carrier	24 hours
Vaccination Post	Cold box	7 days
Health Center with Outreach	Refrigerator (kerosene, gas, solar) plus Vaccine Carriers	1 month
District	Refrigerator (top opening - ice lined) Freezer - (ice lined) Generator	2 months
State	Ice-lined refrigerators Ice-lined freezers Ice-pack freezers Generator	3 months
National	Cold room refrigerator Cold room freezer Ice pack freezer Back-up generator	6 months

refrigerator for each vial, and storing vaccine being used on a frozen ice pack.

Sterilization

CCCD made a major contribution to the global EPI by conducting one of the studies that documented, on a multi-country basis, major problems in sterilization practices. Observational data collected from nine countries documented non-compliance with the policy of a sterile needle and sterile syringe for each injection. Although the method of sampling and the number of observations per country were not standard, the aggregated data documented a serious and dangerous problem especially for a continent where hepatitis B and HIV were endemic, (figure 6.2).

With leadership from WHO and logistic support from UNICEF, several steps were taken to improve the quality of sterilization:

- Identification of sterile needle and sterile syringe as a program priority
- Development of a steam sterilizer by WHO and UNICEF
- Training in sterilizer use and sterile technique
- Supervisory monitoring of technique

As described in the section on training, there were marked improvements in sterilization practices.

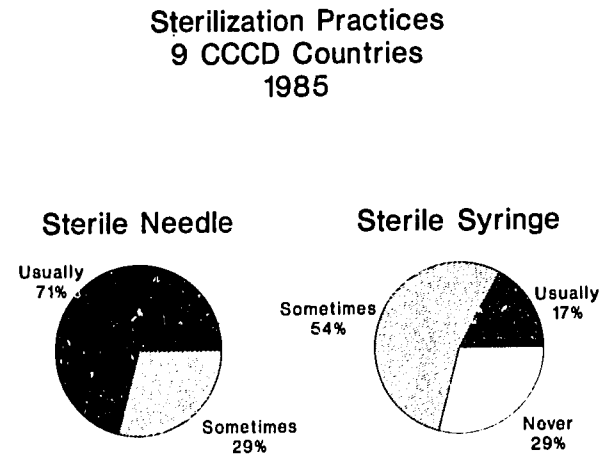


Figure 6.2

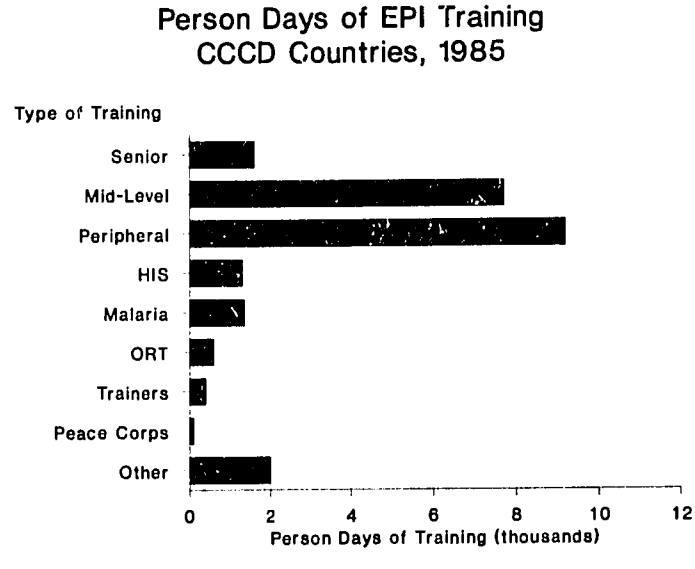


Figure 6.3

Training

Training Courses

Initial CCCD EPI training used Senior Level Management and Mid-Level Supervisory modular training courses developed by WHO. These 1- and 2-week courses were generally held at training facilities or hotels. Such courses were funded regionally through WHO and directly at the country levels. Two modules, both of which involved hands on experience (Cold Chain and Coverage Surveys), were judged most effective in improving skills and performance.

CCCD along with UNICEF, Save the Children Fund (UK), and Rotary International also contributed in supporting (through WHO AFRO) language specific (anglophone and francophone) EPI Managers meetings. These meetings were effective in sharing experiences, identifying problems, and facilitating development of country level work plans.

CCCD Training

The CCCD project paper called for the training of 4,800 senior and mid-level personnel and 15,000 peripheral level health workers. From 1982 to 1985, training was primarily in the form of 1- or 2-week courses using WHO or locally adapted WHO modules. Such modules, interactive in format, were major improvements over the traditional didactic approach. Annually, CCCD reported on training inputs in terms of person-days of training. As can be seen in the graph from the 1985 annual report, more than 20,000 person days of training were reported (figure 6.3).

In 1985, CCCD's priority for training shifted emphasis from the amount of training done to the quality of work performed. This was one of CCCD's most important contributions to child survival in Africa. Training inputs were shifted from

sponsoring discrete courses to on-site assessments of performance and the use of assessment data to focus training on correcting identified problems in performance.

Facility Assessments

CCCD developed a facility assessment methodology in which a random sample of facilities is selected and visited. At each facility four aspects of EPI performance are evaluated: 1) the availability of supplies and equipment (cold chain and sterilization equipment), 2) the ability of health workers to screen and immunize children and women according to WHO and Ministry of Health standards, 3) the keeping of records, 4) the ability to communicate important health education messages to child caretakers. Complete needs assessments used a variety of techniques including observation of health workers, record reviews, and exit interviews with care takers. Studies were initially done in Niger State, Nigeria, and eventually in a total of eight countries. Results of eight country needs assessments are summarized in figure 6.4.

As can be seen in figure 6.4, many of the mechanics of immunization were relatively well performed (e.g., vaccine administration). However, health education, especially in terms of mother's knowledge of whether and when to return was poor. Approximately 40% of mothers were leaving the clinic without this essential knowledge.

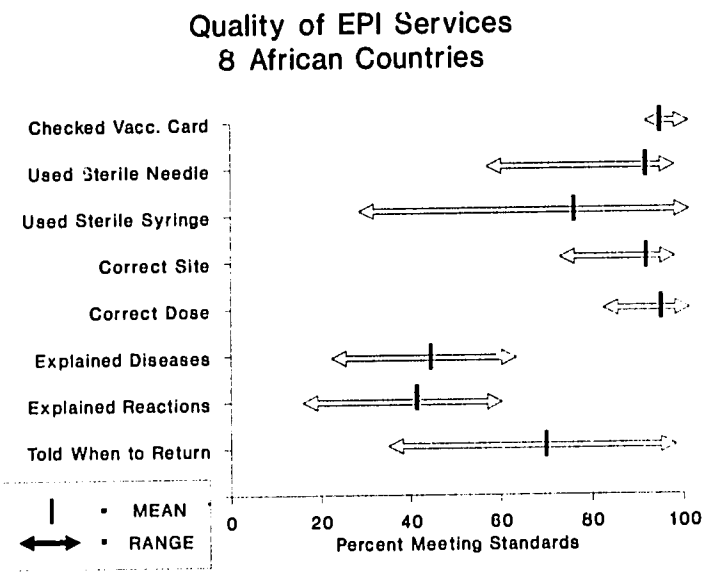


Figure 6.4

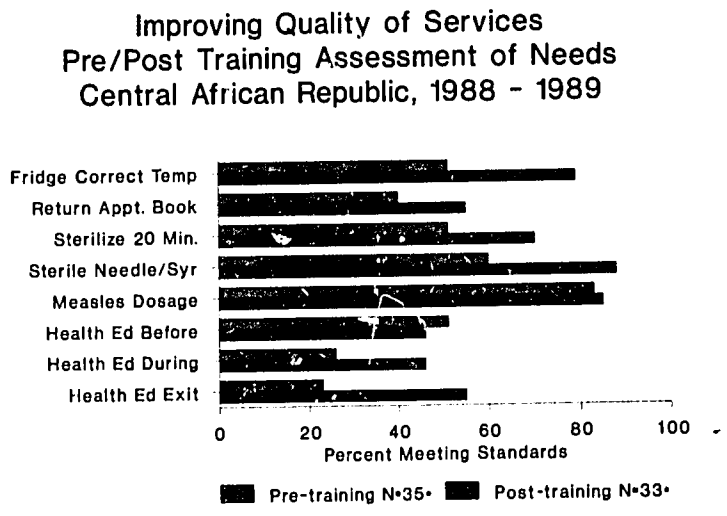


Figure 6.5

Continuing Education

Training approaches shifted to decentralized skills-building training activities based on needs assessments. In Lesotho, a trainer was designated for each Health Service Area (HSA). An annual continuing education workshop was held for HSA trainers who, in turn, planned and conducted training in their HSA and provided supervisory follow-up. In Nigeria, State Continuing Education Units (CEU) were established to train Local Government Area (LGA) supervisors as trainers for their areas. The CEU staff liaised with other sectors to resolve non-training needs that were identified (drug supplies, equipment, etc.). In the Central African Republic, regional supervisors were given the responsibility to: 1) assess quality in a sample of facilities, 2) design training strategies to address identified performance problems, and 3) carry out a follow-up needs assessment at the end of the year. This strategy was effective in improving the quality of immunization, (figure 6.5).

In focusing on performance problems, it became apparent that all problems were not correctable by training. Where performance problems were identified, supervisors needed the skills to assess the cause and to identify appropriate solutions. The table on the next page summarizes the range of causes and solutions for performance problems (table 6.7).

The table emphasizes two things: 1) problems have different causes and require different solutions, and 2) performance problems cannot always be solved by training.

Health Information Systems (HIS)

The upgrading of HISs was also a major contribution of CCCD to the EPI in participating countries. It provided the framework by which progress toward coverage and disease-

reduction targets could be measured. At the start of CCCD, almost all countries were using manual pencil and paper information systems. Reporting was incomplete, collation was delayed (frequently years), and feedback, in general, was nonexistent.

Inputs into the HIS in each country included most of the following:

- Assessment of information needs
- Assessment of the current system (what is reported, channel of reporting, completeness, timeliness, use)
- Assessment of the system of data collation, analysis, feedback, and use
- Development of an HIS plan
- Assessment of data processing needs
- Provision of hardware and software
- Training of staff
- Epidemiologic consultation in analysis
- Financial support for production of feedback bulletins

WHO guidelines were used in identifying data needs for managing the EPI and included:

- Population, fertility, birth, and infant mortality data
- Temperature of refrigerator
- Vaccine inventory by lot, number of vials, and date of expiration
- Number of doses of each antigen administered (BCG, DPT, OPV, and measles) by dose and by age (<1 and >1)
- Number of doses of TT given to pregnant and fertile-aged women by dose
- Vaccination coverage by administrative method and survey
- Outpatient diagnoses of EPI diseases (measles, pertussis, polio)
- Inpatient diagnoses of NNT and measles, by age, and number of deaths, by age
- Epidemiologic surveys for incidence and prevalence
- Outbreak investigations to assess vaccine efficacy and epidemiologic profile of cases in the community

Monitoring Achievement of Targets

Perhaps the single most important element in EPI implementation is the setting and monitoring of targets and the use of the results in replanning and program modification. CCCD has provided national, continental, and global leadership in EPI monitoring (table 6.8).

Progress of African countries receiving CCCD assistance in monitoring is described below.

Coverage

Coverage is defined as the percentage of those in need of a service, in this case immunization, who actually receive that service. In the EPI, coverage is estimated using two methods.

- *Administrative Method:* Vaccinations reported administered to children in the first year of life are divided by the estimated number of children surviving to age 1 and multiplied by 100 to provide a percentage estimate of coverage.

Table 6.7

Types, Cause, and Solution to Performance Problems

Problem	Cause(s)	Solution(s)
Shortage of vaccine	Inadequate supply	Supply more vaccine
	Poor planning	Training in vaccine inventory control
Non-sterile needle	Lack of sterilizer Inadequate numbers of syringes and needles	Provide equipment and supplies
	Lack of knowledge of reasons for sterilization	Training
	Lack of fuel	Cost recovery
Poor health education	"Too much work"	Support and supervision
	Lack of knowledge of importance or methods	Training
	"Require too much time" "Mothers don't understand"	Focus group discussion with health workers

Table 6.8

Evolution of Monitoring Targets		
Year	**Target**	**Method**
1982	Coverage	Surveys
1985	Coverage	Administrative (Vacc <1 divided by pop<1 X100)
1982	Disease incidence	Surveys (Lameness and neonatal tetanus)
1986	Disease incidence	Surveillance
1986	Quality of performance	Survey Supervision
1988	Impact on mortality	Mortality and use of health services surveys

- *Survey Method:* Coverage in 12 to 23-month-old children is determined using the WHO 30 cluster sample methodology of 210 children (WHO 1988). In the early years of the program, coverage was expressed as the percentage of 12 to 23-month-old children having a date of vaccination recorded on their Road-to-Health Immunization Card or a history of vaccination (e.g., received oral drops [OPV] three times). Development of a computerized analysis package (COSAS) by WHO, Epicentre, and REACH facilitated a more sophisticated analysis of survey data including the age and interval appropriateness of recorded immunizations. More specifically, data were provided on the age-specific acquisition of immunization and on percent coverage at 12 months of age. The 12-month coverage excluded doses administered in the second year of life, more accurately assessed the program goal of vaccination in the first year of life, and provided estimates lower than obtained when vaccinations received after age 1 were counted. Furthermore, COSAS provided managers with other important indicators of program performance including the drop-out rate and the proportion of doses that were not administered in accordance with EPI policy.

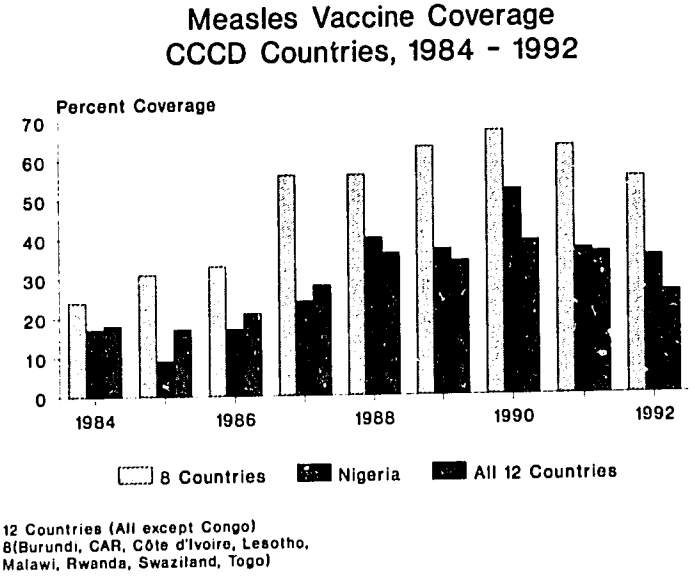


Figure 6.6

Figure 6.6 summarizes overall coverage for CCCD countries for the period 1984 to 1992. Overall coverage increases were gradual and sustained. The fall-off in 1992 relates in part to program collapse due to civil disturbances in Liberia, and Zaire, Rwanda, and Togo. Decreases also reflect a decline in the donor support that was provided to countries in their efforts to achieve UCI in 1990.

Figure 6.7 summarizes CCCD countries measles coverage data for the years 1984, 1990, and 1992. Three broad interpretations can be made from this data: 1) during the period 1984-1990, measles vaccine coverage increased in all countries, 2) increases in coverage were greater in smaller countries where there was a reasonably good distribution of health facilities, and 3) at higher levels of coverage, further increases in coverage became more difficult.

Coverage levels achieved, although less than the targeted 80%, were significant. These reflect the effective collaboration of communities, national health staff (at all levels), NGOs, and bilateral and international technical assistance partners. Sustaining and increasing coverage are a continuing challenges for all involved in child health in Africa. Initially, countries relied on expensive, frequently externally funded, coverage surveys. As information systems developed, reliance was placed on administrative method coverage estimates. Use of coverage surveys has decreased to

every second or third year, primarily as an assessment of quality, e.g., apropriate age and interval of vaccination.

Disease Incidence

During the 1980s, EPI implementation and evaluation focused on achieving coverage targets. UCI, defined as 80% coverage globally and 75% in Africa, was the acknowledged goal and the standard by which all countries and UNICEF offices were judged. High coverage, however, does not ensure disease prevention for a number of reasons including:

- Impotent vaccine
- Administration of vaccine to a child immune because of maternal or disease-acquired antibody
- Incorrect vaccine administration (dose, site, or interdose interval)
- Failure of biologic response to an appropriate dose at a correct site
- Low coverage in high-risk groups

CCCD contributed to a shift in focus to disease control in Africa. Program factors that contributed to this emphasis included:

- EPI disease reduction targets were an essential component of the project from the beginning (Project Paper Logical Framework, 1981).
- The strengthening of HISs (see above) provided a system by which to assess disease incidence, disease trends, and disease impact.
- Disease surveillance and control was allocated a high priority as a program management tool.
- Field and headquarters epidemiologic talent was allocated to disease surveillance.
- Outbreak investigation and control were found by ministries of health to be highly useful.

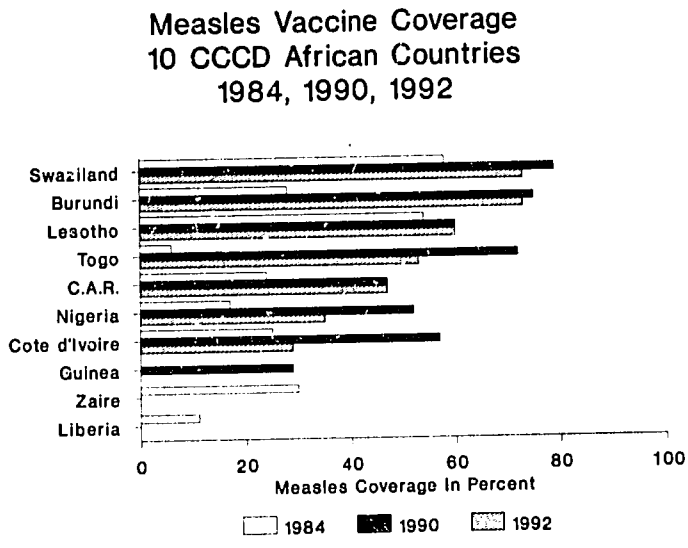


Figure 6.7

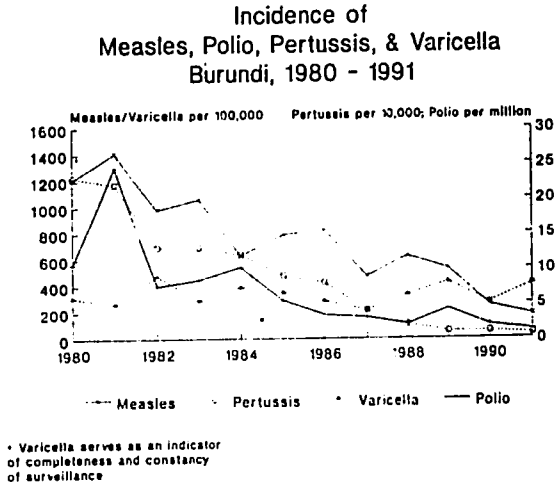


Figure 6.8

Figure 6.8 presents data on three EPI diseases for Burundi (pertussis, measles, and poliomyelitis). The availability of chicken pox (varicella) incidence provides an indicator of the sensitivity of the surveillance system. The relatively flat to slightly increasing trend for varicella incidence indicates a relative constancy of disease reporting and gives added credibility to the reported decreases in disease incidence.

Assessments of national information systems identified four countries (Burundi, Lesotho, Swaziland, and Togo) with HISs for which trend data could be reliably followed for most of the period of CCCD (1981-1993). Measles incidence rates declined in all four countries (figure 6.9).

As EPIs in Africa mature, outbreaks can be expected to occur among groups of accumulated susceptibles. As will be described in Chapter 7, an investigation of an outbreak of measles in Muyinga District Burundi identified 357 measles cases in a house-to-house survey of a 5-hill area and a 58% card-documented measles vaccine coverage in children 9 months through 5 years of age (Chen 1993). Vaccine efficacy was in the expected range (73%). The outbreak was attributed to the accumulation of unimmunized susceptibles and nonresponders to vaccine.

Conclusion

During the 1980s, African countries increased their capacity to plan, implement, and monitor immunization programs. Vaccine coverage increased and disease incidence decreased. As illustrated in the case study of Togo (Chapter 4), progress was dependent on attention to the fundamentals, the key elements of which have been described in this chapter.

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Chen RT, Weierbach R, Bisoffi Z, Cutts F, Rhodes P, Ramaroson S, Ntembagara C, Bizimana F. A "post-honey moon period" measles outbreak in Muyinga Sector, Burundi. Int J Epidemiol (in press).

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Decreasing Measles Incidence
Burundi, Lesotho, Togo, Swaziland

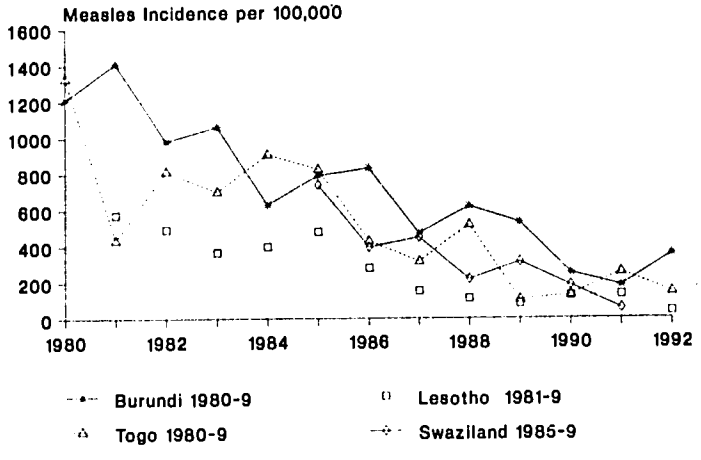


Figure 6.9

Chapter 7
Strengthening Programs and Disease Control through Applied Epidemiologic Research

Examples from the CCCD Project

Measles Control in a Large African City

Investigators

Cutts FT, Othepa O, Vernon AA, Nyandu B, Markowitz LE, Deforest A, Wilkins K, Okwo B

Purpose

In 1988, in collaboration with the CCCD project, UNICEF, and the Belgian Cooperation, Zaire's Ministry of Health initiated a project to improve measles control in Kinshasa. Little decrease in the incidence of measles at sentinel sites and little change in measles vaccination coverage had occurred since the early 1980s (figures 7.1-7.2).

One obstacle to further progress was that a large proportion of reported cases occurred in children less than 9 months of age, the age at which measles vaccination was given (figure 7.3).

A demonstration project was planned that included strategies to increase coverage and a change in the vaccination schedule.

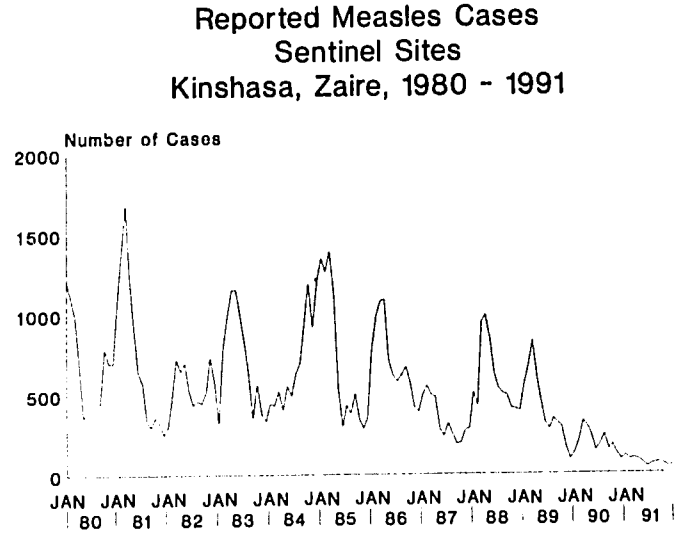


Figure 7.1

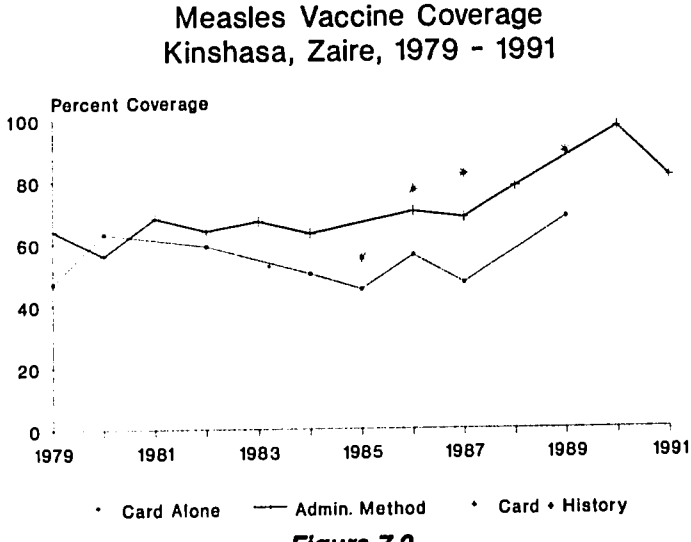


Figure 7.2

Methods and Results

Increasing coverage: Strategies included implementation of the policy of vaccinating eligible children at all health facility contacts, increasing outreach activities in the zones of the city with the lowest measles vaccination coverage, and strengthening supervision and in-service training. Health zones with low coverage were identified through estimates of coverage based on vaccine doses administered and by lot quality assurance sampling. To strengthen supervision and in-service training, a medical officer and four mid-level health assistants were assigned to work with the Kinshasa EPI manager, and a vehicle was assigned full time to the project.

Vaccination with Edmonston-Zagreb (EZ) measles vaccine: To decrease the incidence rate of measles in children younger than 9 months of age, the measles vaccination schedule was changed from Schwarz vaccine at 9 months of age to medium-titer EZ measles vaccine (approximately 4.5 log10 plaque-forming units per dose) at 6 months of age. EZ vaccine of this potency had been shown in other studies to provide seroconversion rates at 6 months of age that were comparable to those obtained with Schwarz vaccine at 9 months of age. Furthermore, a previous study in Kinshasa had shown that 90% of infants lose maternal antibody by 6 months of age (Okwo Bele, unpublished data, 1987), increasing the likelihood that measles vaccination at this age would be effective.

Other vaccination schedules considered were a two-dose schedule using Schwarz vaccine (at 6 and 9 months of age) and continuing with a single dose of Schwarz vaccine at 9 months of age, with all resources focused on increasing coverage. The two-dose schedule was rejected for three reasons: the need for more resources, concerns about the immunogenicity of Schwarz vaccine at 6 months of age, and the possibility of a drop in coverage from the first dose of measles vaccine to the second. Continuing with a single dose of Schwarz vaccine at 9 months of age was considered unacceptable because of the high proportion of measles cases younger than 9 months of age, who also experience the highest case-fatality ratio.

EZ vaccine at 6 months of age was introduced throughout Kinshasa in September 1989, and all Schwarz vaccine was recalled. Mothers were informed of the change in schedule through parish newsletters and when they brought their children to health centers for DPT and oral polio vaccine.

Effect on coverage: In 1990, a vaccination coverage and measles seroprevalence survey was conducted among children 9 to 18 months of age to evaluate EZ measles coverage among children in the 1989 birth cohort. Card-documented coverage with EZ vaccine was 68% at age 5.5 months or older. According to their mothers' oral histories, 17% of children had received measles vaccine, but had no documentation. However, the presence of measles antibodies was similar among children with card-documented coverage (74%) and with a verbal history of measles vaccination only (75%), corroborating the accuracy of verbal histories. If these histories are valid and vaccination prior to 5.5 months of age is included, coverage was 89%. This result, as well as other measures of coverage, indicated that the measures taken to increase coverage had been successful (figure 7.2).

Also, vaccination using the new schedule was timely: of 204 children with documented measles vaccination at or after 5.5 months of age, 171 (84%) received the vaccine before age 7 months.

Impact on measles incidence: There was a sustained drop in the number of reported measles cases from sentinel sites in all age groups after the onset of the demonstration project (figures 7.1-7.4), from 7,080 in 1988 to 616 in 1991. This drop corresponds to a 93% decrease in reported rates of reported measles cases, from 21.9/10,000 persons in 1988, to 1.6/10,000 persons in 1991. It is unlikely this drop was due to decreased use of sentinel health facilities or to incomplete reporting by sentinel health facilities, since there was no downward trend in two other major childhood diseases, malaria and diarrhea (figure 7.4).

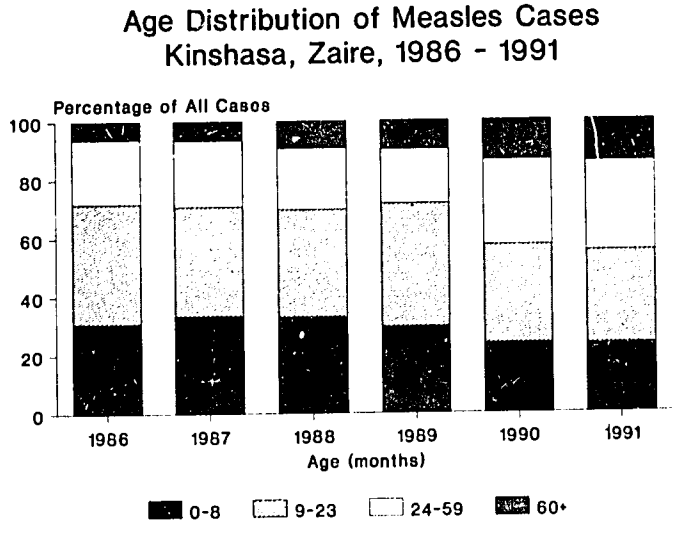


Figure 7.3

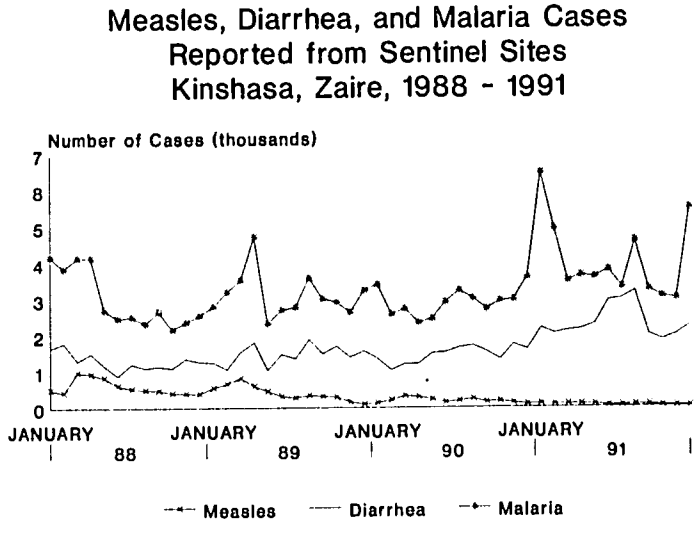


Figure 7.4

Conclusions and Future Directions

The demonstration project in Kinshasa shows the feasibility of achieving major impact on measles incidence with the existing EPI infrastructure, in a manner designed to increase coverage for all antigens and improve the quality of EPI services. Determining how much of the reduction in measles incidence was due to the introduction of EZ vaccine at 6 months of age and how much can be attributed to the increase in vaccination coverage is difficult. However, the project has shown that these strategies, introduced simultaneously, are effective.

The period of low measles incidence since 1989 may be interrupted by outbreaks, especially among older children who have passed the vaccination target age without being vaccinated or vaccinated effectively. In this case, the Ministry of Health will confront a new period in measles control similar to that faced in well-vaccinated rural populations (see data from Burundi and Lesotho, below) in which measles appears mainly in outbreaks affecting susceptible older children.

Although WHO does not currently recommend a 1-dose measles arecination schedule with vaccination at 6 months of age, a 2-dose schedule of Schwarz vaccine (6 months and 9 months) can be used to protect children at this age. Additional trials like the one in Kinshasa, which focus on coverage and early protection, can demonstrate how to achieve greater control of measles in other urban areas.

Measles Control in a Well-vaccinated Rural Population

Investigators

Chen RT, Weierbach R, Bisoffi Z, Cutts F, Rhodes P, Ramaroson S, Ntembagara C, Bizimana F (1)

Purpose

The Expanded Programme on Immunization in Burundi has made substantial progress since its establishment in 1979. The incidence rate of reported measles cases dropped from 12.1 cases per 1000 persons in 1980 to 1.9 cases per 1000 persons in 1991, while measles vaccination coverage in children reaching their first birthday increased steadily from 11% in 1980 to 79% in 1991 (see Burundi EPI summary, Chapter 5). Outside the capital, Bujumbura, Burundi's population is almost exclusively rural.

Despite this success, concerns arose about the program's continued effectiveness when a measles epidemic occurred in northeast Burundi in 1988. An investigation of the outbreak was conducted to address these concerns and to assist in identifying strategies for increased measles control. The investigation was conducted in Muyinga Health Sector, the area most severely affected by the epidemic.

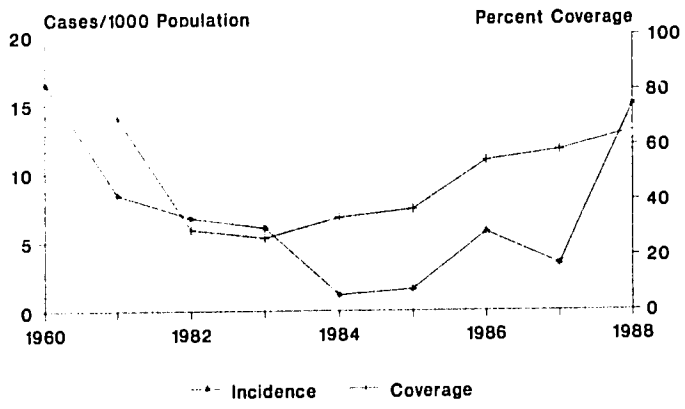


Figure 7.5

The acceleration of vaccination activities in Muyinga began with a mass immunization campaign in 1981. Estimated measles vaccination coverage in children at the time of their first birthday dropped the following year, then climbed to 65% by 1988. The incidence rate of measles dropped from 16.7 cases per 1000 persons in 1980 to a low of 1.1 cases per 1000 persons in 1984. The incidence rate was 3.4 cases per 1000 persons in 1987, the year before the epidemic (figure 7.5).

Methods and Results

Case ascertainment: Measles incidence and vaccination coverage rates in Muyinga were based on routine reporting from health facilities of the number of measles cases seen, the reported number of measles vaccinations given to children under one year of age, and census population projections.

In all, 4,867 measles cases were reported by health facilities in the Muyinga Health Sector in 1988, for an incidence rate of 14.9 cases per 1000 persons. This rate was 4.4 times higher than the incidence rate in 1987 and 13.0 times higher than the incidence rate in 1984.

The age distribution of reported cases, available since 1985, showed that children 24 months and older constituted an increasingly large proportion of cases, reaching 57% in 1988 (figure 7.6).

Investigation at a primary school: A primary school was visited, and children who had measles were identified by teachers' recall and absentee records.

Census of children less than 5 years of age: A census of children who were less than 5 years of age at the beginning of the outbreak was conducted in January 1989 in the five "hills" (administrative population units) in the sector that had the highest reported measles incidence. Interviewers asked parents of these children whether the children had measles during the epidemic, what their symptoms were, and if they died during the epidemic. Interviewers also determined whether the children had been vaccinated against measles according to their vaccination cards. Children without a card were considered to be unvaccinated. Interviewers returned to the same households in September 1989 to assess the survival of children found during the January census.

Census results: Information was obtained on 1,899 children, 357 (19%) of whom had measles during the outbreak according to their caretakers. The incidence rate was highest for 9- to 11-month olds (7.6 cases per 100 person-months) and declined in older age groups (table 7.1). Children younger than the recommended age for measles vaccination (9 months) constituted 18% of cases, and children older than 23 months accounted for 45%.

In all, 1,442 (76%) children had vaccination cards. Of the 1,670 children older than 9 months of age, 976 (58%) had card documentation of measles vaccination. The efficacy of measles vaccination in preventing measles was 73% in an analysis that controlled for potential bias by excluding children without vaccination cards, children not meeting the clinical case definition, and children younger than 9 months of age.

Table 7.1

Frequency and incidence rate of measles by age group, Muyinga Health Sector, Burundi, 1988-1989

Age* (months)	Measles No.	Measles %	Person-months at risk	Incidence rate per 100 person-months
0-5	18	5	1,825	1.0
6-8	46	13	917	5.0
9-11	49	14	645	7.6
12-23	85	24	2,438	3.5
24-35	69	19	2,497	2.8
36-59	90	25	5,420	1.7
Total	357	100	13,722	2.6

* Person-months at risk in each age group were calculated for July 1988-January 1989.

The case fatality ratio for children identified by their caretakers as having had measles during the epidemic was 6.2% (22/357). In an analysis comparing deaths per 1,000 person-months of observation, children with measles were 2.5 times more likely to die than those who did not have measles.

Measles in primary school children and their younger siblings: Among the 299 students in the primary school that was visited, 28 (9%) were reported to have had measles. Among students with measles, 25 (89%) reported that they were the first case in their household, and in these households, 31 subsequent cases occurred in younger siblings.

Conclusions

The estimated measles vaccine efficacy during the outbreak was only slightly less than expected in field use at 9 months of age. Investigators concluded that:

a) The several-year period of relatively good measles control was the result of high coverage with a vaccine that was only slightly less effective than expected.

b) Unvaccinated children and children who were not protected by vaccination accumulated in number until their density was sufficient to sustain the epidemic.

c) The outbreak was an expected occurrence consistent with major long-term impact on disease.

d) The transmission of measles in primary school, with subsequent transmission to younger siblings, contributed to the spread of disease during the epidemic.

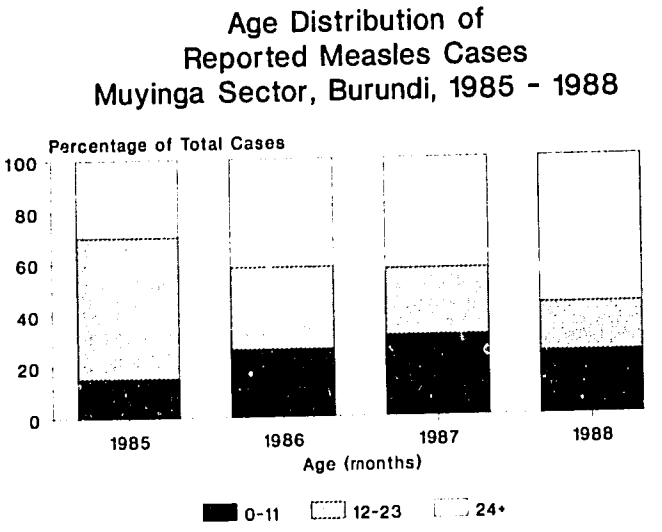


Figure 7.6

Future Directions

The following measures were discussed as possible means to avoid or reduce outbreaks in the future: one-time immunization of older unvaccinated children, vaccinating unvaccinated children at school entry, and vaccinating all children at school entry. To date, Burundi has chosen to continue focusing its resources on the vaccination of children younger than one year of age.

The emergence of measles as an epidemic disease after being greatly reduced as an endemic disease is an increasingly frequent occurrence in rural areas of Africa, where high vaccination coverage has been achieved with measles vaccine by one year of age. Ministries of health should anticipate this changing epi-

demiologic profile and understand that it does not represent a program failure. The general features of such outbreaks can be understood by reviewing investigations conducted in other countries. However, countries should still investigate outbreaks occurring within their borders. Such investigations provide a detailed understanding of the current epidemiologic profile of measles, and since this profile changes as programs progress, it may not be accurately described by such outbreak investigations in other countries. Also, such investigations are necessary for nationally valid estimates of vaccine efficacy.

References

1) Chen RT, Weierbach R, Bisoffi Z, Cutts F, Rhodes P, Ramaroson S, Ntembagara C, Bizimana F. A "post-honeymoon period" measles outbreak in Muyinga Sector, Burundi. Int J Epidemiol (in press).

Development of a Two-Dose Measles Strategy in Lesotho

Investigators

Nkuebe M, Foster S, Gittleman D

Purpose

At the initiation of CCCD activities in Lesotho, the EPI was well developed. The central team was responsible for planning, logistics, supervision, and coordination. Implementation was decentralized to the Health Service Area (HSA) level. Information from the CCCD-strengthened Health Information System (HIS) showed increasing levels of measles vaccine coverage and decreasing rates of measles incidence as well as a shift in the age distribution of measles cases to children 5 years of age and older (figures 7.7-7.8).

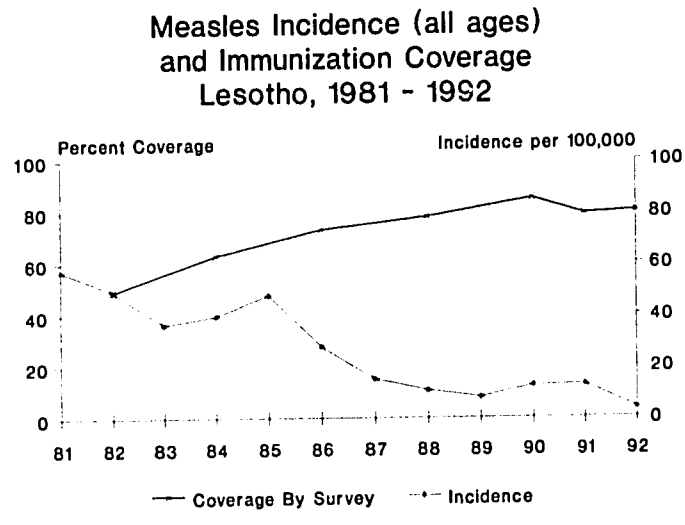
In view of the changing epidemiology of measles in Lesotho, the Ministry of Health convened a working group to identify the most cost-effective strategy option for continued progress in controlling measles.

Methods and Results

Six strategy options were considered (table 7.2). For each of the six options, cases prevented and cases not prevented were estimated.

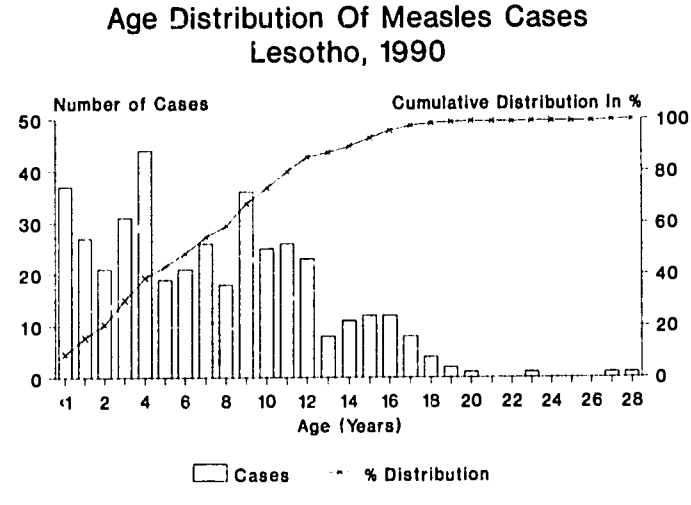
To attain maximal measles control, the Ministry of Health recommended that Strategy 6 be implemented at the HSA level. In practice, Strategy 6 was implemented mainly in HSA's where measles outbreaks occurred, while strategy 5 was implemented elsewhere. To further justify the need for an added dose of measles vaccine at school entry, a serosurvey of school enterers was conducted in 1990. The survey showed that 13.6% of these children were seronegative for measles, a level consistent with the observed epidemiology and a level sufficient to continue the 2-dose strategy.

When vaccination at primary schools proved difficult to sustain because of staff constraints and the difficulties of working in remote mountainous areas, Strategy 4 was adopted, in which a second dose of measles vaccine was administered simultaneously with a DT booster at 18 months of age. As shown in figure 7.7, the measles incidence rate has remained low.



Coverage By Survey: Children 12-23 mos.
Source: MOH Health Information System

Figure 7.7



415 Cases Reported through the Notifiable Disease Reporting System
Source: MOH Health Information System

Figure 7.8

Conclusions and Future Directions

The Lesotho EPI is a mature program with a record of good management, high coverage, and disease reduction. It is a good example of a program using epidemiologic data to develop national strategies. School vaccination was a useful first step in responding to the school outbreaks. The current 2-dose schedule is more sustainable and can be expected to strengthen measles control if coverage is maintained.

Table 7.2

Estimated measles cases prevented and not prevented by six measles control stratagies during the first year of implementation, Lesotho

Strategy options (1)	Doses (not including wastage)	Cases prevented (2)	Expected Measles cases (3)	Doses to prevented one case
1) One dose 9-11 months	40,000	32,000	10,400	1.25
2) One dose and increased emphasis on reducing missed opportunites at 9-11 months	45,000	36,000	10,100	1.25
3) Intensive catch-up vaccination in high risk areas at 9-23 months	56,000	43,520	9.500	1.29
4) One dose at 9-11 months Second dose at 15-27 months	80,000	44,160	9,500	1.81
5) One dose at 9-11 months Second dose at school entry	72,000	42,791	9,600	1.68
6) One dose at 9-11 months Vaccination of all primary school children	200,000	81,274	6,500	2.46

(1) All six strategies assume routine vaccination of 9-11 month infants with a coverage of 80% and an efficacy of 80%

(2) Cases prevented are cases that would occur overtime (by 10 years of age) among the vaccinated population had they not been vaccinated.

(3) Expected measles cases are the expected annual number of cases in the population = > 10 that would occur in the year following the introduction of the listed strategy. Expected cases were estimated as 0.08 times the number of susceptibles.

Assessing Tetanus Toxoid Coverage

Investigators

Deming MS, Bisoffi Z, Weierbach R, Ibsen P, Mokdad A, Ciotti M, Bizimana F

Purpose

As a result of the 44th World Health Assembly's endorsement in 1991 of the World Summit for Children goals, all countries that have been part of the CCCD project are committed to achieving the elimination of neonatal tetanus.

Clostridium tetani is ubiquitous in the environment, and unlike poliovirus and measles virus, is not transmitted person-to-person. Therefore, there is no "herd immunity." The threat of neonatal tetanus must be met by high and sustained coverage with tetanus toxoid (TT) and by hygienic care of the newborn's umbilical cord. Consequently, there is need for an accurate and indefinitely sustainable means for measuring the levels of coverage achieved. Ideally, a method should be available to measure coverage accurately through routinely reported (administrative) data.

It is more difficult to determine the TT vaccination status of women than it is to determine the vaccination status of young children, for four reasons: 1) protection after TT is considered time-limited except after dose 5; 2) the duration of protection changes according to the number of doses received; 3) the minimum intervals between the 5 doses change; and 4) a history of vaccinations extending many years into the past may be necessary to determine a woman's TT vaccination status accurately.

Administrative estimates of coverage: Administrative estimates are calculated by dividing the number of doses given to the target population by the size of the target population. To estimate TT coverage in pregnant women at term, the formula traditionally used has been the total number of doses of TT2, TT3, TT4, and TT5 given to pregnant women during a calendar year divided by the estimated number of live births during the year, obtained from the last census. Each dose counted in the numerator is considered to represent a pregnant woman "covered" at term.

The major problem with this method of estimating TT coverage is that it leads to an under-count of pregnant women "covered" at term to the extent that pregnant women are: 1) seen for antenatal care but do not receive TT because they have already completed the 5-dose series or received TT3 or TT4 too soon before their pregnancy to be eligible for another dose during their pregnancy; 2) not seen for antenatal care but "covered" by doses received before their pregnancy.

Estimates of coverage by survey: TT coverage in pregnant women at term has also been measured using surveys of women who have given birth during the last year. Coverage at the time they gave birth is determined by their history of TT injections. This history can be based solely on documents the women keep at home, or can also take into account their verbal history of doses. Mothers have not always received, and have frequently not kept, written records of their TT injections, and the accuracy of estimates which rely on mothers' recall has not been well established.

A survey was conducted in 1989 to determine the extent to which estimates of TT coverage by different methods correlate with one another and with immunity.

Methods and Results

The survey was conducted in two strata, Bujumbura and the rest of the country (the "rural stratum"). The target population was women who had given birth during the previous 10 months. In all, 206 women were included in the survey sample in Bujumbura and 212 in the rural stratum. Each woman was asked to show all the health documents she had for herself and her children, and the dates of all TT injections were recorded. She was then asked about TT injections received in each of her last three pregnancies. Finally, filter paper samples of blood were obtained by finger prick. Tetanus antitoxin titers were measured by a competition ELISA test that had recently been developed at the State Serum Institute in Denmark. This test is the only in-vitro test that has correlated well with the "gold standard" mouse neutralization test.

Only 1 of 212 women (0.5%) in the rural stratum and 6 of 206 women (2.9%) in Bujumbura refused to have their blood drawn.

Tetanus antitoxin seroprevalence was 67% nationwide (95% CI 59-76). TT coverage estimates differed greatly from one another and in their degree of correlation with seroprevalence (table 7.3).

Conclusions

These results suggest that verbal histories provided an accurate measurement of TT coverage at the time of the survey. However, correlations between estimates of TT coverage and seroprevalence may be different in other countries and may change in Burundi during the next few years. In particular, the policy of vaccinating women of childbearing age at all contacts (adopted shortly before the survey), rather than pregnant women only, may result in less accurate verbal TT histories, since these histories can no longer be confined to pregnancies and will require that women distinguish TT injections from injections for the treatment of illnesses. Also, the increasing percentage of women who have completed the five-dose series will lead to an increasing gap between administrative estimates of coverage and seroprevalence, since these women will not be counted as vaccinated. The accuracy of estimates of coverage based on documents kept at home will improve with the widespread use of lifetime vaccination cards for women.

Table 7.3

Tetanus toxoid coverage and tetanus antitoxin seroprevalence among women who recently gave birth, Burundi, 1988-1989

	Rural stratum (n = 212)	Bujumbura (n = 206)	National (weighted) [95% CI]
Tetanus toxoid coverage at time of delivery* (%)			
Based on home documents	17	49	18 [11-25]
By history, last 3 pregnancies	7[illegible]	95	73 [66-79]
Tetanus toxoid coverage, administrative method ** (%)	n.a.	n.a.	57
Tetanus antitoxin seroprevalence (%)	67	84	67 [59-76]

* From the national vaccination coverage survey conducted in February and March 1989 of women who had given birth since Easter (April 3) of the previous year. Vaccination status was determined as of the time of delivery.

** For the period April 1988 through February 1989

Future Directions

The importance of lifetime cards: The consistent use and maintenance of lifetime tetanus toxoid immunization cards will be essential for accurate estimates of TT coverage in the future.

The use of serology: Tetanus toxoid serology can easily be incorporated into vaccination coverage surveys. Until countries are able to monitor TT coverage accurately, serology can play a useful role in measuring the level of protection obtained through immunization.

Monitoring "protected births" at the DPT1 contact: In response to the problems inherent in estimates of TT coverage in pregnant women at term based on reports of doses administered, a new method based on health-facility reporting has been proposed (1). This method requires adding a box to daily vaccination tally sheets to record the number of infants vaccinated with DPT1 who were protected at birth by the TT vaccinations recorded on their mothers' vaccination cards. The denominator used at health facilities is the total number of infants receiving DPT1, but at the national level the total number of liveborn infants can be used. The method requires that women keep their vaccination cards and bring them to the DPT1 contact. Once this habit is acquired, the method can provide accurate TT coverage estimates for infants receiving DPT1. The method has been recommended for trial use by the World Health Organization (2).

The "protected births" method has two additional advantages. It provides the staff at each health facility the capability to monitor the TT coverage they have achieved in their catchment population, and introduces a routine screening procedure that will reduce missed opportunities for TT immunization at the DPT1 contact.

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Epidemic Poliomyelitis: Vaccine Efficacy and Lessons Learned

Investigators, Surveillance Analysis and Coverage Survey

Otten MW, Deming MS, Jaiteh KO, Flagg EW, Forgie I, Sanyang Y, Sillah B, Brogan D, Gowers P (1)

Investigators, Case-control Study

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Purpose

An epidemic of poliomyelitis caused by poliovirus type 1 involving 305 persons occurred in The Gambia from May through November 1986 (estimated 1986 population 768,995) (figures 7.9-7.10). During the previous 6 years, only 5 cases of poliomyelitis had been reported. Coverage levels for 3 or more doses of trivalent oral polio vaccine (OPV) had been maintained at 60% to 80% (as documented by vaccination cards in surveys) since 1981 (figure 7.9). In August 1986, a mass vaccination campaign was conducted throughout the country, in which children ≤10 years of age were given a single dose of OPV.

CDC collaborated with the Ministry of Health and Social Welfare in The Gambia and other international organizations in investigating the epidemic. The goal of the investigation was to characterize the epidemic and to determine ways to improve poliomyelitis control in the future. The investigation focused on when, where, and in whom disease occurred, on vaccine efficacy, and on the role of the mass campaign in stopping the epidemic.

Methods and Results

Case definition and ascertainment: Cases were persons whose onset of paralysis occurred from May to November 1986 and whose paralytic poliomyelitis was diagnosed by physicians. Case ascertainment during the epidemic was by referral physician reporting. After the epidemic, a national village-to-village search was conducted and children paralyzed during the epidemic, but not already reported as a case, were examined by a referral physician.

Vaccination coverage survey: OPV vaccination coverage rates in children 1 to 2 years of age and 3 to 7 years of age at the onset of the epidemic were determined by a national, stratified household survey.

Case-control study: A case-control study was conducted to estimate the clinical efficacy of OPV. In this study, each 1- to 7-year-old case was compared with up to 5 controls randomly selected from children of the same age and sex living in the 30 closest neighboring households. In all, 195 cases and 839 controls were included in the case-control study.

Vaccination coverage in the vicinity of cases: To determine if case children tended to live in "pockets" of low vaccination coverage, a census of children 1 to 7 years of age was conducted in the 30 households closest to each case's household in the case-control study. The vaccination status of all children in the census was determined.

Major findings applying to all cases:

The national attack rate during the epidemic was 40 cases per 100,000 persons, with cases residing in all parts of the country except the capital, Banjul, where there were

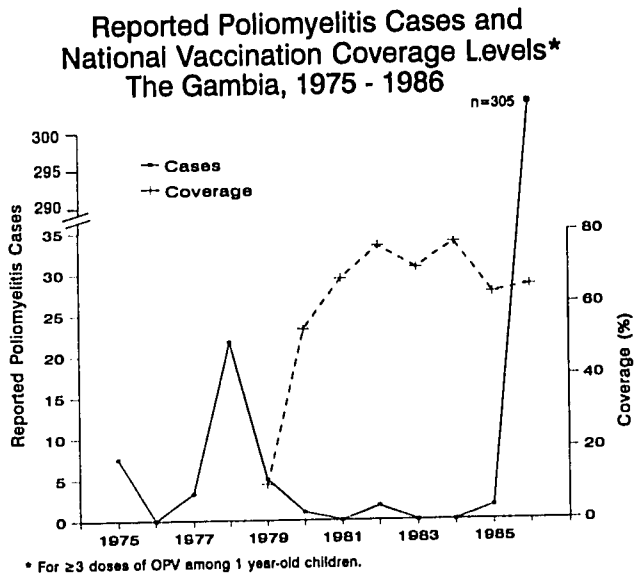

Figure 7.9

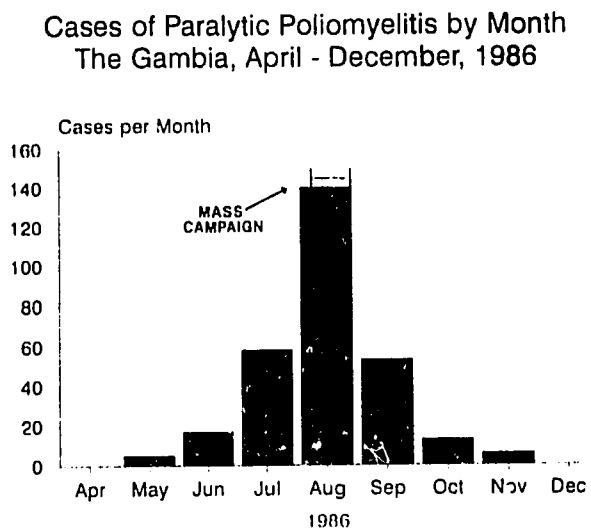

Figure 7.10

no cases. Apart from Banjul, there was no trend in attack rate by size of settlement. Other cities had attack rates close to the national average, as did villages of less than 500 persons (50.2 cases per 100,000 persons). The epidemic did not become established in one area before spreading to another, and epidemic curves were similar in different regions of The Gambia.

The highest age-specific attack rate was in 1-year-old children (394 cases per 100,000 children). Seventy-five percent of all cases were 3 years of age or younger.

At the beginning of the epidemic, 64% of 1- to 2-year-old children in the country were vaccinated with at least three doses of OPV according to their vaccination cards, and 69% were vaccinated with at least 3 doses of OPV when mothers' histories were accepted for children without cards. For children 3 to 7 years of age these coverage levels were 51% and 64%, respectively. In all, 95% of 1- to 7-year-old children were reported to have received a dose of OPV during the mass campaign.

The mass campaign may have prevented poliomyelitis cases but did not end the epidemic. In all, 57 persons became paralyzed more than 2 weeks after the mass campaign took place in their town or village. Since the incubation of polio is usually less than 2 weeks, most of these persons became infected after the mass campaign.

On the basis of previous lameness surveys conducted in The Gambia, 1,100 poliomyelitis cases would have occurred between January 1980 and November 1986 without a polio vaccination program. The actual number of cases identified during this period, including the epidemic, was 310, 72% less than expected. This is unlikely to be a major under-count, since the sensitivity of routine reporting during the epidemic was 86%.

Major findings from the case-control study :

The estimated efficacy of three or more doses of OPV was 72% when children without card documentation were considered to be unvaccinated (table 7.4). The estimated efficacy of three or more doses in 1- to 2-year-old children, in whom the determination of vaccination status was considered more accurate, was 81%.

Estimates of vaccine efficacy increased from 72% (95% confidence interval 53-83%) to 76% (95% confidence interval 53-88%) for three and four doses of OPV, respectively.

In a comparison between cases and controls who had all received three or more doses of OPV, cases were not more likely than controls to have received doses at

Table 7.4

Clinical efficacy of three or more doses of trivalent oral polio vaccine* in a matched case-control study: The Gambia, 1986

Group	Efficacy (%)	95% CI
All+	72	57- 82
1-2 years	81	66 - 90
3-7 years	52	8 - 75
Kanifing Urban District Council	71	30 - 88
Rural Western Region	81	57 - 92
Central Region	76	0 - 95
Eastern Region	62	27 - 81
Outreach	71	49 - 83
Fixed	73	48 - 86

* All doses were documented by vaccination cards.
\+ 164 matched sets, since only cases and controls with zero doses or three or more doses were used in this analysis.

intervals that were too short. Therefore, vaccine failure could not be attributed to administering OPV2 and OPV3 less than 4 weeks after the preceding dose.

It is unlikely that vaccine failure was associated with inadequate protection of vaccine from heat for the following reasons:

- The estimate of vaccine efficacy in 1- to 2-year-old children (81%) was exactly the same as the seropositivity rate to type 1 poliovirus in children who had received three doses of OPV protected from heat at the Medical Research Council in The Gambia as part of a research protocol.
- Several samples of vaccine collected from health centers in The Gambia were fully potent as measured by their total virus titers.
- The estimate of vaccine efficacy in areas served by outreach teams (71%) was very close to the estimate for areas served by fixed centers (73%).
- Previous evaluations of The Gambia's vaccination program had not identified exposure to heat as a major problem.

Card-documented vaccination coverage with 3 or more doses of OPV among 1- to 2-year-old children living in the immediate vicinity of fully vaccinated cases was 62%, close to the national coverage rate for this age group (64%).

Conclusions

Even when epidemic cases are included, an estimated 72% of potential poliomyelitis cases in The Gambia were prevented by vaccination from January 1980 to November 1986.

Experience in The Gambia has shown that epidemic poliomyelitis can reappear after being controlled as an endemic disease. The road to eradication may pass through an "epidemic" period in other countries. The threat of such epidemics emphasizes the importance of collaboration between neighboring countries, so that polio-free zones emerge in which there is reduced likelihood of reintroduction of wild poliovirus.

There was very wide exposure to wild poliovirus during the epidemic. The virus was not confined to "pockets" of low vaccination coverage or to cities and large towns.

The investigation showed that vaccine failure was a major cause of the accumulation of susceptibles that allowed the outbreak to occur and that exposure of vaccine to heat was probably not the major cause of decreased vaccine efficacy. The relatively low efficacy of OPV in much of the developing world constitutes a major obstacle to polio eradication. Only modest increases in efficacy were gained by giving a fourth dose, although confidence limits in this analysis were wide.

The Gambia's national mass campaign, which provided a supplementary dose of OPV to a very high percentage of children, was only partially successful in stopping an epidemic that was already well-established. Other countries should not assume that mass campaigns will be more successful in stopping epidemics.

The complete absence of poliomyelitis cases in Banjul provides the encouraging example of a major sub-national population that was protected during the epidemic. Possible explanations include differences between Banjul and neighboring areas in vaccination coverage, water supply, sanitation, proximity to the central vaccine cold room, and economic and educational levels.

Future Directions

The Gambia's experience raises the question of whether epidemics of poliomyelitis can be avoided in African countries that have not yet started national immunization days (mass campaigns) but which are part of a block of contiguous countries that have attained high vaccination coverage through routine means. This question may be answered by a large block of countries of southern Africa where the incidence of poliomyelitis has been reduced to a low level and where national immunization days have not yet been undertaken.

There are three principal possibilities for increasing polio seroprevalence rates among vaccinated children in Africa: 1) increasing the number of OPV doses children receive (which occurs as a result of national immunization days); 2) reformulation of OPV; and 3) adding a dose of enhanced-potency inactivated polio vaccine to the routine polio vaccination schedule.

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Poliomyelitis: Disease Control in an Urban Population Having Recently Achieved High Vaccination Coverage

Investigators

Babaniyi OA, Yeye-Agba B, Parakoyi DB (1-2)

Purpose

The Expanded Programme on Immunization (EPI) was "revised" in the Ilorin Local Government Area (LGA), Kwara State, Nigeria, in 1985. The EPI had existed previously, but had not been effective in raising coverage. In view of the reduced efficacy of trivalent oral polio vaccine (OPV) in sub-Saharan Africa compared with industrialized countries, a review of sentinel surveillance and vaccination coverage was undertaken in the Ilorin LGA to determine to what extent OPV coverage levels corresponded to disease reduction. In addition, a household lameness survey was conducted in 1988 to establish the baseline prevalence and incidence of poliomyelitis in this area.

Methods and Results

The lameness survey included 4,576 children aged 5 to 9 years. Thirty-one polio cases were identified, giving a prevalence rate of 6.8/1,000 children 5 to 9 years of age, and a derived annual incidence rate of 38.3/100,000 persons.

The sentinel surveillance review was conducted at the University of Ilorin Teaching Hospital Physiotherapy Unit. Records were reviewed for each year from 1981 to 1988. Only children whose parents gave the Ilorin LGA as the place of residence at the time of paralysis were included in the study. Population projections for the Ilorin LGA were based on the 1963 national census.

Vaccination coverage results of children 12 to 23 months of age from surveys conducted in the Ilorin LGA in 1983, 1984, 1986, and 1988 were reviewed. The vaccination history given by mothers was accepted for children who did not have cards.

Results of the vaccination coverage surveys and of sentinel surveillance are shown in table 7.5. Vaccination coverage for OPV3 increased from 16% in 1983 to 85% in 1988. The number of cases of poliomyelitis diagnosed at the sentinel site decreased from 40 in 1981, to 27 in 1985, and to 12 in 1988, equivalent to annual incidence rates of 9.6, 5.9, and 2.4 per 100,000 persons, respectively. The approximate sensitivity of sentinel surveillance at this site can be assessed by comparing the annual incidence rates of poliomyelitis based on sentinel surveillance for the first 3 years shown in table 7.5 (9.6, 10.6, and 6.4 cases per 100,000 persons, respectively) with the rate derived from the lameness survey (38.3 cases per 100,000 persons), which represented risk of disease during the early 1980s. If the proportion of cases reported through sentinel surveillance remained constant during the 1980s, the incidence rate based on sentinel surveillance of 2.4 cases per 100,000 persons in 1988

Table 7.5

Paralytic poliomyelitis by year of onset, based on records from the University of Ilorin Teaching Hospital Physiotherapy Unit and immunization coverage in Ilorin Local Government Area (LGA), Kwara State, Nigeria, 1981-1988.

Year of onset	Cases of paralytic poliomyelitis	Population of Ilorin LGA	Incidence rate per 100,000 persons	Percentage of children aged 12-23 months who received 3 doses of OPV, by survey
1981	40	415,211	9.6	no survey
1982	45	425,857	10.8	no survey
1983	28	536,776	6.4	16
1984	31	447,975	6.9	23
1985	27	459,462	5.9	no survey
1986	16	471,243	3.4	65
1987	21	483,024	4.3	no survey
1988	12	497,998	2.4	85

represented a 77% decrease in incidence rate compared to 1982, and a 59% decrease compared to 1985.

Conclusions

This study suggests that without supplementary OPV vaccination, high OPV3 coverage in a densely-populated area of West Africa can have a major impact on disease incidence. However, it also shows the limitations of this approach, since high OPV3 coverage achieved by routine program activities did not interrupt transmission or achieve the nearly complete control of endemic disease, as it did in The Gambia.

Future Directions

Moving from poliomyelitis control toward poliomyelitis eradication in West Africa will require two major new strategies: 1) the prompt detection, reporting, and investigation (including stool samples) of all cases of acute flaccid paralysis, and 2) the introduction of supplementary vaccination activities. Many countries in the region have not yet attained the high levels of vaccination coverage through their routine programs at which these strategies are indicated. However, it is useful for individual countries to gain pilot experience with these strategies before they are applied more widely. The CCCD project provided support to such a pilot experience in Togo, where the surveillance and case investigation of acute flaccid paralysis was established in 1990.

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The Immunogenicity of a Supplemental Dose of Oral Versus Inactivated Polio Vaccine

Investigators

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Purpose

The World Health Organization currently recommends administration of trivalent oral polio vaccine (OPV) at birth ("OPV zero"), followed by OPV1 at 6 weeks, OPV2 at 10 weeks, and OPV3 at 14 weeks. A child who has received OPV1-OPV3 is considered to be fully vaccinated against polio; the dose at birth is desirable, but is not necessary for children to be considered fully vaccinated.

For reasons that are not well understood, OPV is less effective in inducing serum neutralizing antibodies against poliovirus in developing countries than in industrialized countries. This difference has been shown in several seroconversion studies, and was seen in the investigation of the polio epidemic in The Gambia. This difference is especially marked for poliovirus types 1 and 3.

The visits children make to health facilities for measles vaccination can also be used to give an additional dose of polio vaccine, with the goal of increasing the proportion of children who are protected against poliomyelitis. A randomized clinical trial was conducted in Abidjan, Côte d'Ivoire, to compare the relative immunogenicity of a dose of OPV or enhanced potency inactivated polio vaccine (IPV) at the time of measles vaccination among children who had previously received three doses of OPV at approximately 6, 10, and 14 weeks of age.

Methods and Results

The study was conducted at a large primary health care center in Abidjan from 1990 to 1992. Infants were randomly assigned to receive a fourth dose of OPV or a dose of IPV. Two age groups were enrolled: those approximately 9 months of age (n = 346), who also received Schwarz measles vaccine, and those approximately 6 months of age (n = 368), who also received Edmonston-Zagreb (EZ) measles vaccine. Blood specimens were obtained from each child at the time of vaccination, at 4 to 6 weeks post-vaccination, and at 13 to 17 months post-vaccination. The characteristics of the children in the study at

Table 7.6

Serologic profiles of 6- and 9-month old children after 3 doses of OPV and the response in seronegative children to a fourth dose of polio vaccine (either OPV or IPV), Côte d'Ivoire

Characteristics	6-month-old children		9-month-old children	
	OPV	IPV	OPV	IPV
Type 1				
No. (%) with antibody after OPV3	139/182 (76)	136/186 (73)	141/169 (83)	150/177 (85)
No. (%) seronegative after OPV3, with antibody after 4th dose	17/43 (40)	40/50 (80)	4/28 (14)	22/27 (81)
Type 2				
No. (%) with antibody after OPV3	165/182 (91)	173/186 (93)	154/169 (91)	165/177 (93)
No. (%) seronegative after OPV3, with antibody after 4th dose	9/17 (53)	13/13 (100)	4/15 (27)	12/12 (100)
Type 3				
No. (%) with antibody after OPV3	104/182 (57)	124/186 (67)	126/169 (75)	135/177 (76)
No. (%) seronegative after OPV3, with antibody after 4th dose	17/78 (22)	47/62 (76)	2/43 (5)	28/42 (67)

the time of vaccination and 6 weeks following vaccination are shown in Table 7.6. At the time of entry into the study, the overall seroprevalence rates among the 6- and 9-month-old infants were 74% and 84% for type 1, 92% in both groups for type 2, and 62% and 75% for type 3. In both age groups, increases in the proportion of children with detectable antibody to all three types were significantly greater after vaccination with IPV than with OPV. In addition, geometric mean titers at 4 to 6 weeks post-vaccination were significantly higher among children who received IPV than among those who received OPV.

Only 23% of children from whom blood was obtained 4 to 6 weeks after receiving their supplementary dose could be located and bled at 13 to 17 months after vaccination. In both age groups, the projected proportion of children who remained seropositive 13 to 17 months after vaccination (based on the titers measured in the children who could be found) tended to be higher in the IPV group than in the OPV group, although few of these differences were statistically significant.

Among all 714 children initially enrolled, 42% had no detectable antibody against one or more poliovirus types at the time of the supplementary vaccination. Seronegative children who received IPV were 2 to 14 times more likely to seroconvert than those who received OPV. In addition, secondary increases in antibody titer (4-fold) were higher among children who received IPV compared with those who received OPV.

Conclusions

The percentages of children who were seronegative after three appropriately spaced doses of OPV were similar to those observed in other developing countries, and show that routine vaccination with three OPV doses at 6, 10, and 14 weeks of age leaves a large proportion of children unprotected against type 1 and type 3 poliovirus infection. In this study, an additional dose of either IPV or OPV administered at the time of measles vaccination increased the proportion of children who were protected, and the increase was substantially greater after IPV than after OPV.

Future Directions

Countries that have achieved high immunization coverage with OPV3 may consider an additional dose of polio vaccine at the time of measles vaccination. The greater immunogenicity of IPV as an additional dose must be weighed against its higher cost. Further studies will be necessary to determine the effect of an additional routine dose of polio vaccine on the circulation of wild poliovirus.

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Missed Immunization Opportunities at Urban Health Facilities

Investigators, Missed Opportunities Assessment

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Investigators, Other Lagos Urban Assessment Components

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Purpose

It is estimated that almost half of the Nigerian population will live in urban areas by the year 2000. A major consequence of this rapid urbanization has been an increase in the number and proportion of urban dwellers living in poverty. Despite the potential for enhanced delivery of immunization services in large cities, many inequities exist among urban inhabitants. The urban poor face unique problems related to the epidemiology of vaccine-preventable diseases, consumer characteristics that restrict the use of immunization services, and features of the health care delivery system that reduce access to and effectiveness of services.

International agencies have recognized the need to enhance the quality of primary health care (PHC) in urban areas in developing countries, and immunization has been viewed as a PHC component that could lead the development of urban health care. In 1992, the CCCD project collaborated with the Resources for Child Health (REACH) project on an urban demonstration project in the Lagos local government areas (LGAs). A review of routinely reported data showed that access to immunization, defined as the proportion of children who had received the first dose of DPT vaccine, was similar in urban and rural areas and that dropout from the immunization program was high in both urban and rural areas. These problems were confirmed by immunization coverage surveys conducted in all 15 LGAs in September 1992. To understand these problems better, a health facility assessment was conducted in 70 health centers in the 12 urban LGAs in October 1992.

Methods and Results

Clinics were randomly selected, with the probability of selection proportional to the number of DPT1 doses administered. The assessment consisted of observation of child management (children younger than 24 months of age, for immunization visits; and children younger than 5 years of age, for sick visits), parental exit interviews, health care worker interviews, and an inventory of supplies and equipment. A fixed number of visits were observed at each health center.

The assessment team observed 2,081 clinic visits; 1,648 (79%) were immunization visits and 433 (21%) were sick visits. The majority of sick visits were for minor illnesses, and no sick child required hospitalization. More than 90% of children in each group (immunization or sick visits) had a vaccination card with them.

Missed opportunities were assessed for 1,841 children younger than 24 months of age who had an immunization card (table 7.7). A missed opportunity was defined as the failure of a health worker to administer any or all vaccines for which a child was eligible at the visit. We did not assess missed opportunities to repeat doses which had been given previously, but were invalid because the recommended minimum age or interval between doses had not been respected. Because yellow fever vaccine (YF) was unavailable at most health centers, few eligible children (≥9 months of age) received it. Excluding missed opportunities for YF, 29% of children had at least one missed opportunity at the visit; if YF is included, 38% of children had a missed opportunity.

Among mothers accompanying children to immunization or sick visits, only 221 (11%) were screened for their own TT

Table 7.7

Immunization status of children coming to health centers, Lagos, Nigeria, 1992

Type of Visit	N	Fully Immunized for age*	Missed Opportunity (Incl. YF)	Missed Opportunity (Excl. YF)
Sick	252	126 (50%)	126 (50%)	99 (39%)
Vaccination	1,589	1,010 (64%)	570 (36%)	433 (27%)
Total	1,841	1,136 (62%)	705 (38%)	532 (29%)

* Children with cards, fully immunized, including yellow fever vaccine (YF)

status; 138 (7%) women had a card showing evidence of at least one prior TT immunization. Among the 53 (38%) women who were eligible to receive an additional dose of TT on the day of the visit, 25 were vaccinated; however, more than half had a missed opportunity.

At 68 (97%) clinics, individual vaccines were given only one day each week. Some facilities gave a different vaccine each day of the week. In addition, provider misconceptions about recommendations were common: among 91 health workers interviewed, one third were unaware that TT is currently recommended for all women of childbearing age. Finally, many providers invoked false contraindications as reasons for deferring vaccination. Only 9% of 78 nurses said they would vaccinate a child with fever and only 10% would vaccinate a child with diarrhea. When asked about reasons for delayed immunization, only 5% of health workers cited provider ignorance as a contributing factor; however, one third of mothers who reported that their child had been refused immunization in the past specified a minor childhood illness as the reason.

Most health workers did not use routinely collected data on vaccine doses administered to estimate coverage or to determine dropout rates. The dropout rates between DPT1 and DPT3 ranged from 2% to 44% (median 17%) and between DPT3 and measles vaccine they ranged from 0% to 53% (median 21%) in clinics where these data were available.

Conclusions

Missed immunization opportunities and barriers to receipt of services contribute to low coverage and high dropout rates in Lagos. Missed opportunities occurred because of lack of integration of services, unavailability of vaccines, and misconceptions about contraindications to vaccination, particularly with regard to vaccinating mildly ill children and women who have previously received TT during pregnancy. Although the Federal Ministry of Health policy states that health workers should use all opportunities to screen and vaccinate eligible women and children, no clear guidelines have been developed to assist providers in the field with implementation of this policy.

Future Directions

To achieve the WHO goal of global elimination of neonatal tetanus, all women of childbearing age must have a personal health card containing a lifetime record of TT immunizations and should bring these cards to all health center contacts. Only 7% of women had a card documenting receipt of TT with them at the time they brought a child for health care. Although a greater proportion of women may actually possess TT cards, most are in the habit of bringing them only to antenatal health care visits. Resources should be made available for producing and distributing personal health cards, and health workers should instruct women to retain the cards and to bring them to all health center contacts for themselves or their children. Although this will require substantial reorientation of health workers and education of women, some of this education can occur during the health education talks already scheduled at childhood immunization sessions.

Guidelines should be developed to clarify the federal immunization policy, including recommended ages for vaccination, intervals between doses, valid contraindications to vaccination, and vaccination at every opportunity. Continuing education materials and workshops should focus on screening and vaccinating at each health center contact, as well as on reducing false contraindications to vaccination.

It is essential to ensure that vaccine stocks are consistently available at health centers. Health workers should report shortages as they are identified, and resources should be secured to correct the situation. Health workers should be taught to calculate dropout rates and to use this information as a means to monitor their progress in meeting their immunization targets. If unacceptably high dropout rates are detected, managers can investigate the causes and develop strategies to reduce them.

The Potential Impact on Vaccination Coverage of Avoiding Missed Opportunities for Vaccination

Investigators

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Purpose

Investigators have frequently attempted to document opportunities missed by health workers to administer vaccines to eligible children seeking health care. Results of these studies have shown that missed opportunities frequently occur at visits for curative care and at visits for vaccination. Missed opportunities at vaccination visits generally occur when children receive at least one, but not all of the vaccinations that are due. These have been referred to as missed opportunities for "simultaneous" vaccination. Some exit-interview surveys have included women of childbearing age and have shown that missed opportunities occur frequently in this target group as well.

Although many ministries of health have adopted the policy of avoiding missed opportunities, observations at health centers have indicated that this policy is not widely implemented or clearly understood. The relative lack of priority accorded to the policy may be due, in part, to the need for better documentation of its effect on vaccination coverage. It is not possible to estimate from exit interview surveys what the effect on vaccination coverage of avoiding missed opportunities would be, since these studies are not community-based. Data collected in vaccination coverage surveys have been used to estimate the increase in coverage potentially achievable by avoiding missed opportunities. However, these studies have usually been limited to estimating the potential impact on coverage of avoiding missed opportunities for simultaneous vaccination, since the only dates available for analysis were vaccination dates. The 1990 national vaccination coverage survey in the Central African Republic provided the opportunity to carry this type of "potential gain" study further, since the same health care booklet used to list vaccination dates was also used to list all other dates of health facility visits.

Methods and Results

The survey in the Central African Republic took place in January 1990 and was stratified by area: Bangui, other cities (the "urban stratum"), and the rest of the country (the "rural stratum"). A total of 642 children between 12 and 23 months of age were included in the survey. Interviewers copied all health visit dates from the children's health care booklets. Vaccinations were accepted as valid if they respected minimum age and interval requirements, although there was no requirement that they be received before age 1. The frequency of missed opportunities was defined as the percentage of all opportunities to vaccinate that were missed.

The frequency of missed opportunities for measles vaccine nationally was 70%, with results in the three strata ranging from 68% to 75% (table 7.8).

The potential gain in measles vaccination coverage achievable by avoiding missed opportunities was substantial (table 7.9). Measles coverage would have increased from 54% to 76%. However, only 55% of this gain (54% to 66%) could have been achieved by vaccinating only children who had never received measles vaccine. Achieving the remaining potential gain would have required that health workers recognize that a previous measles dose was given before 9 months of age, and therefore needed to be repeated.

Nationwide, 73% (54% - 70%) of the full potential gain in measles coverage could have been achieved simply by avoiding missed opportunities for simultaneous vaccination. However, avoiding missed opportunities for simultaneous vaccination alone would have achieved only half of the full potential gain in coverage in the urban stratum.

The largest potential gain was in fully-vaccinated coverage, which would have increased from 34% to 65% nationwide in the absence of all missed opportunities.

Table 7.8

Frequency of missed opportunities for measles vaccination, national vaccination coverage survey, Central African Republic, 1990

	Rural stratum (n = 220)	Urban stratum (n = 210)	Bangui (n = 212)	National (weighted)
Missed opportunities (%)*	228 (68)	348 (75)	319 (67)	(70)
Valid vaccinations (%)*	105 (32)	119 (25)	154 (33)	(30)
Total opportunities	333	467	473	

* column percentage

Table 7.9

Measles vaccination coverage documented by card and measles vaccination coverage potentially achievable if there were no missed opportunities for measles vaccination, national vaccination coverage survey, Central African Republic, 1990

	Rural stratum (n=220)	Urban stratum (n=210)	Bangui (n=212)	National (weighted)
Card-documented coverage (%)	48	57	73	54
Coverage potentially achievable (%):				
With no missed opportunity to vaccinate children who never received measles vaccine	58	71	85	66
With no missed opportunity of any kind (including the opportunity to revaccinate children who received measles vaccine too early)	70	79	90	76

A "potential gain" analysis of tetanus toxoid coverage was not done because of the absence of a complete record of tetanus toxoid dates and other health facility visits.

Conclusions

The "potential gain" survey in the Central African Republic showed that substantial increases in vaccination coverage in children are achievable if all opportunities for vaccination are avoided, and that most of the increase is achievable by avoiding opportunities for simultaneous vaccination.

Future Directions

Two important questions remain after the "potential gain" studies. The first is to what extent theoretically attainable increases in vaccination coverage can be achieved in practice. One reason to feel concern that there may be a large difference between what is theoretically and practically achievable is that in the Central African Republic health workers would have needed to recognize invalid measles vaccine doses to achieve more than 55% of the full potential increase in measles vaccination coverage. Identifying children who need to be revaccinated because a vaccination received previously was invalid may be more difficult than identifying children who need to be vaccinated because the needed dose was never received.

The second question is what increases in vaccine wastage accompany achievable increases in vaccination coverage. This question has become more important as countries feel increasingly challenged to make efficient use of vaccine. The challenge arises because of the large increases in OPV needed for the supplementary vaccination activities of polio eradication and the increasing need for countries to purchase their own vaccines.

The CCCD project provided support to a demonstration trial in Togo designed to answer these questions. As part of the trial, an effort was made to implement fully a policy of avoiding missed opportunities in Ogou Prefecture through intensive training and supervision. In addition, registers for patients seeking curative care were revised to provide a worksheet for health workers and a means for supervisors to review the completeness and accuracy of implementation of the policy. Vaccination wastage rates were monitored closely through the use of a revised stock control form and close supervision. The analysis will compare vaccination coverage and vaccine wastage in Ogou Prefecture with a neighboring prefecture where no measures were taken to promote implementation of a missed opportunities policy.

The policy of avoiding missed opportunities has been widely promoted in African countries. However, the policy is largely unimplemented and has seldom been defined operationally through guidelines for specific scenarios. For example, the guidelines should specify what to do when a target-age woman or child fails to bring a vaccination card and whether the guidelines for the person being seen apply also to accompanying persons, such as a mother accompanying her sick child.

The Integration of Family Planning Services with EPI

Investigators

Birmingham M, Mbonikankuye D, Deming M, et al.

Purpose

The Expanded Programme on Immunization (EPI) has frequently been viewed as a model and leader for the development of other primary health care programs. One of the ways it can serve this function is by making EPI contacts available as service-delivery points for other interventions. An example of this approach is the integration of family planning with EPI.

Burundi has had the second-highest population density in Africa, and since 1983 the Government of Burundi has been officially committed to family planning as a means of slowing population growth. The EPI and the national family planning program in Burundi are both well established. They have been in existence since the early 1980s, and have benefited from considerable donor and government support. Nonetheless, these two programs have differed greatly in the success they have achieved. In 1991, according to reports of doses administered, 83% of children had received DPT3 by their first birthday, and 75% had received measles vaccine. In contrast, the national contraceptive prevalence rate in 1992 was estimated to be only 2- 3%.

Although the contraceptive prevalence rate remains very low, the national family planning program has created a demand for family planning services. This demand was evident during an exit-interview survey in 1992 at the 13 health facilities in the family planning/EPI integration demonstration project (see below). In all, 76% (98/130) of women leaving immunization sessions for their children stated that they would like to receive family planning services during these sessions. In addition to creating demand, the national family planning program has trained health workers and provided health centers with family planning supplies, primarily pills and injections.

Currently, women must take the initiative to make a separate visit to request family planning. The hypothesis on which the family planning/EPI integration demonstration project is based is that a more proactive approach is needed that takes advantage of existing health facility contacts.

Methods and Results

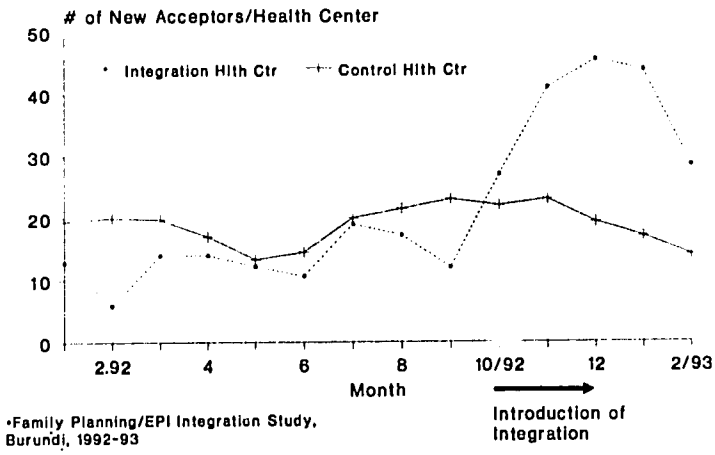
Family planning services were integrated with EPI at five randonly chosen government health facilities chosen randomly in Muramvya Health Sector,starting in October and November 1992. Women are asked at each EPI contact if they would like to begin family planning at that visit. If they do not desire services, any questions they have about family planning are answered, and they are encouraged to think about starting family planning at a later vaccination visit. New vaccination cards for children have been designed and printed for these health facilities: The cards show each mother's family planning record as well as her response to the health workers' questions about family planning.

The "integration" health facilities (Group I) are being compared with two other groups of health facilities: the remaining four government health facilities in Muramvya Health Sector (Group II), which receive supervisory visits from the study field coordinator with the same frequency as the "integration" health facilities, and four randomly chosen health facilities close to Muramvya Health Sector (Group III), where there is no intervention associated with the study.

The effect of the integration on the contraceptive prevalence rate and vaccination coverage will be evaluated with data from the community and from health facilities. A baseline census was conducted of all women of childbearing age and children 12 to 23 months of age living within two kilometers of each health center in the three groups, and a follow-up census will be conducted at the end of the study. A record is kept at health facilities of the number of new family planning acceptors and of the number of vaccinations given to children each month.

Figure 7.11 shows that the mean number of new family planning acceptors per Group I health facility increased approximately four-fold during the first 2 months of full intervention. There was a drop in February 1993, but the number remained above baseline. There was no corresponding change in the

Number of New Family Planning Acceptors in Integration and Control Health Centers*



*Family Planning/EPI Integration Study, Burundi, 1992-93

Figure 7.11

Group II health facilities. The proportion of all new acceptors at Group I health facilities who received family planning services at a vaccination visit for their children increased to more than 70% in January 1993, and remained at this level during the drop in the overall number of new acceptors in February 1993 (figure 7.12). There was no marked divergence in the curves showing the number of children vaccinated with DPT3 in Group I and Group II health facilities.

Conclusions

Preliminary results indicate that the integration of family planning with can EPI substantially increase new family planning acceptor rates without decreasing the number of children vaccinated.

Future Directions

If a sustainable increase in contraceptive prevalence rate is demonstrated and can be attributed to the integration of family planning with the EPI, the integration will be given consideration as a national policy in Burundi and may be of interest to other African countries.

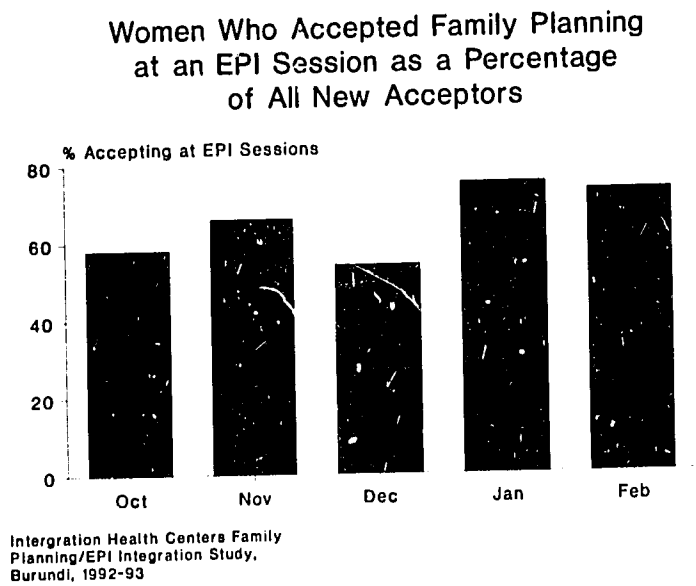


Figure 7.12

Chapter 8
Immunization in Africa: Achievements, Challenges, Resources

Introduction

In Africa, diseases that are preventable through vaccination contribute 20% of the under age five mortality. Since 1985, countries and donors have allocated substantial financial, human and material resources to expanding and improving immunization programs. Immunization has been a primary component and top priority of the child survival strategy of the United States Agency for International Development (USAID), the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF).

With substantial donor input, countries throughout the developing world strove to achieve the global goal of 80% coverage for childhood immunization by 1990.[1] During the decade, tremendous progress was made in immunization coverage and disease prevention in Africa. Achievements in immunization also represent improvement in the accessibility and delivery of health services. African countries, USAID, UNICEF, WHO and other donors expect that success achieved in immunization will strengthen the delivery of other primary health care services.

The outlook for immunization in Africa during the 1990s is not clear. Despite the progress made to date, many countries still have coverage rates far below 80%. There is a recognition that some of the achievements made during the 1980s may not be sustainable.

This chapter reviews the current status of immunization programs in Africa and explores some of the factors contributing to low or unstable coverage. Some of the immunization initiatives for the 1990s are reviewed in relation to their potential effect.

Immunization Coverage

Progress in Immunization Coverage

During the late 1980s astounding progress was made in the improvement of immunization programs in Africa. Figure 8.1 shows that regional coverage rates for vaccines against tuberculosis (BCG), diphtheria, pertussis and tetanus (DPT), poliomyelitis (OPV) and measles nearly doubled between 1986 and 1990 (UNICEF, 7/28/92).

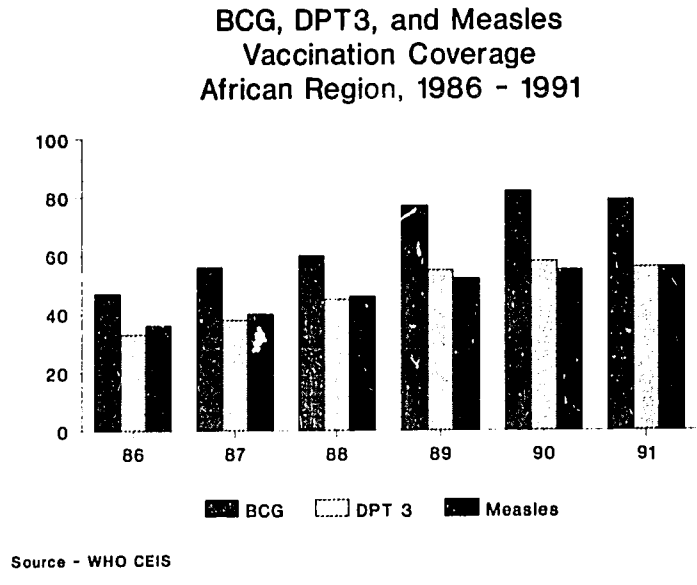


Figure 8.1

A regional coverage rate of nearly 60% in 1990 for the third dose of DPT meant that more than half of under-1 children in Africa came in contact with the health care system at least three times during that year. This indicates that notable improvements have been made in the delivery of immunization services. Through successful efforts to increase coverage, innovative technologies have been introduced and important lessons learned about how to plan, manage, implement, and evaluate health services delivery programs to maximize program accessibility and effec-

1 In Africa, a slightly lower goal of 75% coverage was set for 1990.

tiveness. Important lessons have also been learned about how to mobilize all sectors of society for the successful implementation of a health initiative.

When the world celebrated the attainment of Universal Child Immunization (UCI) in September 1991 and achieved average coverage rates over 80%, Africa was just approaching 60% coverage for most antigens — a remarkable achievement for the region but significantly below the global goal of 80% and the Africa regional goal of 75%. Figure 8.2, a regional comparison of coverage rates, clearly shows that the Africa region lags behind all other regions of the world.

As is true for other regions of the world, coverage of reproductive age women with tetanus toxoid is lower than the levels of childhood vaccination achieved. The regional average for coverage with the second dose of tetanus toxoid (TT2) in Africa in 1990 was 48% (WHO CEIS, April 1992).

The Global Advisory Group (GAG) on Immunization has identified a category of "Lower Coverage Countries" that generally have mitigating circumstances such as war, civil strife, economic hardship, under-developed infrastructure, and sparsely settled populations. In this category 15 of the 20 countries are in Africa (EPI/GAG, October 1991).

Each year a new target cohort needs to be immunized. Coverage rates most often refer to children less than 1 year of age. In terms of coverage, immunization programs in essence start from "zero" each year.

Using longitudinal data for the 17 African countries that had reported 1992 coverage data to WHO through July 1, 1993, there is a marked fall in coverage from the rates achieved in 1990 (figure 8.3).

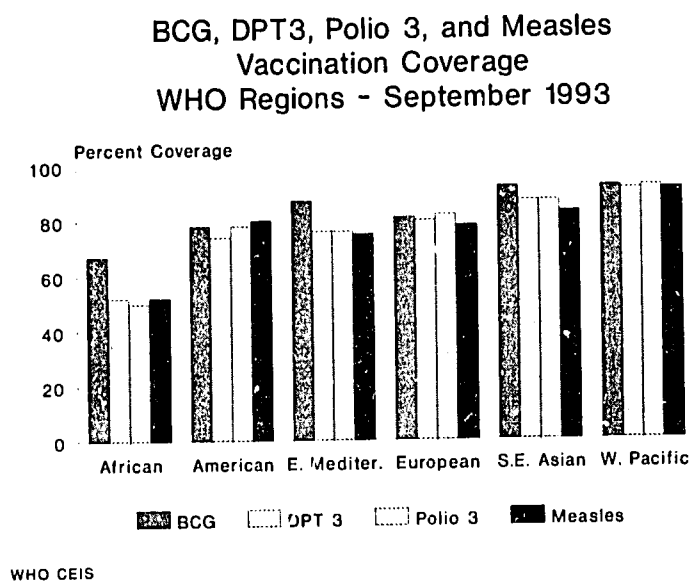


Figure 8.2

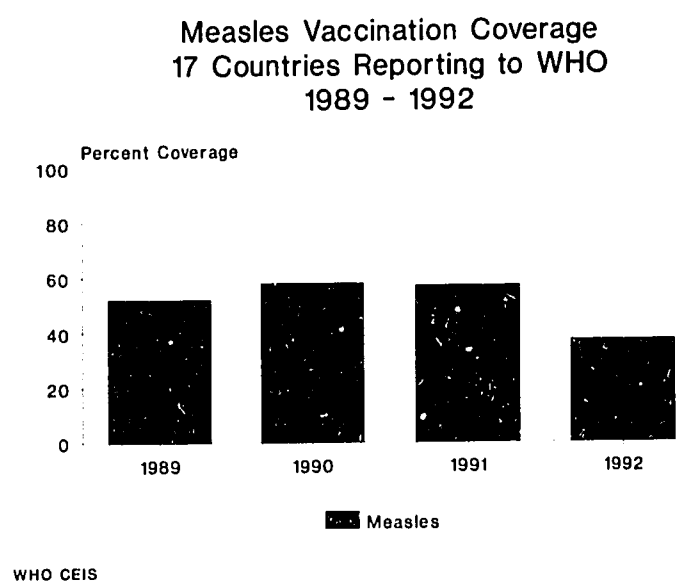


Figure 8.3

In sum, when the generally low coverage levels in Africa are compared with all other regions of the world, the number of countries experiencing declines in coverage since 1990 and the magnitude of these declines give rise to serious concern about the future of immunization and child survival in Africa.

Implications of Low Coverage and Coverage Declines

Disease Control: The ultimate goal of any immunization program is disease reduction. The global Expanded Program on Immunization (EPI) is adopting a targeted approach that emphasizes disease control goals and strategies. These include a 90% reduction in measles cases by 1995, the elimination of neonatal tetanus by 1995 and polio eradication by the year 2000 (EPI/GAG, October 1991). Although good data on disease incidence are not widely available and recent trends cannot be readily assessed, the first step in attaining disease reduction is to sustain high levels of immunization coverage, at least 80%. Low coverage rates in some African countries and the instability of coverage in others have serious implications for our ability to prevent EPI-related diseases and deaths in Africa.

Public Confidence: The tremendous progress of the late 1980s and the widespread extension of vaccination services has instilled public confidence in the health care system. Great demand for vaccination has been generated. Throughout Africa, scenes of mothers waiting with their children in long lines at vaccination centers have become very

familiar. Faltering accessibility to immunization services will likely result in faltering public confidence in the health care system. With new and more complex threats on the horizon, such as HIV/AIDS and resurgent malaria, Africa can ill afford a loss of the peoples' confidence in the health care system.

Access to Health Care: Of all health interventions in Africa, vaccination is the one that most often reaches the largest percentage of the population. With outreach and mobile strategies, vaccination services have been extended deep into the rural areas. In this respect, vaccination coverage is an indicator of health care accessibility. At best, access to health services will be only as good as vaccination coverage. For curative, more static services, access is likely to be significantly less. It is estimated that only 56% of the population in Africa has regular access to any form of modern health service. The ratio of health facilities to people is estimated to be as low as 1:10,345 (UNICEF, Jul 1992).

During the 1990s, many countries are moving towards more comprehensive, integrated health programs. Interventions such as the control of infectious diseases (including malaria and acute respiratory infections), micronutrient supplementation, and maternal health services (including family planning) are being added as priority activities to ongoing efforts in immunization. Such interventions are critical to further reducing childhood morbidity and mortality in Africa. Offering these services in an integrated manner allows for a multi-purpose, synergistic approach to health care delivery. For example, mothers can be educated about family planning and provided birth control supplies when they bring their children for immunization.

Low or unstable immunization coverage does not bode well for the planned addition of integrated preventive and curative services. It indicates that regular access is limited or decreasing; consequently, opportunities for comprehensive and integrated care are constrained and may be declining. A widespread, sustainable delivery system will be required to maintain high vaccination coverage and to allow for the successful addition of other interventions.

The serious implications of low and unstable immunization coverage in Africa mandate a close look at immunization programs and the factors that contribute to coverage. In the sections that follow, four major factors are considered: delivery strategies, sustainability measures, donor commitment to immunization, and funding levels.

Delivery Strategies

Strategic Approaches to Increasing Coverage

As indicated in Chapter 6, achieving coverage targets requires the selection of an immunization strategy or strategies using information about the spatial distribution of the population and health facilities and the capability of those facilities to provide immunization. Four main strategies are available.

Fixed Facilities: This strategy provides immunizations at fixed health facilities, such as health centers, clinics, or outpatient departments of hospitals. The ideal situation would be to have health centers within a reasonable distance of all families and to offer comprehensive basic preventive and curative services, including immunization, on a daily basis. However, access to health care facilities in Africa is limited. In at least 18 countries, less than 50% of the population has access to a modern health care facility (UNICEF, 1992). In rural and remote areas, the figure is much lower. Moreover, with resource limitations, many fixed facilities do not offer comprehensive services and can only provide immunizations weekly or monthly.

Outreach: Outreach immunization sites are fixed places away from health facilities (e.g., community health posts) where permanent health facility staff visit regularly to offer immunizations. Dates, times, and sites of immunization must be pre-scheduled and well known by the target community for the strategy to succeed. Outreach can greatly increase access and coverage in areas around fixed facilities but is limited by staff, transportation, and weather constraints.

Mobile Teams: In areas that are too remote to be served by fixed or outreach services, special teams can be sent to visit a series of immunization sites. The teams travel over a period of several days visiting prearranged villages and sites. This strategy is particularly appropriate for nomadic or very sparsely populated areas. It is an expensive strategy and is constrained by a lack of proper supervision and the long intervals between visits. In Burkina Faso for example, mobile teams are scheduled to reach each child only twice annually in their assigned areas of coverage, making it impossible for the children to be fully immunized with all vaccines during the first year of life (REACH, June 1992).

Acceleration: Accelerated strategies are designed to immunize a large number of children at the appropriate age within a limited time frame. A wide range of accelerated strategies, including: mass campaigns, national immunization days, weeks, or months; and local community door-to-door "pulses," are available. Social mobilization and public awareness building are extremely important components of acceleration that ensure the maximum target population is reached. Often during acceleration activities, fixed facilities, outreach sites, and mobile teams are all used.

Costs Of Different Delivery Strategies

The cost of immunization programs varies according to the type of delivery strategy used. In Africa, one study found fixed facilities to be the least expensive approach at about $7 per fully immunized child. More expensive were mobile teams ($11) and campaigns ($16) (REACH, March 1991).

However, the variation on cost per fully immunized child within any strategy is also significant. In West Africa, the costs of delivery through fixed facilities ranged from $7 in Mauritania to $17 in The Gambia. Mobile costs ranged from $7 in Burkina Faso to $14 in Mauritania and campaign costs ranged from $8 in Mauritania to $19 in Senegal. Some of the factors identified that influence the cost-effectiveness of vaccination programs include coverage rates, size of the target population, the number and type of personnel, as well as their productivity, and the type and durability of materials and supplies (REACH, March 1991).

Recent Trends In Implementation

Accessibility to health facilities in many African countries is limited. With the push for UCI during the late 1980s, accelerated immunization strategies were implemented throughout Africa to increase coverage beyond the reach of fixed facilities. According to WHO, 85 acceleration activities were reported by 43 countries in Africa between 1986 and 1990. Most of these acceleration efforts were national in scale; no other region reported a higher number of acceleration activities (WHO CEIS, April 1992).

Analyses have shown that these accelerated efforts had a tremendous effect on coverage in some areas. For example, one study in Nigeria revealed that as many as 50% of the immunizations given in 1988 were given during the nine National Immunization Days held that year (WHO, et al., November 1989). Coverage in the rural areas of Senegal increased threefold during a 6-month acceleration phase in 1986 and 1987. (UNICEF, No. 5). In Cameroon, nearly 60% of the doses of vaccine administered during 1986 were administered on two national immunization days. Increases in coverage were especially evident in areas with otherwise low performance (UNICEF, No. 4).

Since 1990, Nigeria and many other countries have not engaged in accelerated activities. Nigeria is one of the countries to experience a drop in coverage during 1991 and 1992. In Chad, mass campaigns ended in 1989 in favor of intensifying fixed facility activity. The result was a 20% to 30% drop in coverage rates for all antigens in 1990 and continuing through 1991 (CABLE, 8/6/92).

Fixed facilities in many African countries are not yet able to provide the level of coverage achieved through acceleration. Acceleration has allowed these countries to push beyond the system and reach populations who otherwise have no access to modern health care. In remote inaccessible areas, accelerated strategies may be the only effective means of reaching these populations at this time. The inability of countries to sustain high levels of access without acceleration is already causing coverage declines and has serious implications for efforts to integrate additional services into the immunization delivery system on a sustained basis.

The costs and effects of acceleration vary across countries and even within countries. The question is not one of fixed versus accelerated strategies. The challenge ahead is to identify locally appropriate and efficient combinations of delivery strategies that reach the maximum populations but do not detract from the longer term process of developing an infrastructure and delivery system through which comprehensive basic health services can be provided over the long term.

Sustainability

Along with funding and delivery strategies, a second issue to consider when assessing the apparent declines and instability of vaccination coverage in many African countries is whether immunization efforts have been designed and implemented to maximize their sustainability. Sustainability refers to the ability of programs to continue financially and institutionally after external support has been terminated.

In this section, immunization technical assistance in Africa is assessed in terms of five conditions that have been identified through a series of field studies to increase the likelihood of sustainability. These conditions are:

- Perceived Effectiveness: Technically effective interventions whose effectiveness has been brought to the attention of relevant constituencies.
- Integration: Strong implementing agencies with activities fully integrated into the Ministry of Health in a manner that encourages integration of child survival activities.
- Local Financing: Increasing portion of overall recurrent program costs borne by local sources, including the national budget and communities.
- Training: Strong and institutionalized training program with trained cadre of trainers.
- Design Process: Design and redesign efforts that occur in a process of mutual respectful negotiation and that are responsive to nationally defined needs, objectives, and capabilities (USAID, December 1990).

Perceived effectiveness: This condition has been met to some extent in terms of coverage but not in terms of disease reduction. Both types of data are essential to the effective management of immunization programs. With a globally-accepted standard and a simple methodology (30 cluster coverage surveys), countries have been able to show the accomplishments of their immunization coverage targets. In 1990, all countries in Africa reported their national immunization coverage rates to WHO. However, by mid-1992, 1991 coverage data for several African countries are still unavailable. To be useful for program

management, coverage data must be standardized, complete, timely, and accurate.

Documenting the effectiveness of immunization programs in reducing disease in Africa is problematic. Current data on disease incidence are woefully inadequate. As an example, all of Africa reported 611 cases of polio to WHO in 1990. Calculations on the basis of incidence and population estimate that the total number of polio cases was actually over 50,000 (WHO/CEIS, April 1992). The CCCD project has established model surveillance programs and WHO, UNICEF, Rotary International, the REACH project, and others are giving increasing attention to surveillance. However, better documentation of disease reduction will be critical to the attainment of EPI goals and will be an important tool for sustaining interest in and commitment to immunization programs during the 1990s.

Integration: To date, this condition has not been met in most African countries. Largely in response to the weak and underdeveloped health care delivery systems existing in these countries, heavily subsidized immunization programs have often been implemented on a vertical basis with separate procurement, administration and evaluation systems. In many countries, accelerated strategies have been pursued that mobilize and are dependent on resources from outside the national health care system. The expansion of immunization services has far outpaced other health services, creating an autonomous delivery system, including outreach and mobile capability. It is now recognized that sustainable program achievements require strong infrastructure and support systems, including training, logistics, management and information. More and more programs are being designed to build capacity and to strengthen institutions. The challenge to these programs is to ensure that all of the important EPI lessons and technologies are incorporated and built upon.

Local Financing: This condition has not been met. The likelihood of complete financial sustainability for immunization on the part of African governments is minimal during the foreseeable future. However, the need to strive for increasing self-sufficiency is clear. The trend for immunization program funding during the late 1980s was one of donors increasing their inputs. Over the years, donors have been putting more and more resources into immunization programs and governments are providing less than we previously assumed. In Malawi, the immunization program does not appear as a line item on the government's budget. Six years into Chad's 10-year EPI program, the government has not contributed any financial support (CABLE, 8/6/92). If countries begin to shoulder some of the costs of immunization during the 1990s, they will become more prepared to take over the programs as donors turn to other development problems

Training: This condition has been partially met in the sense that EPI training in Africa has been very strong but is not yet institutionalized. Through training of trainers courses and courses in management and supervision, a strong talented, and dynamic cadre of immunization managers, trainers, and supervisors has been developed throughout the continent. EPI training programs have served as models for the development of other training programs, including diarrheal disease control and acute respiratory infection control. However, EPI training programs are not yet fully integrated within the existing education and health care systems. In-country training courses sponsored by a variety of donors have not always been well-coordinated. Most countries do not have overall national training plans to ensure that training is obtained by those who need it when they need it. In addition, EPI workshops are most often held outside of the countries' formal education system as periodic in-service training activities. Although the REACH project has made some progress in Kenya, EPI has not yet become an integral part of medical, nursing, and other health worker education programs in Africa.

Design Process: The initial EPI goals and strategies were not negotiated on a national basis. The target of 80% coverage by 1990 was a global target. Although Africa adopted a target of 75% coverage, this was only a slight modification of the global target, rather than a determination based on local priorities and capabilities. Unified, simple goals served to galvanize tremendous interest and accomplishment in immunization during the early years of the UCI initiative. However, the 1980s revealed variation in how and what the regions, countries and sub-national areas can accomplish in immunization. The global goal may have been too high and acceleration may have been too extreme for many countries in Africa to achieve and sustain. Negotiating a balance between the global coverage and disease control goals set for the 1990s and the need for locally appropriate and negotiated goals and strategies will be of critical importance in terms of sustainability.

In terms of the five conditions thought to lead to eventual sustainability, the EPI experience in Africa during the 1980's has been mixed. Two conditions, local financing and mutually negotiated program design at the local level, have not been met. Integration of immunization services into existing systems and programs has not been achieved in most countries. The remaining two conditions, perceived effectiveness and institutionalized training, have been partially attained. On the basis of these sustainability criteria, immunization project assistance in Africa during the late 1980s was not designed and implemented to facilitate sustainability. This is likely to be contributing to the perceived instability of immunization coverage rates. Complete financial sustainability is probably not an appropriate goal for immunization in Africa. However, increasing the share of the governments' contribution and

enhancing institutional capacities can certainly strengthen immunization programs in Africa and reduce the level of external resources required.

Commitment to Immunization

One of the most significant features of the immunization drive during the 1980s was that all the major health donors agreed in their ranking of immunization as a top priority health intervention. UNICEF, WHO, the United States, Scandinavian, Italian, Canadian and other governments, Rotary International, and other non-governmental organizations all promoted immunization as a key intervention in developing countries. This convergence of donor interests and strong national government commitment throughout most of Africa was a major driving force in increasing immunization coverage rates. It appears that donor priorities are expanding in other important health and development areas during the 1990s, and the relative priority ascribed by donors to immunization as a health intervention is waning. Examples of policy developments at UNICEF and USAID are illustrative.

Beginning in 1977, the World Health Assembly adopted a resolution that included the goal of providing immunization for all children of the world by 1990. In 1985, the United Nations affirmed full support of this goal and 74 Governments and more than 400 voluntary organizations pledged their support.

"UCI" or the attainment of Universal Child Immunization became the key development objective for UNICEF during the late 1980s. UNICEF did continue to work in growth monitoring, oral rehydration, breast-feeding, and other areas, but efforts in immunization dominated the organization's development agenda. Working with Ministries of Health, UNICEF offices throughout Africa engaged in extraordinary activities to attain 80% coverage. In 1991, the attainment of UCI on a global basis was celebrated. This global accomplishment, however, masked regional and country variation. As noted above, the average coverage rate in Africa was 60% in 1990.

UNICEF's policy commitment to immunization remains high in the 1990s, but the focus of UNICEF's program has expanded dramatically. At the close of the decade during the World Summit for Children, 27 child health and development goals were established. In the 1990s, UNICEF is expanding from its primary focus on immunization to a number of other areas, including basic education, nutrition, and aiding children in especially difficult circumstances. In Africa and other regions, UNICEF is also promoting the Bamako Initiative. This Initiative is focused on the development of sustainable systems for the delivery of health services and is not specific to particular disease interventions, such as immunization.

During the 1980s, child survival was also one of USAID's top priority development strategies and immunization was a key child survival intervention. Of the four major child survival components, immunization and oral rehydration therapy, the "twin engines," were given higher priority than nutrition and child spacing. Country missions were encouraged to focus on raising immunization coverage as the first order of business in health development. Most central, regional and bilateral health projects focused primarily on the "twin engines."

As we enter the 1990s, the official USAID policy on child survival remains unchanged. However, the definition of child survival has been widely expanded. Today, in addition to immunization, oral rehydration therapy, nutrition and child spacing, activities in acute respiratory infection control, health systems development, vector control, water quality, malaria, nutrition of women, women's health, orphans and displaced children and health care financing are all important to child survival. Most of USAID's new bilateral health projects are more comprehensive than their predecessor projects. They are integrated programs that cover a number of health interventions and system development strategies.

Both UNICEF and USAID have expanded their top priorities in health beyond immunization and other core child survival interventions. Given the multitude and complexity of factors that influence maternal and child health in Africa, expansion beyond the "twin engines" is important. Without a more comprehensive approach, achieving maximum effect on mortality reduction and improving child health status during the 1990s will be difficult. However, it is not clear that all countries in Africa have the capacity to expand beyond immunization and other core interventions now. This is especially true for countries with low or unstable immunization coverage that may not be sustaining modest gains made to date.

The expansion of health program focus and scope does appear to have caused a decrease in the level of priority and attention given to immunization by UNICEF, USAID and other donors. Diminishing donor commitment to immunization is probably one cause of faltering coverage rates in some African countries.

Funding of Immunization

A major factor in ensuring high coverage rates is the level of funding provided for immunization programs. In this section, recent funding trends for immunization programs in Africa are considered in terms of their potential effect on coverage levels.

Immunization Program Costs

The total cost of an immunization program includes personnel, transportation, vaccines, needles, syringes, ice packs and other supplies, refrigerators and other equipment, vehicles, buildings costs, maintenance, training, communications, and miscellaneous operating expenses. Data on the percentage costs of specific immunization budget line items are difficult to find. One study conducted in 1986 estimated the following breakdown:

Salaries	38-39%	
Supervision	20%	
Vaccines	10-12%	
Transport	8-9%	
Other	5-7%	
Capital Cost	14-16%	(REACH, March 1991)

A commonly used indicator to compare the cost of different immunization programs is "total cost per fully immunized child." This is the total cost of the program (including technical assistance) divided by the number of infants fully immunized with all required vaccines. Cost per fully immunized child varies notably across programs, from $4 to $19, but averages about $15 per fully immunized child (REACH, March 1991).

Recent price increases have focused a lot of donor attention on the cost of vaccines as a critical component of immunization programs. Vaccine prices since 1986 are shown in the table below. These prices will result in an increase in the cost of vaccines to immunize one child from $0.69 in 1991 to $0.85 in 1992 and a global increase in the cost of UNICEF vaccine procurement from $46.9 million to possibly $89 million during the same period. (UNICEF, April 1992).

UNICEF Vaccine Prices Per Vial (US$)

Vaccine	Doses per Vial	1986	1987	1988	1989	1990	1991	1992
BCG	20	0.82	0.87	1.10	1.10	1.00	1.10	1.30
DPT	20	0.4	0.68	0.85	0.78	0.80	0.90	1.15
OPV	20	0.43	0.95	0.95	0.85	0.95	1.10	1.40
Measles	10	0.68	1.54	1.45	1.30	1.16	1.35	1.60
TT	20	0.38	0.38	0.50	0.40	0.40	0.55	0.65

Source: UNIPAC/Supply Division

This increase in vaccine prices is significant and will have serious implications for the future financing of immunization programs. To keep this development in perspective, it is important to recall that vaccines, although an essential hard currency expense, are only 10% to 12% of the total budget for an immunization program.

Financial Support of Immunization Programs in Africa

Funding for immunization programs in Africa has come from host country governments and multilateral, bilateral and non-governmental donors.

African Governments

National governments have most often covered the costs of salaries, some communications, general expenditures and buildings. These costs do not usually represent additional outlays for immunization programs but are part of the general budget for operating the public health system. A 1990 synthesis of EPI cost effectiveness studies suggested that national governments in Africa are financing fewer immunization costs than previously estimated. In this study, governments were found to shoulder about 30% to 60% of program costs as opposed to the 80% assumed earlier. The authors hypothesized that financing patterns may reflect the relative dominance of donor organization priorities and level of resources rather than a lack of commitment on the part of national governments. The availability of donor resources may lead to a redirection of government monies away from EPI toward other health programs (e.g., curative services). (REACH, September 1990).

Although governments may be able to provide additional support to their immunization programs, a 1990 policy analysis showed how difficult it would be for African governments to fully support their immunization programs during the 1990s. This study estimated that African countries would have to spend between 0.1% and 0.5% of their gross domestic product (GDP) on immunization programs in order to achieve 80% immunization coverage in the year 2000 (REACH, February 1990). With health care budgets receiving, on average, only 1-2% of GDP, this allocation to immunization would be very significant, and more than likely, not feasible.

If countries were to allocate 0.1% of their GDP to immunization, this study projected that 27 of the 28 African countries studied would not achieve 80% coverage by the year 2000. Of these 27 countries, 14 would have coverage rates below 40%. The global goal of 80% coverage at a cost of $15 per fully immunized child would take many African countries more than 25 years to achieve, since it would be that long before 0.1% of the GDP of these countries was large enough to cover the necessary costs.

The authors contend that ". . . even under the most optimistic (and unrealistic) assumptions about economic growth, meeting an 80% coverage target is well beyond the economic capacities of many countries. Under the more likely [growth] scenarios, many countries would be hard pressed even to allocate the amounts of resources required to maintain existing coverage levels without external resources" (REACH, February 1990).

Donors

Within current immunization programs, vaccines, training, supplies, vehicles, equipment and external technical assistance are primarily funded by the donors. In addition, donors often support communication (e.g., mass media) and social mobilization activities. The 1990 synthesis of EPI cost studies mentioned above suggested that donors cover between 40% and 70% of the costs of immunization programs in Africa (REACH, September 1990). This support includes both foreign exchange

Table 8.1

UNICEF Funding for Selected Line Items (millions)						
Budget Item	1986$ in MIL. (%)	1987 in MIL. (%)	1988$ in MIL. (%)	1989$ in MIL.(%)	1990$ in MIL. (%)	1991 $ in MIL. (%)
EPI	15 (13)	28 (21)	27 (18)	38 (23)	51 (24)	31 (15)
Health	22 (20)	24 (19)	31 (21)	36 (21)	50 (23)	50 (24)
Emergency Relief	19 (17)	18 (14)	23 (16)	16 (10)	19 (9)	35 (17)
Source: UNICEF, June 1992						

costs (such as vaccines) and local recurring costs (such as fuel and staff per diem).

Many donors have provided both financial and technical support to immunization programs in Africa. What follows is not a comprehensive review of donor support but rather focuses on the inputs of selected major financial donors, including UNICEF (the primary multilateral donor), Rotary International (the most significant non-governmental donor), and the U.S. government (an important bilateral donor). Although WHO is the lead provider of technical guidance and contributes financially to EPI on a global basis, this paper does not include a detailed review of WHO support. However, it has been reported that WHO funding for EPI in Africa is declining during the 1990s (WHO, May 1992).

UNICEF

UNICEF serves as the primary donor[2] to childhood immunization on a global basis. UNICEF procures vaccine at competitive prices for most of the developing world and also provides support for cold chain equipment, vehicles, training, supplies, social mobilization, and other program costs.

In 1990, UNICEF allocated $155 million globally to immunization. Of this allocation, $51 million went to Africa. For Africa this represented a near doubling of the $26.7 million allocated in 1988 (UNICEF's Operating Statistics June 1992). In fact, with UNICEF's major emphasis on meeting the global targets by 1990, this amount may have been excessive. It generated levels of effort among UNICEF staff and host country officials and health workers that could not have been sustained over the long term. In this respect, some leveling off in 1991 of funding, activities, and coverage should have been anticipated.

Executive Director James Grant recently declared that it is appropriate for up to 20% of general resources to be allocated for immunization activities. Above that amount, countries may request additional funding from global funds (UNICEF, 2/28/92). Despite this high-level commitment to immunization, UNICEF expenditures for Africa declined from 51 million in 1990 to $30.9 million in 1991 (UNICEF, June 1992). Although some decline from 1990 may have been expected, it is worrisome that the 1991 expenditures are even lower than those for 1989. Thirteen country programs are currently experiencing shortfalls in funding. For Benin, Chad, Congo, Liberia, and Zimbabwe, the budget shortfall represents over 40% of UNICEF's planned program expenditures for 1992/93. One cause of these shortfalls was the 1990 cut-off of Italian government funding to UNICEF for UCI in Africa. (UNICEF 2/11/92, 8/14/92).

With UNICEF's move towards program expansion and integration, some immunization funding is possibly being included in the more general "health" line item. However, during 1991, UNICEF's budget for health in Africa remains at its 1990 level of $50.3 million making it unlikely that "health" is picking up where EPI is dropping off. It is interesting to note that outside the health sector, funding for emergency relief in Africa increased significantly from $19 million in 1990 to $34.8 million in 1991. This included responses to crises in Liberia, Somalia, and elsewhere. During 1991, the number and complexity of emergencies in Africa increased. That trend is expected to continue. Table 8.2 is an outline of UNICEF's expenditures on EPI, health, and emergency relief since 1986 in millions of dollars and as a percent of UNICEF's total expenditures.

At the June 1992 UNICEF Executive Board meeting, the descision was made that immunization funding would be

2 UNICEF support includes UNICEF's general resources as well as money channeled through UNICEF to Africa from governments and other donors.

lined over the next 5 years at a global level of $100 million. Although this amount is substantial, how much effect it will yield in light of growing populations, continuing efforts to increase coverage, and increasing vaccine prices is not clear. It is also not yet clear what percentage of the $100 million will be spent in Africa.

USAID

Since the smallpox eradication campaign, the U.S. government has been an important bilateral donor to immunization programs in Africa. A major channel for USAID support to immunization programs in Africa during the 1980s was the Africa Child Survival Initiative — Combatting Childhood Communicable Diseases (CCCD) Project.

USAID funds have primarily and increasingly been used to support technical assistance. USAID has also been involved in the procurement of vaccines, supplies and logistics, but procurement for Africa has declined in recent years. With "Buy America" policies, USAID generally does not have a comparative advantage in procurement. Vaccines from the United States cost anywhere from 5 to 100 times more than vaccines procured internationally by UNICEF. Needles can be purchased from New Jersey at competitive prices.

USAID funding for immunization during the late 1980's can be summarized in terms of obligations. Expenditure data are not readily available. Between 1988 and 1990, USAID obligated just over $25 million for immunization in Africa. This amount included regional funding as well as bilateral funding from 19 country missions in Africa. This figure does not include central obligations because these numbers cannot be disaggregated regionally. (ISTI, July 1992)

Between 1991 and 1993, planned obligations for immunization in Africa total about $16.5 million, with bilateral money from ten country missions. By 1993, there will be no regional funding for immunization programs in Africa and only seven USAID country missions plan to obligate funds for immunization. These countries are C.A.R., Côte d'Ivoire, Kenya, Mali, Niger, Nigeria and Togo. (ISTI, July 1992)

The decline in USAID funding for immunization is caused by several factors. In part, it is a result of the termination of the regional CCCD Project. Also, USAID has nearly stopped direct procurement activities for immunization in Africa. In 1991, only two countries allocated funds for vaccine procurement. Another factor is the expansion in program focus described above. As the priority of other health interventions increases, the proportion of funds allocated for immunization is declining.

Rotary International

Rotary International has been the primary donor to Africa for polio vaccine. Rotary's financial support is the result of a one-time global fund-raising effort. Through this campaign, Rotarians around the world set out to raise $120 million to eradicate polio from the face of the earth. Instead, they raised $240 million and are currently supplying polio vaccine through UNICEF to nearly 100 countries around the world. During the late 1980s, estimates showed that Rotary was providing (through UNICEF) 80% of the developing world's polio vaccine.

Between 1988 and 1990, Rotary committed approximately $30 million annually to national immunization programs. These funds are awarded as "PolioPlus" grants to individual countries for vaccine and to a much lesser extent, for social mobilization, cold chain equipment and surveillance. With respect to Africa, a total of approximately $44 million in "PolioPlus" funding has have been awarded to 39 African countries and $19 million has been expended since 1985. (Rotary, 7/16/92). The lion's share of these funds have passed through UNICEF for vaccine procurement.

Polio eradication, the goal of Rotary's efforts, requires much more than routine immunization. It must also include systematic reporting of all suspected cases, regular vaccination "blitzes" or campaigns, establishment of laboratory networks, and other measures. According to WHO, global polio eradication will cost as much as $1 billion or more in foreign exchange costs alone (Rotary, July 1992).

Therefore, as Rotary's "global pot" of funds is drawn down and the challenges of global polio eradication are fully realized, Rotary is becoming more strategic and focused in its support of immunization programs. Rotary has decided to reduce annual funding for UNICEF to about $10 to $15 million and to direct funds towards countries and regions that have specific polio eradication plans and are well on their way to implementing them. In the global plan for polio eradication, Africa will be the last region tackled at the end of the decade. Therefore, the flow of Rotary funding to Africa can be expected to slow over the next few years, with the exception of targeted efforts in the southern cone countries as they push towards polio eradication.

General Comments on Funding

Funding for immunization in Africa during the late 1980s was plentiful. A great deal of financial, logistic, and technical support was forthcoming from external sources, including many

[3] In 1992 UNICEF pays $0.03 for a dose of TT, $0.06 for DPT, $0.07 for OPV, and $0.16 for measles vaccine. The Centers for Disease Control and Prevention (CDC) prices are $0.14 for a dose of TT, $6.25 for DPT, $2.09 for OPV and $9.48 for measles vaccine.

donor agencies and organizations. With this support, immunization coverage in Africa increased greatly. As we enter the 1990s, the major donors appear to be reducing their funding for immunization programs. Donor funding declines are probably an important factor that contributes to the instability of program coverage in Africa.

African governments will have difficulty in rapidly absorbing the full costs of their immunization programs. If left to their own resources, projections show that many countries in Africa would not reach 80% coverage for more than 2 decades. Although results of studies have indicated that there may be much greater potential for Governments to support their programs than was evident in the 1980s, significant and rapid declines in donor funding for immunization will have serious implications for disease control in Africa.

In the 1990 EPI cost analysis mentioned previously, the authors conclude that donor partnerships for EPI must be established. ". . .donors will have to commit to provide, on a continuing basis, the difference between country resources and resources sufficient to meet the agreed upon target coverage levels. This means the donor obligations, in financial terms, will vary in relationship to the economic capacity of the country partner. Of critical importance, as well, is that donors' commitments cannot be time limited. Rather, they must be based on an open-ended commitment to provide necessary resources as long as the country partner continues to demonstrate commitment and political will by providing a fixed [increasing] and substantial share of national economic resources to the program" (REACH, February 1990).

Initiatives For The 1990's

Governments and donors recognize the need for continued progress in immunization coverage, disease reduction and sustainability during the 1990's. Several initiatives are underway with the objective of contributing to one or more of these goals. In this section, selected initiatives are reviewed in terms of their purpose and potential.

Initiatives Designed For Increased Coverage And Disease Reduction

At the 1991 World Summit for Children, the World Health Assembly goals of neonatal tetanus elimination by 1995, 95% reduction of measles deaths by 1995, and global polio eradication by the year 2000 were endorsed. In this section, efforts towards the measles and polio goals are reviewed. Although the neonatal tetanus initiative is very relevant to Africa, where TT coverage is low and 52% of births are not attended by trained health workers, it is not specifically reviewed in this chapter.

The Children's Vaccine Initiative

The problem of vaccine supply is being addressed through a major initiative spearheaded by UNICEF. The Children's Vaccine Initiative is an effort to ensure the development and introduction of new and improved vaccines at the lowest possible cost. Two aspects of the Children's Vaccine Initiative are addressed in this section: the Global Vaccine Supply Strategy and the Vaccine Independence Initiative (VII).

As part of the Global Vaccine Supply Strategy, a scatter plot was made of 130 industrial and developing countries on the basis of population size and relative wealth. Countries were categorized according to their potential for engaging in vaccine production. Although this analysis showed great potential for improving the global vaccine supply situation, the analysis revealed that most African countries and over 50% of the world's children fall into the lowest potential categories (GAG, October 1992). Although wealthier countries can become more independent in vaccine supply in the near future, donors should anticipate providing vaccine for the lower category countries for many years to come.

The VII is organized to provide a mechanism for countries to become self-reliant in vaccine procurement. The VII includes four components: 1) planning for vaccine needs, 2) procurement, 3) a revolving fund, and 4) a mechanism for using local currencies and replenishing the dollar-based fund.

The short term objective of the VII is to establish a vaccine planning, financing, and procurement mechanism for high-quality, low-cost vaccines for EPI in a group of countries that have the national budgetary resources to finance some or all of their vaccine requirements. The long-term objective is to ensure sustainability of national immunization programs by assisting countries in becoming self-reliant in the systematic procurement of quality, low-cost vaccine delivered in a timely and dependable manner (UNICEF, April 1992). USAID has committed up to $6 million ($4 million in mission funding) to the global VII. Most of this support will be for revolving fund capitalization. A small portion will cover technical assistance.

The criteria for countries to participate in the VII revolving fund include GNP per capita, government interest, level of immunization coverage (i.e., at least 50%), capacity of the local UNICEF office to absorb local currency, and the strength of the country's currency. On the basis of these criteria, sub-saharan African countries are anticipated to be among the latter countries to become involved.

Notwithstanding the financial constraints noted above, there would be two major advantages to early sub-Saharan African country participation in the VII revolving fund. First, the establishment of a revolving fund will require countries to create a line item on the government budget for EPI vaccines, even if they are only paying for 5% of their vaccines. Second,

the VII will strengthen the procurement capability of the government. Both of these developments would contribute to a foundation for improved sustainability. Although the VII can be an important step towards greater sustainability of immunization programs, its limitations must be acknowledged. Vaccines, as noted previously, are only 10% to 12% of immunization program costs. Therefore, even if African countries were to fully absorb the cost of vaccines, 30% to 60% of immunization program costs would still need to be provided by external sources.

Bamako Initiative

Most donors are putting a higher priority on systems strengthening for sustainability during the 1990s. One major effort in this regard is the Bamako Initiative, spearheaded by UNICEF in collaboration with the World Bank and selected bilateral donors, including Italy and the Netherlands.

The aim of the Bamako Initiative is to revitalize the public health care delivery system by strengthening district management while capturing some of the resources the people themselves are spending on health. Four key interventions are pursued: 1) maintenance of immunization coverage; 2) the prevention and treatment of malaria, diarrhea, and acute respiratory infections; 3) safe motherhood; 4) and HIV/AIDS prevention. The Bamako Initiative plans to incorporate and build on lessons learned through immunization programs during the 1980s. As of mid-1992, the initiative was operating in selected districts in 18 African countries with a total target population of 20 million. Start up and implementation have been slow in some countries because of policy resistance and administrative constraints (UNICEF, July 1992).

The Bamako Initiative is designed primarily to address many critical sustainability issues, including local financing through essential drugs, cost recovery, and community participation; integration of programs into existing institutions; and institutionalization of services.

It is too early to fully assess the effect of the Bamako Initiative. The initiative does appear to have political support in Africa, and USAID offices in Senegal and Burundi report notable progress in linking the Bamako Initiative to EPI sustainability (Cables, 8/7/92 and 8/11/92). However, with a limited target population and a prolonged process approach, this initiative will not solve Africa's immunization constraints in the short term. Coverage and sustainability objectives will only be realized over the long term.

The Measles Initiative

The Measles Initiative is a recent USAID effort with the chief objective of showing that the immunization system can be made to work effectively in countries that have lagged behind in building their immunization programs. The Measles Initiative specifically targets measles, the most serious of the vaccine-preventable diseases in Africa in terms of childhood morbidity and mortality. The Measles Initiative operates in Kenya, Burkina Faso and Niger.

The Measles Initiative is initially a 2-year, $3 million effort. It is based on the assumptions that shortages of vaccines and supplies are not the main reasons for low coverage in most of these countries and that a coordinated effort to improve the management, communication, and quality of care of the EPI can yield decreased measles cases and mortality (CABLE, State 312575). The Measles Initiative is a combined effort of three major USAID projects: the REACH Project, HealthCom, and the Quality Assurance Project. These projects provide intensive technical assistance in management, planning, evaluation, communication, and quality assurance.

As of mid-1992, surveys and baseline analyses had been completed and workshops and training had been implemented in the target countries. In Kenya and Burkina Faso, where there is a high drop-out rate between the first dose of DPT at 6 weeks and the measles vaccination at 9 months, efforts focus on decreasing this gap through raising awareness and sustaining demand. In Niger, where coverage rates are still very low, the major objective is to increase the population's access to basic immunization services (USAID, June 1992).

Although this initiative may be appropriate in its effort to target measles and to identify and pursue locally appropriate mixes of delivery strategies, it has some significant constraints. First, the initiative is too short in duration and too small of an investment to expect achievement of sustainable impacts. Second, it is disturbing to note that one of the countries, Kenya, is now experiencing a measles vaccine shortage with a budget shortfall of $2.5 million expected over the next 3 years. USAID has been the sole supplier of measles vaccine to Kenya until recently when the mission's operating year budget (OYB) was reduced. This situation brings into serious question the Measles Initiative's design assumption that adequate logistics are available and only intensive technical assistance is needed to improve immunization programs in most African countries. It suggests the need to re-evaluate the extent to which program resources are meeting the countries' priority immunization needs.

Polio Eradication

As mentioned previously, the global polio eradication effort is being phased in on a regional basis. To date, polio has been eliminated in the western hemisphere and efforts are greatly increasing in the Western Pacific. It is anticipated that the polio eradication effort will intensify in Africa towards the end of the decade. The advantages in human and financial terms of eradicating polio are significant. Globally, it is estimated that polio eradication will result in the prevention each year of disability for 600,000 polio victims and of 20,000 unneces-

sary deaths (Rotary, July 1992). The cost savings from eliminating the need for polio vaccine in the United States alone would currently be $220 million each year (CDC, August 1992).

Polio eradication will require systematic reporting of all suspected cases, regular vaccination "blitzes" or campaigns, establishment of laboratory networks, and other measures in addition to strong and effective routine immunization programs. Globally, polio eradication will cost as much as $1 billion or more in foreign exchange costs. Including local expenditures, the total cost will be much higher.

The global pursuit of polio eradication does pose some serious issues for immunization programs in Africa. First, polio eradication is a global priority that is not a top health priority for many African countries facing HIV/AIDS, uncontrolled fertility, and resurgent malaria. Second, the polio eradication effort may pull resources away from routine immunization services and temporarily away from certain geographic regions. Third, polio eradication is a very vertical intervention and may hamper efforts to integrate basic health services. Fourth, the types of interventions required by polio eradication are very advanced for the current immunization situation in Africa. These include nearly universal immunization coverage, weekly reporting on a case no case basis from every district, outbreak response, and laboratory capability. If these are implemented rigorously with external resources for fast results at the close of the decade, the chances of leaving behind a sustainable infrastructure for the delivery of other immunizations and health services are limited.

As a global campaign with tremendous potential global benefit, polio eradication will come to Africa late in the decade. To capitalize on the experience and maximize its benefits, African governments and donors must identify and pursue those aspects of polio eradication that will strengthen immunization and health care systems over the long term. For example, efforts made now to improve surveillance and information systems will ensure a good foundation for eradication and are likely to result in additional long-term benefits, such as improved advocacy for immunization and data-based decision-making in the health sector.

Summary Of Findings And Issues

Findings

Tremendous progress was made by immunization programs in Africa during the 1980s. Coverage rates nearly doubled for the region and declines in vaccine-preventable disease and death were documented in some countries. Access to immunization services was increased notably as services were extended deep into rural areas. Innovations in social mobilization, training, technology and delivery strategies and improvements in planning, management and evaluation were realized as a result of immunization efforts.

Yet, overall immunization coverage in Africa lags behind all other regions of the world and there is evidence of program instability and coverage declines since 1990 in some African countries. Whether this is a temporary slump caused by "overexertion" during 1990 or whether it is more serious is not yet clear. However, the generally low coverage levels in Africa, the number of countries experiencing unstable and declining coverage rates, and the magnitude of some of the declines give rise to serious concern about the future of immunization and child survival in Africa.

The possible consequences of low, unstable or declining coverage in Africa include: 1) reduced ability to control childhood disease and death, 2) a loss of public confidence in the health care system, and 3) reduced opportunities for the provision of integrated basic health services. Changes in donor commitment, funding levels, and delivery strategies and inadequate attention to the issue of sustainability have all been found to be important factors in terms of past and future immunization program coverage in Africa.

Issues

Country Variation and Global Priorities

An important lesson learned from immunization programs during the 1980s is the tremendous variation among countries in Africa in terms of needs and capacities. Levels of achievement, extent of infrastructure, availability of trained health personnel, and other variables differ markedly across regions and countries within Africa. The global goal of 80% (75% in Africa) coverage by 1990 was too ambitious for many African countries to achieve and sustain. Goals of eliminating and eradicating selected diseases during the 1990s are also likely to be too resource intensive and imposing for most African countries. Attempts to achieve these goals and to expand into many other health areas in Africa will likely hamper impact and threaten the longer term health care system development process. Striking a balance between local and global priorities so that programs can be tailored to meet each countries' needs and ensure maximum sustainable impact will be an important challenge of the 1990s.

Funding Approach and Local Ownership

Donor funding for immunization in Africa during the 1980s was plentiful and immunization programs were largely associated with the donors. Since 1990, donor funding is declining while the costs of immunization programs are rising. Most African governments are committed to their immunization programs but are not yet able to fully absorb the costs of their immunization programs. The time frame and scope of many of

the new donor initiatives are too short and too small to compensate for this gap. Providing sufficient donor support while encouraging longer term financial and institutional sustainability on the part of African countries is a second major challenge for the 1990s.

Accessibility

Acceleration strategies were effective at increasing access to immunization services in many difficult and remote areas of Africa during the 1980s. However, these accelerated activities tended to be quite resource intensive. A reduction in accelerated immunization activities has occurred since 1990. Fixed facilities have not been able to fully compensate for this reduction. Increasing access through a locally appropriate, cost-effective, and sustainable mix of delivery strategies is a third major challenge for the 1990s.

Expansion and Integration

Many of the national immunization programs in Africa have been narrowly focused and conducted on a vertical basis, outside of the existing health care infrastructure. Some of the new initiatives, such as polio eradication, will require even greater verticality. At the same time, most governments and donors are striving to expand and integrate various maternal and child health interventions for greater effect, efficiency, and sustainability. Finding a way to maintain the effectiveness of vertical programs while increasing program scope and integration is a fourth major challenge for the 1990s.

Information Systems

Weak information systems have made it extremely difficult to measure the true impact of immunization programs. Data on coverage and disease incidence are critical to the effective management of immunization programs. Coverage data are standardized, collected, and reported by many African countries. However, not all countries are reporting and there continue to be problems in terms of the timeliness, completeness, and accuracy of reports. Data on disease incidence and the systems to collect them are virtually absent in Africa. Improving information systems in a way that strengthens the overall health delivery system is a fifth major challenge for Africa during the 1990s.

Emergencies

Political instability and civil strife continue to be a significant constraint to development in Africa. Crises in Liberia, Rwanda, Somalia, Zaire, and other countries have disrupted ongoing immunization and health programs. They have taken a significant toll in human life and are diverting resources away from longer term development efforts. Designing and implementing health development activities that facilitate larger efforts to stabilize and enhance the economic and political conditions of African countries may be the greatest challenge to be faced during the 1990s.

Vision

Seizing the opportunity to improve child health through immunization will require a common vision among populations, health workers, countries, and donors. Leadership in this area is crucial.

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Chapter 9
Conclusions, Issues and Recommendations

Conclusions

Four diseases preventable by immunization (neonatal tetanus, pertussis, measles, and poliomyelitis) are major causes of morbidity, disability, and mortality in African children.

- Experience in countries participating in CCCD has shown that immunizations can be effectively delivered in Africa, and that programs can achieve high levels of coverage, and can achieve measurable reductions in morbidity, disability, and mortality.
- Between 1984 and 1992, an estimated 32 million children received one or more immunizations and 20 million received measles vaccine in CCCD participating countries. An estimated 500,000 to 1 million deaths were prevented.
- Capacity of Africans and Ministries of Health to plan, implement, monitor, and evaluate immunization programs has increased significantly.
- Achievements in immunization were the result of effective partnerships of African governments and international and bilateral partners. African countries provided an estimated 50% to 70% of costs; 30% to 50% of costs were externally funded.
- African nations differ in their capacity to support ongoing immunization; few African countries, however, will be able to maintain current levels of coverage without external assistance for cold chain equipment and vaccines.
- Capacity to effectively use external assistance is significantly affected by political, economic, leadership, and commitment determinants. Without political and economic stability, provision of immunization services is difficult to impossible.

Contributions Of ACSI/CCCD

During the last 11 years, A.I.D. and ACSI/CCCD technical assistance has been provided to 13 countries for periods ranging from 4-9 years. As the impact of EPI resulted from the collaborative efforts of African countries and multiple technical assistance partners (WHO, UNICEF, Rotary International, and A.I.D.), it is neither practical nor possible to attribute achievements to a single technical assistance partner. Each partner had its own areas of expertise. The following are the areas for which ACSI/CCCD has made major contributions:

- Strengthened the capacity of Ministries of Health in the areas of planning, training, monitoring, and evaluation.
- Provided the main impetus to the upgrading of capacity to collect, analyze, use, and feed back program related data.
- Provided key leadership in the identification of quality as a critical aspect of program implementation (assessment, analysis, and remedial action).
- Collaborated with African governments in developing methods to strengthen continuing education as an operational strategy to identify and correct performance problems.
- Utilized the expertise available at CDC, to serve as a prime source of technical information and consultation.
- Provided a major impetus in the identification of problems (technical, logistic, operational) and for the implementation of applied research for analysis and problem solving.

Immunization As A Tool For Development

- The World Bank has just completed a study of Disease Priorities in Developing Countries (1993). Using figures for disability-adjusted life years gained, measles, tetanus, and polio vaccines rated among the most cost effective of potential health interventions.
- The World Bank's 1993 World Development Report concludes as follows: "Intensified government support is required to extend the Expanded Programme of Immunization (EPI), which currently protects about 80 per-

cent of the children in the developing world against six major diseases at a cost of $1.4 billion a year. Expanding EPI coverage to 95 percent of all children would have significant impact on children in poor households, who make up a disproportionately large share of those not reached by the EPI. Other vaccines, particularly hepatitis B and yellow fever, could be added to the six currently included in the EPI, as could vitamin A and iodine supplements. In most developing countries, such an "EPI Plus" cluster of interventions in the first year of life would have the highest cost-effectiveness of any health measures available in the world today." (1993 World Bank Development Report)

Issues

As developing country, international, and bilateral partners wrestle with the development agenda, the following priority questions need to be answered.

- Does the global community have a responsibility to ensure that all children of the world have access to a basic minimum package of health services?
- Where does immunization rank as a humanitarian and development priority versus population, HIV/AIDS, education, democratization, or environment?
- What is the continuing responsibility of international and bilateral agencies that encouraged African countries to commit resources to immunization in the 1980s?
- How well do current strategies of international and bilateral technical assistance match the needs and absorptive capacity of African countries?
- What characteristics of countries facilitate effective use of technical assistance in immunization?
- What forms of technical assistance will meet the needs of African countries over the next decade in terms of technical soundness, developmental relevance, and cost effectiveness?

Recommendations

Countries

Maintenance and expansion of immunization coverage will require continued leadership on the part of African countries to:

- Define their commitment to EPI in 1) political support, 2) personnel, and 3) funding.
- Review and update national EPI plans including 1) a realistic assessment of the current status of their EPI, 2) coverage and disease reduction targets, 3)strategic plan, and 4) an assessment of resource needs.
- Develop 5 to 10 year plans for supporting EPI activities taking into account the availability or resources and the long term goal of sustainability and self sufficiency.
- Meet together with potential technical assistance partners to 1) explore interest in and willingness to collaborate, 2) identify specific needs for technical assistance, and 3) develop a coordinated multi-donor implementation plan.

Global Partnership of African Countries and Technician Assistance Partners

- *Analysis of Coverage Rates:* Further analysis of immunization coverage rates since 1990 in African countries is urgently needed. The magnitude, scope and causes of any declines in coverage must be identified and delineated. Analysis of countries that have sustained high coverage levels will also be important. These analyses should help in determining the level and type of support required for country immunization programs in Africa over the next decade.

Technical Assistance Partners

- *Time Frame:* Donors need to consider a long term (10-20 years) time frame in their support of immunization programs in Africa. Tremendous work remains to be done to reduce the heavy toll of vaccine preventable diseases on children in Africa. It is clear that African governments cannot rapidly absorb the costs of, or sustain their immunization programs independent of donor input. Long-term partnerships between donors and governments must be developed to ensure ongoing support for immunization and to encourage increasing self-sufficiency for immunization.
- *Funding:* For the short term, the major donors should meet to review their commitments to immunization programs in Africa. New initiatives should be considered. The objective of this meeting should be to ensure adequate resources, identify potential shortfalls, and reach consensus on how to compensate for any major gaps in country programs. Strengths of individual donors (e.g., UNICEF and procurement) and complementarity of donor inputs should be the guiding principles in this process.
- *Vaccine Supply:* Inadequate supplies of vaccine, already evident on some African countries, threaten the achievements made in the 1980's.

Epilogue

Immunization is a cost effective development strategy which contributes to equity and social justice. In dealing with large numbers, millions of deaths prevented or not prevented, it is important to remember that each unit refers to an individual child, family, and community.

References

Disease Control Priorities in Developing Countries, Oxford University Press for World Bank 1993.

1993 World Development Report - Investing in Health, Oxford University Press for World Bank 1993.

Appendix
Acronyms

ACSI	Africa Child Survival Initiative
AFP	Acute Flaccid Paralysis
A.I.D.	Agency for International Development
AIDS	Acquired Immune Deficiency Syndrome
APMP	Association pour la Promotion de la Médecine Préventive (Paris)
AVB	Action Vaccination Bé (Babies)
AVT	Action Vaccination Togo
BCG	(Tuberculosis Vaccine)
CCCD	Combatting Childhood Communicable Diseases Project
CDC	Centers for Disease Control and Prevention
CEIS	Computerized EPI Information System
CIE	International Children's Center (Paris)
COSAS	Coverage Survey Analysis System (EPI coverage)
CUSO	(Canadian Volunteer Service Organization)
DPT	Diphtheria, Pertussis and Tetanus Vaccine
EPI	Expanded Program on Immunization
E-Z	Edmonston-Zagreb Measles Vaccine
FIC	Fully Immunized Child
FMOH	Federal Ministry of Health (Nigeria)
GAG	Global Advisory Group on Immunization
GOBI	Growth Monitoring, Oral Rehydration, Breast Feeding, and Immunization
GDP	Gross Domestic Product
GMT	Geometric Mean Titer
GNP	Gross National Product
HIS	Health Information System
HIV	Human Immunodeficiency Virus
HSA	Health Service Area (Swaziland)
IMR	Infant Mortality Rate
IPV	Inactivated Polio Vaccine
LGA	Local Governmental Area (Nigeria)
MCH	Maternal and Child Health
MOH	Ministry of Health
NGO	Non-governmental Organization
NIH	National Institutes of Health
NMIMR	Noguchi Memorial Institute for Medical Research (Ghana)
NNT	Neonatal Tetanus
OCCGE	Organisation de la Coordination et de Coopération pour la Lutte Contre les Grandes Endémies
OPV	Oral Polio Vaccine
ORT	Oral Rehydration Therapy
OYB	Operating Year Budget
PHC	Primary Health Care
REACH	Resources for Child Health Project
SHDS	Strengthening Health Delivery Systems Project
STDs	Sexually Transmitted Diseases
TOPV	Trivalent Oral Polio Vaccine
TOT	Training of Trainers
TT	Tetanus Toxoid Vaccine (for women)
UCI	Universal Childhood Immunization
UNICEF	United Nations Children's Fund
UNIPAC	United Nations Children's Fund Supply Division Procurement and Assembly Centre
USAID	United States Agency for International Development
VII	Vaccine Independence Initiative
WHO	World Health Organization
YF	Yellow Fever