JANUARY 2002

USAID-DHHS Partnership in Health

Health & Human Resources Analysis for Africa Project (HHRAA)
Participating Agency Service Agreement (PASA)

REVIEWS FROM SELECTED ACTIVITES IN SUB-SAHARAN AFRICA

USAID, Bureau for Africa, Office of Sustainable Development

DOCUMENTATION OF RESULTS AND LESSONS LEARNED

From Selected Activities in Sub-Saharan Africa:

Carried out under the Participating Agency Service Agreement (PASA) between the U.S. Agency for International Development's Bureau for Africa (USAID/AFR/SD) and the Office of International and Refugee Health of the U.S Public Health Services (HHS/PHS/OIRH)

- KEMRI Bednet Study in a Malaria High Endemic Region of Kenya
- DOTS Strategy for Tuberculosis Prevention and Control in Botswana
- CDC Technical Support for Strengthening WHO / AFRO to Address Malaria, Epidemic Preparedness and Response and Disease Surveillance

---

prepared by

Support for Analysis and Research in Africa Project
Academy for Educational Development

for

USAID, Bureau for Africa, Office of Sustainable Development

January 2002

Table of Contents

Acknowledgements

The SARA project would like to express appreciation to all persons who took time from demanding work schedules to provide critical input—via telephone, e-mail and direct meetings—for assessing impacts of the selected activities. Staff of USAID, Bureau for Africa, Office of Sustainable Development, Hope Sukin, Chief, Human Resources Division, Subhi Mehdi, Technical Advisor, Monitoring and Evaluation and CTO of the SARA Project, Mary Ettling, Technical Advisor, Infectious Diseases / Malaria, Mary Harvey, Technical Advisor, Child Survival, and Cornelia Davis, Technical Advisor, Infectious Diseases, and U.S. Department of Health and Human Services, Office of International and Refugee Health, Roscoe M. Moore, Jr., Assistant Surgeon General and Associate Director for Development Support and African Affairs, and Linda Hoffman, International Health Officer, directed the focus of the report and furnished useful background documentation. John Paul Clark, Co-Leader on Policy Issues for the Roll Back Malaria Project, WHO / HQ in Geneva provided tremendously useful insights from his previous position with USAID and years of work on malaria. Staff of WHO / AFRO, Paul Lusamba-Dikassa, Regional Advisor, Communicable Disease Surveillance and Response, Wondi Alemu, Regional Advisor, Communicable Disease Surveillance and Response, Dr. Yao Kassankogno, Regional Advisor, Malaria Prevention and Control, Dr. Edwin Afari, Medical Officer, Malaria Prevention and Control, and others, addressed areas relevant to policies and programs in Africa. Staff of the Centers for Disease Control and Prevention, including Rick Steketee, Chief, Malaria Epidemiology Branch, Division of Parasitic Diseases, National Center for Infectious Disease, and his colleagues, Patrick Kachur and Peter Bloland; Bradley Perkins, Chief, Meningitis and Special Pathogens Branch, Division of Bacterial and Mycotic Diseases, and his colleagues Craig L. Leutzinger and Kathleen F. Cavallaro; as well as CDC specialists overseas, Trenton K. Ruebush and Penny Phillips-Howard, among others, all offered vital insights on technical aspects of the activities. Greg J. Jones, Office of Infectious Diseases, CDC, facilitated coordination within CDC.

Acronyms and Abbreviations

AED	Academy for Educational Development
AFR/SD	Africa Bureau, Office of Sustainable Development
AIDS	Acquired Immunodeficiency Syndrome
AIM	Africa Initiative for Malaria
AIMA	African Integrated Malaria Activity Project
AJTMH	American Journal of Tropical Medicine and Hygiene
CDC	Centers for Disease Control and Prevention
CSR	Communicable Disease Surveillance and Response
DOTS	Direct Observed Therapy Short Course
DSS	Demographic Surveillance System
EMC	Emerging, Re-emerging and other Communicable Diseases
EPI	Epidemiology
EPR	Epidemic Preparedness and Response
ETEC	Enterotoxigenic Escherichia cola
GAVI	Global Alliance on Vaccines Initiative
GPS	Global Positioning System
HHRAA	Health and Human Resources Analysis for Africa Project
HHS	Health and Human Services
IDS	Integrated Disease Surveillance
IDSR	Integrated Disease Surveillance and Response
IMCI	Integrated Management of Childhood Illness
IUATLD	International Union Against Tuberculosis and Lung Disease
KEMRI	Kenya Medical Research Institute
MAL	Malaria Unit, WHO
MI	Malaria Initiative
MOH	Ministry of Health
NGO	Non-Governmental Organization
NIAID	National Institute of Allergy and Infectious Diseases
NIH	National Institutes of Health
OFDA	Office of Foreign Disaster Assistance
OIRH	Office of International and Refugee Health
OR	Operations Research
PASA	Participating Agency Service Agreement
PET	Participatory Educational Theater
PHS	Public Health Service
PI	Principal Investigator
POA	Plan of Action
RBM	Roll Back Malaria
RIP	Rapid Implementation Plan
SADC	Southern African Development Community
SARA	Support for Analysis and Research in Africa Project
STI	Sexually Transmitted Infections

TB	Tuberculosis
TBA	Traditional Birth Attendant
TOT	Training of Trainers
TST	Tuberculin Skin Test
UNF	United Nations Foundation
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
VPD	Vaccine Preventable Diseases
WHO	World Health Organization
WHO/AFRO	World Health Organization, Regional Office for Africa

Executive Summary

Introduction

The Health and Human Resources Analysis for Africa Project (HHRAA) was created in direct response to a request by President George H. W. Bush in 1990, "to see what else America and the world can do to advance child survival across that continent and the world." His remarks, made at the United Nations' World Summit for Children, called for the Secretary of the Department of Health and Human Services and the Administrator of the Agency for International Development to travel to Africa to review health care conditions and assess how the United States could assist those countries in improving health care delivery for African children and their families.

In September 1992, in response to recommendations made by the Presidential Mission Team, the United States Agency for International Development, Bureau for Africa, Office of Sustainable Development (USAID / AFR / SD) established a Participating Agency Service Agreement (PASA) with the Department of Health and Human Services (DHHS), through its Office of International Health (OIH)[1], a division of the U.S. Public Health Service (PHS). OIH provided support for information, research, and analysis through cooperation with the Centers for Disease Control and Prevention (CDC), the National Institutes of Health (NIH), and other Public Health Service offices.

The HHRAA Project provided a mechanism to increase the use of research, analysis, and information in support of improved health care, nutrition, education, family planning strategies, policies, and programs throughout the African continent. HHRAA was an Africa-centered effort, responding to the needs, capacities, and constraints faced by the African health community. Participation of African professionals and African institutions was critical in the design and implementation of research and analysis activities of the project, as well as in the dissemination of its findings. Emphasis was given to priority issues and problems identified by host countries and institutions, and those falling within the range of the USAID Bureau for Africa's analytical agenda.

The 1992 PASA was a critical step in beginning an innovative partnership approach with African nations to address critical health and human resource problems by focusing on the major disease threats of malaria, tuberculosis, HIV / AIDS, diarrhoeal diseases, and vaccine-preventable childhood diseases. The proliferation of deadly illnesses had become insurmountable obstacles to economic stability and progress.

With an initial funding of $1,656,000, AFR / SD has provided incremental funding for the OIRH / PASA for a total of about $30 million to date. The PASA agreement provided an

[1] The Office of International Health became the Office of International and Refugee Health (OIRH) in 1995.

efficient mechanism for the transfer of expert field teams and other technical assistance to African communities. By establishing direct linkages with all offices in the Department, the Office of International Health (OIH) achieved great flexibility and timely response to the respective needs identified by African constituencies. All activities studied were funded under the same PASA and remained in effect for the entire nine-year period. AFR / SD has expressed satisfaction with the working relationships formed and quality of technical assistance provided by the PASA.

Purpose

In order to share lessons learned from previous activities with other partners, AFR / SD asked the Support for Analysis and Research in Africa (SARA) Project to assist in documenting the results and lessons learned from selected activities carried out under the PASA.

The present report comprises an impact review of three distinct activities supported under the OIRH / PASA. Such impact reviews highlight the strengths and weaknesses of the activities with a view to planning future activities. In addition, impact reviews describe processes undertaken to implement each activity, as well as resulting capacity building, policy, and program impacts in Africa.

Methodology

Information contained in the present document was collected from April to August 2001, based on:

- review of key documents provided mainly by USAID / AFR / SD, OIRH, and its partners;
- interviews (via phone, e-mail and direct meetings) with key persons involved with the activities and with selected potential beneficiaries / clients in the field;
- synthesis of findings for each activity.

A draft report was circulated for review by USAID / AFR / SD and OIRH; the comments were incorporated into the final version.

Background on activities under review

<u>KEMRI Bednet Study in a Malaria High Endemic Region of Kenya</u>

Every year malaria claims as many as 1 million lives worldwide, with an estimated 350-500 million new cases. A disproportionate share of malaria-related death and illness occurs in Africa, affecting primarily children under five years of age and pregnant women. Given the daunting challenge to control and prevention programs posed by anti-malarial drug

resistance, it is necessary to mobilize all appropriate, alternative weapons in the arsenal to fight malaria.

The purpose of this research activity was to investigate various effects of the bednet intervention to understand its potential contributions to combat malaria. More specifically, it was considered timely and important to collect data permitting scientific assessment of the efficacy of treated bednets in areas of high, perennial malaria transmission. Previous studies had investigated the effectiveness of treated bednets in reducing mortality in children under the age of five years only in areas of low, or high but very seasonal, malaria transmission in Africa, in randomized controlled trials. In designing the bednet study in western Kenya, the Kenya Medical Research Institute (KEMRI)—with its 15-year history of community-based medical research—was chosen by the U.S. Centers for Disease Control and Prevention (CDC) as a local partner for its unique capacity to conduct medical and public health research in a challenging setting.

DOTS Strategy for Tuberculosis Prevention and Control in Botswana

At the time the study was developed, tuberculosis was responsible for more mortality and lost productivity in sub-Saharan Africa than any other infectious agent. Since 1985 the number of cases of TB in sub-Saharan Africa is as much as 50 percent higher than would have been expected, had trends from the pre-HIV era continued. Investigations were needed to learn more about the magnitude of the increase in TB morbidity, especially associated with HIV infection, and the ability of TB control efforts to counteract it.

This study focused on Botswana's national tuberculosis control program, then recognized as a model among African countries. During project start-up in 1993, Botswana had one of the highest rates of TB in Africa, despite a well-structured TB program and plentiful economic resources generated by diamond mines. Botswana had good records on TB management, including documentation of each single dose of any drug in any location. Further, with the hiring of a microbacteriologist for the National Health Laboratory in Gaborone in late 1993, the government established the capability to complete all requisite laboratory testing in country.

CDC Technical Support for Strengthening WHO / AFRO to Address Malaria, Epidemic Preparedness and Response, and Disease Surveillance

Despite many well-known interventions to control communicable diseases, such diseases represent a major public health problem in Africa. Ineffective disease surveillance systems, including ad hoc reporting and tracking mechanisms, in most countries are responsible for failures to detect epidemics, resulting in the spread of diseases, human suffering, and loss of lives. Among other things, weaknesses in data collection (e.g., the absence of timely and reliable data to measure geographic spread and propensity), the analysis and use of information for action, at all levels, in addition to lack of resources and awareness about the usefulness of the system are some of the factors contributing to weak surveillance systems.

And even in cases where such data may be collected, a further obstacle to controlling the spread of disease is often posed by insufficient supplies of vaccines, drugs, and commodities.

Prompted by the 1992-93 cholera epidemic in southern Africa, the World Health Organization Regional Office for Africa (WHO / AFRO) developed a regional strategy for epidemic preparedness and response (EPR), including epidemiological surveillance strengthening, which was adopted as a framework for cooperation by all African member states. Then in 1996, the worst epidemic of meningitis ever reported hit several countries in West Africa. The devastating effects of these successive outbreaks underscored the imperative to put in place preparedness mechanisms and a coordinated response for future epidemic outbreaks. Accordingly, WHO / AFRO, with support from the U.S. Agency for International Development's Bureau for Africa (USAID / AFR / SD) and other partners, launched an initiative to enhance the ability of countries to respond to outbreaks of epidemic-prone diseases. WHO / AFRO has teamed with CDC to assist several countries in implementing Integrated Disease Surveillance (IDS) systems to simultaneously address different diseases at district level. This support has included CDC technical assistance to WHO / AFRO for managing its Malaria Action Program that strengthens national control programs in Africa. Various facets of this technical support are reviewed in the present report.

Findings

General findings

USAID-CDC-WHO / AFRO Partnership

The three activities reviewed have been implemented through collaboration among three principal partners—USAID, HHS / OIRH / CDC, and WHO. USAID / AFR / SD funding, through the Participating Agency Service Agreement (PASA) mechanism, enabled the U.S. Department of Health and Human Services, Office of International and Refugee Health (OIRH) to mobilize the Centers for Disease Control and Prevention (CDC) as the prime technical partner for these activities, based on their impressive contributions to disease surveillance and response to outbreaks around the world. USAID facilitated the partnership between WHO / AFRO and CDC for their unique and complementary strengths—CDC for its extensive technical experience combating disease in the U.S. and around the world, and WHO / AFRO for its important ability to affect programs and policies at regional, national and community levels in Africa. The respective contributions of all partners are detailed in the report. In general, the USAID-OIRH / CDC-WHO / AFRO triad has provided a highly effective mechanism to realize the goals set for the activities. Collaboration among these three partners also has provided a platform for mobilizing resources with other external partners.

According to WHO / AFRO and CDC staff interviewed, the most productive and enriching collaboration appears to have benefited from individual relationships based on mutual

respect and shared commitment (i.e., from a group of AFRO-CDC-USAID colleagues) to a particular goal, or to developing something new, e.g., a surveillance system. There is general agreement that joint collaboration (WHO / AFRO-CDC-USAID), upon which the Roll-Back Malaria (RBM) Program is building, has strengthened capacity at both the regional and country level for accelerated implementation of malaria control. Specific accomplishments of the partnership include, for example, standardizing testing for the efficacy of anti-malarials; developing indicators for program evaluation, conducting malaria surveillance, developing strategies for mitigating the effects of malaria in pregnant women and treatment policy formulation, and establishing a database on drug resistance. In fact, CDC staff have lauded WHO / AFRO's significant accomplishments in malaria prevention and control. One CDC staff member even noted that many of the vital lessons learned on malaria control in Africa were applicable to his work in Latin America. Many CDC researchers noted that their work with AFRO colleagues has permitted a better understanding of the process required to adapt research findings to policy and program formulations, in an African setting.

Friction between CDC and WHO / AFRO seems sometimes to result from differences in strategic focus for each organization, which underlie differences in the pace of work. WHO / AFRO's mandate is affected by the immediacy of health needs in the African setting, while CDC is committed to careful, systematic, thorough biomedical research that often cannot be rushed. For example, it has taken longer than expected to bring IDS to the district level. USAID started supporting surveillance in 1998. The process of developing generic guidelines and tools, including field-testing, extended beyond 12 months. Once developed, generic technical guidelines then must be adapted by each MOH. Some countries have been waiting three years (e.g., Tanzania) for case definition and thresholds. Confronting immediate needs, some countries may rush to make determinations on their own and risk making mistakes.

Not surprisingly, management, coordination of activities, and financial planning by the three partners has proven challenging. In efforts to synchronize the work of each partner, USAID has found it useful to organize frequent and regular sessions for information exchange, including updates of matrices, tracking materials, joint progress reports, and work plans. One of several purposes for such frequent coordination among partners is to avoid expenditures on isolated or tangential activities that do not coherently fit into the big picture of work to be accomplished.

<u>African Capacity Building</u>

The review of each activity examines the extent of African capacity-building, acknowledging the need for this commitment to insure the success and sustainability of any large-scale project covering a range of disciplines. Each activity, in varying degrees, has involved ministries of health and researchers throughout sub-Saharan African countries in workshops, training courses, operational research, and program design, implementation, and evaluation.

Numerous instances have been observed where technical knowledge acquired in one country has been applied in another, as with the exploration in South Africa of appropriate adaptations to the Botusa computer program used so effectively for TB management in Botswana.

WHO / AFRO and other African institutions such as KEMRI now serve as vital repositories of technical resources and expertise, both to fight and prevent disease. All parties can only stand to benefit from following their example and developing more organizations with similar skills and capacities.

Sustainability of Health Systems

Despite knowledge now widespread in African countries regarding the imperative for surveillance, prevention, and control of infectious diseases and the devastation associated with past epidemics such as Cholera in 1992-93, there is still a pervasive dependence on external financial resources for national health programs. Very few countries now have sufficient resources to meet their needs, even for IDS. However, in view of the persistent uncertainties regarding future donor support, it is especially important for countries to document accomplishments that attest to solid returns of earlier investments.

The governments of many countries, including Uganda, Tanzania, and Ghana, have committed their own funds to surveillance. Experiences documented in the present report attest to the fact that governments who put stock in their own future do a better job of realizing longer-term objectives than countries who rely solely on donor support. Further, governments that demonstrate political commitment by becoming an active financial partner in developing their countries' health systems become more attractive to donors.

Key findings from each activity

KEMRI Bednet Study in a Malaria High Endemic Region of Kenya

- Bednets are good for everyone and are important, for all persons in high transmission areas, to prevent and control the spread of malaria. Benefits identified for specific population groups follow:
    - Mortality in under-ones decreased by an overall 21 percent;
    - Clinical malaria (fever plus age-dependent parasite rate) was significantly reduced by ~ 45 percent in children < 3 years living in intervention villages;
    - Under-fives mortality decreased by 15 percent (less than the preliminary analyses but typical of impact levels);
    - Low birthweight (both intrauterine growth retardation and pre-term delivery) reduced significantly in 1-5 pregnancies;
    - Maternal anemia significantly reduced;
    - Child morbidity from malaria significantly reduced.

- With this excellent coverage, Bednets have a 'community protective effect' for clinical malaria, parasitemia and anemia, on children from control villages living close to intervention villages.

- No permethrin resistance was detected during the study.

- Successful experience in extended use of bednets in western Kenya households provide useful insights into processes through which ownership is established and communities are mobilized to pursue general strategies that allow sustainability.

DOTS Strategy for Tuberculosis Prevention and Control in Botswana

- The study provided information on relationships between TB and other diseases with implications for the management of TB control programs. Insights were gained into the relationship between TB and other diseases, such as HIV infection. For example, rates of HIV infection in new patients with TB are significantly higher than in the general population and may exceed 50 percent. WHO / AFRO found this information quite useful. Gaps in understanding of interactions between TB and other diseases, such as HIV / AIDS and leprosy, contribute to failure of optimal TB management and control. Results from this study are valuable for other countries in sub-Saharan Africa and throughout the developing world, in their own battles against increasing rates of infection for TB and HIV / AIDS.

- An important accomplishment of this project was the introduction of a software package to enter records required to track and manage TB, at the district level. This package subsequently has been introduced in South Africa and other developing countries. In the early 1990s, throughout all of Africa, medical records were compiled by hand, an extremely time-consuming process, that left insufficient time for analysis. The International Union Against TB and Lung Disease (IUATLD) / WHO had developed a record-keeping system for managing TB patients, based on reports on incident cases generated quarterly and cohort analysis. To enable automatic generation of comparable information, a user friendly, menu-driven computer program, Botusa, was developed, based on EPI-Info version 6, a public-use software program obtained for minimal cost and already used in several developing countries.

CDC Technical Support for Strengthening WHO / AFRO to Address Malaria, Epidemic Preparedness and Response, and Disease Surveillance

- The collaboration between WHO / AFRO, CDC and USAID has strengthened capacity at the regional and country level for accelerated implementation of malaria control in the region.

- Further strengthening of general disease management and control activities is needed at the community, district and national levels.

- Access to good quality anti-malarial drugs remains an obstacle at the community level for malaria control.

- The generic Technical Guidelines for Integrated Disease Surveillance and Response in the African Region (July 2001) developed jointly by WHO / AFRO and CDC constitute an important set of tools that have been proven useful to countries. These guidelines are available in electronic versions so that individual countries may make appropriate adaptation for their respective systems.

- Training, resource materials, and disease management guidelines for understanding and responding to epidemic dysentery have contributed to improvements in national programs.

- Sensitization of all stakeholders and consensus-building are key to success in the process of IDSR implementation.

- IDSR is taking advantage of disease control programs already in place, such as poliomyelitis eradication in its surveillance component.

Next steps

The proposed future actions are illustrative of a more comprehensive list detailed in the individual impact assessments:

KEMRI Bednet Study in a Malaria High Endemic Region of Kenya

- It is important to address social and behavioral aspects of malaria control, and investigate policy and program implications of the community protective effect identified in the KEMRI bednet study.

- Future useful applications may be found by looking at what has been effective and what has not in terms of the longer-term sustainability of the bed-net intervention, e.g., ways to mobilize communities effectively and establish ownership.

- All results from the study should be carefully examined to clarify the areas of conflict arising from the former trials. A large gap remains between the scientific outcomes generated from research studies and the implementation of appropriate control interventions. In the former multi-center trials, very little time was made available to assess or digest the results of the studies fully. This resulted in an over-

interpretation of the results and conflicts between scientists that spilled into the public health arena.

DOTS Strategy for Tuberculosis Prevention and Control in Botswana

- The development of a partnership between the Botswana TB Control Program, WHO / AFRO, and other partners would facilitate the adoption and use of the Botusa software by TB programs in other African countries for record keeping and management of information on TB patients. A first step has been taken through support to the South African TB control program.

- Findings of operations research on TB in Botswana provide a sound basis for further investigations, including on the effect of the HIV / AIDS epidemic on TB transmission. The effect on the annual risk of infection of an increase in HIV-infected TB patients has been inadequately assessed. The documentation of increased levels of transmission is important for long-term planning and public health advocacy. In countries with high rates of HIV infection, community studies would be helpful to determine the relative importance of recent transmission as opposed to reactivation of TB. There are additional implications for use and duration of preventive therapy. The effects of the HIV epidemic on trends of TB in children and related consequences for TB in HIV-infected children need to be better understood. In general, continued advocacy is needed to promote funding for TB control programs, as well as applied research.

CDC Technical Support for Strengthening WHO / AFRO to Address Malaria, Epidemic Preparedness and Response, and Disease Surveillance

- 2001-02 are critical years for IDS during which at least three early adapter countries are needed with functioning systems at district level, to provide a basis for writing up practical lessons learned.

- Measures must be found to address problems that persist with contingency supplies, shortage of reagents for laboratory investigations and outbreak response, etc. most of which are given by donors. Donors suffer from fatigue, and countries must explore ways to assume more responsibility.

- To enhance effectiveness, it is important to incorporate malaria control interventions into integrated strategies at the level of health facilities and households.

KEMRI Bednet Study in a Malaria High Endemic Region of Kenya

Name of Activity:	Effect of Permethrin-Impregnated Bednets on Child Mortality in an Area of Intense Malaria Transmission in Western Kenya
Dates of Activity:	October 1995-September 1999
Location(s):	Kenya
Implementing Agency and Partners:	OIRH, CDC, Kenya MOH, Kenya Medical Research Institute (KEMRI), NGOs, PVOs, WHO, UNICEF
Total AFR/SD Funding:	$2,001,913
Leveraged Funds:	?

1. What was the problem or gap being addressed?

Bednets have long been used as one relatively simple measure for protection against the serious health threat posed by malaria. Previous studies in Africa had examined the effectiveness of treated bednets, in randomized controlled trials in areas of low, or high but very seasonal, malaria transmission and found them useful in reducing mortality among children under five years of age. For example, relevant studies indicate that treated bednets reduce child mortality by approximately 19 percent (14-29%). No data were available, however, to measure the efficacy of treated bednets in areas of high perennial malaria transmission. Since data from the randomized controlled trials suggested that bednet efficacy appeared to be higher in areas of low transmission, and was lower in areas of high transmission, it was deemed important to conduct a scientific investigation in an area of intense perennial malaria transmission (WHO, Informal Consultation in Brazzaville, March 1996). The randomized, controlled trial in western Kenya, supported by USAID, was designed to fill this gap.

A careful evaluation of morbidity and mortality data collected and analyzed in previous randomized controlled trials identified certain key scientific issues to be resolved:

- Is the efficacy of bednets affected by study year rather than by transmission?

  The overall efficacy of the trials has been estimated, regardless of a study's duration. On disaggregation of overall results from multi-center trials, the efficacy of bednets is shown consistently to be higher in the first compared with the second year. Results from a study in Burkina Faso revealed high efficacy (30% reduction) the first year, contrasted with zero percent in the second, yielding a low overall efficacy rate (14%) in this high transmission area. In The Gambia, a low transmission area, the efficacy of bednets was classified as high (23%), based only on first-year results. The efficacy in Kilifi, a low transmission area, was greatest overall

(19%), but still higher in the first year than in the second. Only in Ghana (with high but seasonal transmission) were results consistent (18%) for both study years.

- Is the efficacy of bednets affected by coverage rather than transmission?

Results from previous studies suggest that net efficacy may relate not solely to transmission, but also to coverage. In Ghana, where general efficacy was 18 percent, one bednet was allocated to three persons within the total population. In Kilifi, with efficacy estimated at 29 percent, the person-to-net ratio was 1.5.

- Does the efficacy on child morbidity increase with specific case definition?

The actual effect of bednets on child survival is more compelling, if similar effects are shown for malaria-associated morbidity indicators. While a significant effect was detected in all outcomes, including severe malaria at the district hospital in Kilifi, this was not seen at any of the other trial sites. In Burkina Faso, the more specific the malaria case definition, the lower the efficacy. In The Gambia, treated bednets did not impact on high-density parasitemia or on the mean packed cell volume. Morbidity outcomes were not presented from the Ghana trial. Anemia, the most important marker of malaria-associated morbidity and one of the most important risk factors for child survival, was inadequately monitored in the multi-center trials.

- Do treated bednets improve pregnancy outcomes?

It is generally assumed that malaria only affects women in the first and second, but not subsequent pregnancies. The multi-center trials only assessed effects of bednets on first pregnancies. Results are confusing, limited, and inconsistent. Burkina Faso did not examine pregnancy. Ghana conducted a trial but distributed nets after pregnancy was declared, and apparently has not published efficacy results, although verbal reports suggest no efficacy. Thus, no data are available on the effect of bednets on pregnancy outcomes in high transmission areas. Results from Kilifi indicate bednets did not impact on first pregnancy, in low transmission areas, while The Gambia (also low transmission) reported a seasonally-dependent effect.

2. What was the purpose of the activity?

The purpose of the activity was to investigate various effects of the bednet intervention, in an area of high transmission, to understand its potential contributions in combating malaria.

Researchers recognized, at the start of the trial, that ‘public health’ was moving faster than science, in terms of the desire to distribute bednets in all endemic countries. Regardless of the outcome of the bednet trial, bednet programs would already have been introduced by the time results were published. Consequently, it was decided to take the time to make the bednet trial in western Kenya the ‘definitive’ scientific study, one that would address conflicting findings, such as those described in the preceding section, and clarify certain

issues that may have been poorly monitored in earlier studies. This was done by clearly defining the efficacy of treated bednets on under-five child mortality and morbidity in an area of high perennial malaria transmission, using methods similar to those adopted in the multi-center trial, to allow comparability of effects observed in western Kenya with other sites. The shortage of rain mid-way in the study provided an opportunity to evaluate the effect of bednets in the same area and population, but with a different malaria transmission pattern.

3. What were the specific objectives of the activity?

The primary objective of the bednet trial was to measure the effect of permethrin-impregnated bednets on reducing all causes of mortality among children 1-59 months of age.

Specific objectives were to:

- measure the impact of the intervention on severe disease in young children;
- measure the impact of the intervention on the incidence of placental parasitemia and low-birth weight;
- measure the impact of the intervention on child growth and development;
- elucidate socio-economic factors affecting long-term sustainability of this intervention in Western Kenya;
- measure the effect of the intervention on the amount of malaria transmission due to each of the three major vectors of malaria present in the study area; and
- measure the effect of the intervention on the degree of tolerance to permethrin in the vector population, with emphasis on the principal vector, A. gambiae.

Various secondary objectives involved estimations of the effect of the intervention on general and malaria-specific morbidity among children under 59 months of age; on placental malaria and maternal anemia, and birth outcome; on entomological parameters, including the development of resistance to permethrin; and on social and economic factors associated with bednet use. Spatial analysis was used to determine the potential public health impact of partial coverage of bednets.

4. What took place in implementing the activity?

Prior to the trial, meetings were held with government officials (division officers, chiefs, and assistant chiefs) to explain the purpose of the bednet trial. Open community meetings (barazas) were conducted in each of the 33 sub-locations in Asembo and Gem, to obtain the support and participation of the villagers. Such meetings provided an opportunity to answer questions about the planned study, e.g., the need for it in western Kenya; the nature and methodology of sub-studies; expectations of voluntary participation; bednet ownership

and care during the study. Bilingual leaflets describing the project (in the local language, Dholuo, and English) were distributed. The barazas concluded with authorization by participants to conduct the trial in their particular village or area. Community approval was granted in all 33 sub-locations.

Educational activities were initiated to inform the community further about the trial. Traditional birth attendants (TBAs) wrote songs about the study to sing at barazas and other traditional functions. Ten local actors were trained to perform Participatory Educational Theatre (PET) skits specifically about the trial. The PET team, prior to the introduction of the bednets, visited villages at least once. PET skits were also performed at primary schools in Asembo. Children participated in school drawing and poetry competitions detailing the main elements of the study. Winning materials were used for pictorial information calendars with monthly educational messages on malaria prevention and on study activities. Voluntary village bednet committees were formed to help communicate information about the trial to villagers.

The mapping team travelled throughout Asembo and Gem, and painted a coded number on the doors of individual homes designating the village, compound and house. Mapping was performed using a differential global positioning system (GPS). Family compounds, market areas, schools, health facilities, churches, study offices, boreholes, shallow wells, river beds, roads and potential mosquito breeding sites (dams and burrow pits) were mapped, and calibrated locations were exported in Dbase format to create base maps of the study area and to link with all epidemiological, clinical, entomological, and sociological data for spatial analysis.

A community-based demographic and health surveillance site (DSS) was designed to enumerate children in the study site; monitor deaths and trends in child morbidity; and measure clinical indices. Surveillance methods conformed to guidelines set by WHO for the previous randomized controlled trials. Periodic data were gathered on coverage and compliance with bednet use, entomological indices, perceptions of disease and treatment-seeking behavior and disease-related costs at both household and health service levels. Sub-studies were grouped according to four research and surveillance classifications for evaluating the impact of bednets on child mortality, morbidity, entomological and spatial indices, and socio-economic variables.

As field operations commenced, central site offices were created in both Asembo and Gem. For logistical purposes, the study site of 500 km^2 was divided into 38 geographical clusters, or sectors. A local office was established for each sector and managed by a field supervisor. Supervisors were trained to take responsibility for census, surveys, and communications in their sector. Senior supervisors conducted training and monitoring activities through their central field office, which became an important interaction point for field staff and scientists. Some 300 TBAs, attached to their respective sector office, were recruited to conduct census enumeration and communication activities in their village of residence. Forms, bednets, permethrin, and clinical supplies were transferred from the administrative,

laboratory, and computer central facilities in Kisian, to central and sector offices. Laboratory and entomology samples were transported daily to Kisian. Bednet distribution and re-treatment activities were organized by the entomology team. A fleet of nine vehicles were maintained for transport of forms, supplies, and personnel.

5. What were the outcomes of this activity?

- Villagers trained in bednet use

After learning that approximately 30 percent of villagers were either not using their nets at all or had not hung them properly, staff organized to visit every house in the study, thereby insuring that each individual to whom the net was assigned was instructed in its proper use.

- Computer facilities upgraded at the central field office of KEMRI

- Surveillance activities strengthened at health facilities

- Surveillance methodologies developed

Monitoring instruments were designed for vital registration and tracking health events (e.g., hospitalization for severe disease, death). ID cards were issued to children to track patterns of health-seeking behavior and outcomes. The verbal autopsy form and a separate instrument for monitoring socio-cultural events surrounding child deaths were field tested and finalized.

- Numerous clinical studies analyzed

Baseline data (collected 9-10/97) were analyzed measuring hemoglobin, parasitemia levels, and development status.

- Results disseminated locally, nationally, and internationally

Community meetings are planned for August 2001 to report back to the population, administrative persons, and other partners in the field. Nationally, at a meeting planned for late August 2001, in Nairobi, results will be presented to supporting agencies and interested partners in Kenya. (A copy of the agenda is attached as Appendix A.) Internationally, the results will be published as a series of 20 academic papers in a "Bednet Supplement" to the American Journal of Tropical Medicine and Hygiene (see Appendix B). A symposium on the subject is planned for the American Society of Tropical Medicine meeting in Atlanta, November 2001.

- Local infrastructure supported

Buildings at KEMRI have been upgraded, rebuilt and maintained for the bednet study, including facilities for staff, laboratories, computing, and administration. Technical materials and computers have been made available to local scientific staff. Prior to the trial, ten 386 computers were accessible in two administrative offices. With the influx of

large volumes of census forms, and data entry needs, a computer center was established, and the computing capacity expanded, initially to include 486 computers, then networked Pentium computers. By the end of the project, some ten Pentium computers were in situ. A satellite link (VSAT system) was set up allowing faster Internet access and improved communication for all employees.

6. What complementary efforts have contributed to the results of this activity?

Supplementary USAID grants provided additional funding for more in-depth research on some child health issues, including anemia, anti-malarial drug resistance, and HIV. Additional funding by WOTRO (The Netherlands) supported training for Kenyan and Dutch researchers. A WHO grant provided training for a student investigating the impact of bednets on cellular and humoral immunity. Links with the Ministry of Health enabled a public health officer to be seconded to the bednet project.

The following activities, funded by various sources, complemented the bednet project:

- Insecticide resistance studies by Dr. J.M. Vulule of KEMRI, funded by WHO / TDR (in addition to routine monitoring of permethrin) assessed biochemical and molecular mechanisms of permethrin resistance intended to develop a rapid test of permethrin resistance for effective management in the field.

- Immunological studies by Mr. Simon Kariuki (as his Ph.D. dissertation), funded by WHO / TDR, compared immune responses of children and adults who either do or do not sleep under permethrin-impregnated bednets.

- Population genetics of A. gambiae by Ms. Luna Kamau, in collaboration with Dr. Tovi Lehmann, funded by WHO, examined the effect of bednet use on population genetics structure of A. gambiae.

- Ethnomedical and ethnographic studies, by Dr. Karen Shelley, CDC / Emory University, provided a basis for sociological and anthropological project activities.

- Cohort study, funded by USAID, is monitoring longitudinally a cohort of children from birth, using clinical, immunological, parasitological and entomological data routinely gathered within the bednet study site.

- HIV / AIDS surveillance, at the community and hospital levels, with testing and counseling, is ongoing in part of the bednet site to provide crude estimates of HIV seroprevalence.

- Vertical transmission studies by KEMRI, is trying to assess better the interaction between placental parasitemia, vertical transmission of HIV, and progression of HIV-related disease.

- Upgrading CDC / KEMRI's computer network, funded by CDC's Emerging Infections Program, includes a 24-note Novell network that incorporates eight Pentium PCs.

7. What results (impact) have been achieved to date?

USAID support provided the western Kenya study the unprecedented freedom to broaden its original scope to follow up on unresolved issues. This was done by incorporating the following elements into the study design:

- Disaggregating first and second year results, staggering sites so that first year of Gem corresponds with second year of Asembo; assessing effects of 'community protection' from mass effects of bednets on control population in first and second study year; assessing effects of changes in transmission (rainfall / entomology) to test transmission theory.

- Providing the same high coverage as the study in Kilifi, observing coverage and adherence to bednet use throughout the trial, and assessing impact of coverage on entomological indices.

- Testing all key morbidity markers, e.g., anemia, parasitaemia, and monitoring immunological markers; defining efficacy of bednets on increasingly specific case definition for malaria and anemia; monitoring longitudinally as well as repeat surveys; investigating the influence of 'community mass protection' of bednets (in control villages bordering intervention villages) on child morbidity; and defining which markers best detect this effect.

- Providing bednets to women pre-pregnancy (all women received cover regardless of pregnancy status), monitoring key pregnancy outcomes, and assessing effects of bednets on all parities.

Although this expanded scope of work unavoidably delayed publication of results, this study will provide closure on conflicting scientific findings related to the use of bednets for malaria prevention and control.

Understanding the problem

Currently, analyses of the data have been completed and all papers are nearing completion. (Appendix B lists the draft papers to be submitted for the supplement to the AJTMH.)

The trial achieved a bednet coverage rate (average number of persons per bednet issued) of 1.46 persons. Adherence, i.e., the proportion of people observed to be sleeping under their bednet, was 72 percent during the study. Mortality analysis was based on intention to treat, by village of residence. Highlights of the unpublished findings can be summarized as follows:

- Mortality in under-ones decreased by an overall 21 percent.

- Clinical malaria (fever plus age-dependent parasite rate) was significantly reduced by ~ 45 percent in children < 3 years living in intervention villages.

- Overall, bednets significantly reduced the mortality of children 1-59 months of age by 15 percent (95% confidence intervals) and saved eight lives for every 1,000 children protected. Between 1997-99, 1,719 deaths occurred in children aged 1-59 months, in a total population of 35,931 child-years contributed. Mortality rates among children from control and intervention villages were 51.5 and 44 per 1,000, respectively. In children aged 1-11 months, bednets reduced mortality by 21 percent, and by 8 percent in children aged 12-59 months. Bednets had a higher efficacy in 1997, the first study year, in Adembo, reducing mortality in children 1-59 monts by 34 percent. The efficacy was lowest during the second study year in Gen, in 1999, when mortality was 4 percent higher in bednet villages, contrasted with control villages. Reasons for this trend are unclear and possibly result from several factors, e.g., improved health in control villages consequent to the community mass effect of bednets, fluctuating immunity of young children under bednets, and increased mortality from other illnesses, such as HIV.

- Low birthweight (both intrauterine growth retardation and pre-term delivery) reduced significantly.
    - Maternal anemia significantly reduced.
    - Child morbidity from malaria significantly reduced.
    - Immune markers of sporozoite exposure down.
    - Markers of overall immunological robustness up (children not overwhelmed by the parasitemia).

- A. funestus densities much more affected by ITNs than A. gambiae.

- Important behavioral findings on use of nets and barriers: children less than 5 years of age were significantly less likely than older individuals (65.9% vs. 74.0%) to use bednets regularly. Non-adherence was due to temperature and to “disruption of sleeping arrangements.”

- Indoor-resting density of fed A. gambiae s.l. and A. funestus was 58.5 percent in bednet houses and 94.5 percent in control houses.

- P. falciparum transmission in intervention areas was 90 percent lower than in control areas.

- No permethrin resistance was detected during the study.

- As measured by densities of A. gambiae s.l., the efficacy of bednets declined, if one or more residents did not sleep under a net or, if bednets had not been retreated within six months.

- In pregnant women (gravidae 1-4), the incidence risks of malaria were 37.6 percent in bednet villages, compared to 45.5 percent in control villages; the incidence risks of moderate anemia were 20.3 percent and 32.9 percent, respectively, and the prevalence of adverse birth outcome was 24.8 percent and 32.1 percent, respectively.

- Data from western Kenya do not support the hypothesis that bednets are more effective in areas of low malaria transmission.

Permethrin-treated nets, under trial conditions, were therefore shown to be effective in reducing child mortality and morbidity and adverse pregnancy outcomes, to substantially modify entomological indices, and to have a community mass effect, for clinical malaria, parasitemia and anemia, that extended into control areas of the study.

Changes in policies and programs

The present study was designed, from its inception, to focus on research, as opposed to policy. The study was undertaken to collect statistically significant data permitting a scientific assessment of the effectiveness of bednets, both in terms of protective benefits to users and cost (for training in proper use, the cost of nets, and their semi-annual reimpregnation—in an area with limited resources), in an area of intense malaria transmission. As a result of the work in western Kenya supported by USAID, CDC, and others, it is established that one can, without hesitation, promote a more normative application of bednets as an effective tool to combat malaria. Bednets are good for everyone—pregnant women, children, individuals, and families, in areas of low or intense transmission. This indisputable finding obviates the need to designate potential receipents of bednets in one district or geographic area as opposed to others, thereby circumventing any related political sensitivities.

More specifically, it is clear that appropriate provisions must be made to instruct recipients of bednets in their proper use, as systematic arrangements are necessary to treat the nets that are not permanently impregnated at least every six months. Given the vulnerabilities of young children and pregnant women, bednets offer important protection for these population groups. It will be timely to examine more closely the nature of the ‘community

protective effect, particularly on children, for clinical malaria, parasitemia, and anemia, in addition to any second-year effects.

African capacity building

Implementation of a large-scale field study covering a range of disciplines required a commitment to build capacity among non-academic and academic staff. At the field level, TBAs were recruited, if they had previous field or NGO experience and could read and write English. The most capable TBAs were trained further to conduct gestational assessments, and, over time, served as supervisory staff for pregnancy monitoring. Field supervisors were chosen from a pool of locally resident, predominantly male, field staff, with a final year of secondary education, and experience with previous field studies. Exceptional supervisors were awarded grants for specialized training in GIS, social sciences, demography, or data management. Some field staff have trained further to become clinical officers and technical assistants. Numerous technical staff at KEMRI have participated in various training programs at CDC and other institutions, in GIS, data management, statistics, epidemiology, and public health.

Over the course of the project, some twenty scientists, national and international, participated in the scientific agenda. Of those seeking higher education, seven achieved post-graduate degrees. Four African scientists were awarded M.Sc. degrees, two were awarded Ph.D. grants, and one is completing papers for a Ph.D. dissertation. A number of African scientists have served as members of workshops and panels on their area of expertise. In the most practical sense, the study provided solid training in basic data management, computer skills, and enhancement of literacy levels among local health workers.

8. What lessons have we learned from this activity?

- Interpretation of results and relevant implications for policies and programs

A large gap remains between the scientific outcomes generated from research studies and the implementation of control interventions. In the former multi-center trials, very little time was made available to assess or digest the results of the studies fully. This resulted in an over-interpretation of the results and conflicts between scientists that spilled into the public health arena. The results from this current study, while taking longer to finalize, have been meticulously considered to clarify the areas of conflict arising from the former trials.

- Research methodology

Retrospectively, CDC researchers conclude that monitoring the total population was not necessary for the success of the bednet trial. With hindsight and an accumulation of five years of data, researchers consider that the activity could have focused solely on children < 3 years of age. Extending the study into Gem strained the infrastructure,

particularly with respect to data management. Adding scientific questions made the study more comprehensive but increased the data management burden, and prolonged the time frame. It was not adequately recognized, when the study was undertaken, how much time or expertise would be required to clean the data from the census and clinical studies effectively. The attempt to monitor individual children over time, through the census, was particularly challenging owing to the difficulty in accurately tracking a mobile population, the effect of adult mortality on child residence, and changes made routinely within families to their children's three names. Morbidity studies were too complicated, and gathered a substantial number of indices that required dedicated cleaning over a period of years.

- Sustainability

Based on the experience in extended use of bednets in households in western Kenya, useful insights may be gained into general strategies that allow sustainability and processes through which ownership is established and communities may be mobilized to pursue important goals.

- Areas to address in building African capacity

Recruiting Kenyan scientists was difficult, because western Kenya is not considered a prestigious place to work and many NGOs in Kenya offer higher salaries than research institutes. The CDC / KEMRI salary structure was not sufficiently competitive to recruit people with suitable qualifications away from NGO and international organizations. More junior-level national and international staff were thus recruited who required more mentoring by senior staff. Further turnover was high among junior Kenyan scientists, which disrupted the study. This occurred because students appeared highly competent during interviews but, in practice, had little experience or expertise.

9. What are the next steps to capitalize on the activity?

- Disseminate findings, as described above.

- Present findings to WHO and other international partners committed to implementing malaria control strategies.

- Evaluate long-term efficacy of bednets (currently in progress).

- Evaluate critically public health issues that will impact on a bednet program in Kenya; for example, the logistical issues associated with getting young (post-weaning) children to use bednets, maintaining adequate concentration of insecticide, and modes of subsidizing bednets and insecticides for target populations.

- Based on findings from studies conducted in parallel with the bednet study, clarify priority areas of research (e.g., definition of the next anti-malarial drug regimen, definition of tools to improve the recognition and treatment of anemia at health facilities and in the community, methods to strengthen diagnosis and treatment at peripheral health facilities).

- Identify appropriate ways to use and maintain the very large laboratory facility now developed in western Kenya with its good capabilities to track the morbidity of large populations. It may be used as a national or regional reference laboratory

Key Informants

Dr. Peter B. Bloland, CDC
Dr. John Paul Clark, WHO / HQ (formerly with USAID)
Dr. Sambe Duale, SARA Project
Dr. Mary Ettling, USAID / AFR / SD
Dr. William Hawley, CDC
Ms. Linda Hoffman, OIRH / USPHS / HHS
Dr. Patrick Kachur, CDC
Mr. Craig Leutzinger, CDC
Mr. William Lyerly, USAID
Ms. Subhi Mehdi, USAID / AFR / SD
Dr. Roscoe Moore, OIRH / USPHS / HHS
Dr. Penny Phillips-Howard, CDC
Dr. Suzanne Prysor-Jones, SARA Project
Ms. Elaine Roski, OIRH / USPHS / HHS
Dr. Trent Ruebush, CDC
Dr. Laurence Slutsker, CDC
Dr. Rick Steketee, CDC
Dr. Hope Sukin, Chief, USAID / AFR / SD
Dr. Feiko O. ter Kuile, CDC

APPENDIX A

Randomized Controlled Trial of Permethrin-Treated Bednets in Western Kenya: Dissemination of Results to Institutional Partners

Agenda for Kenya Bednet Project Closing Ceremony/Demographic Surveillance System (DSS) Launch

21 August (Tuesday)

Arrival in Kismu of invited guests:
Dr. David Alnwick, Director, Roll Back Malaria
Dr. David Fleming, Deputy Director, CDC
Dr. Steve Blount, Director, Office of Global Health, CDC

2:00 pm	Briefing of District Health Management Teams for Bondo and Siaya Districts (Odhacha and Hawley).

22 August (Wednesday)

Official Closing Ceremony for Bednet Project
Official Launch of Demographic Surveillance System

Venue:	Raliew Primary School, Asembo and Lwak, Family Life Training Center
Morning:	Bicycle Race, Road Race, Boat Race
Noon:	Lunch in Asembo or Lwak for visiting dignitaries
2:00 pm:	Closing Ceremony

Though open to all interested, these individuals from the local area will be invited:

1. The local area District Officer. D.O. Wagai, D.O. Yala D.O. Rarieda
2. All the chiefs and assistant chiefs from Asembo and Gem
3. Selected school teachers from both Asembo and Gem
4. Opinion and church leaders
5. Counselors
6. Local health personnel

Arrival of guests: Nyamrerwa songs.
Introduction of guests by Master of Ceremonies (Amos Odhacha).
Welcoming speech Director CVBCR, KEMRI (Dr. Vulule)
Welcoming speech Director of CDC / Kenya (Dr. DeCock)
Presentation of key findings of Bednet Project (Dr. Nahlen)
Remarks by Director, Roll Back Malaria, WHO (Dr. David Alnwick)
Remarks by Deputy Director of CDC (Dr. David Fleming)
Remarks by MOH Bondo
Remarks by MOH Siaya
Remarks by PMO Nyanza
Closing Remarks: Dr. Larry Slusker Director CDC / KEMRI
Presentation of awards
Official Launch of DSS
4:00 pm Football competition—Asembo vs. Gem.

<u>23 August 2001 (Thursday), Holiday Inn, Nairobi</u>

Arrival
2:00 pm Welcome and introduction of guests:
Dr. Kevin DeCock, Director, CDC / Kenya
2:05 pm Opening Remarks: US Ambassador to Kenya, Johnny Carson
2:15 pm Opening Remarks: DMS (Dr. Muga)

Session 1. Chair: Dr. Kevin DeCock, CDC / KEMRI
2:25 pm Rationale and design of the Kisumu bednet trial:
Dr. Penny Phillips-Howard
2:35 pm Effect of bednets on mosquitoes and malaria transmission:
Dr. William Hawley
2:45 pm Factors affecting bednet use, the human component:
Dr. Jane Alaii
2:55 pm Impact of bednets on children: Dr. Feiko ter Kuile
3:10 pm Immunological studies associated with bednet use:
Dr. Simon Kariuki
3:20-3:35 pm Break

Session 2.	Chair: Dr. John Paul Clark, WHO / RBM
3:35 pm	Impact of bednets on pregnant women and birth outcomes: Dr. Feiko ter Kuile
3:50 pm	To what extent do your neighbors' bednets protect you? Dr. William Hawley
4:00 pm	Do bednets reduce child mortality in western Kenya? Dr. Penny Phillips-Howard
4:10 pm	Bednets and Roll-Back Malaria: Dr. Bernard Nahlen
4:20-4:55 pm	Open forum discussion
4:55-5:00 pm	Closing remarks

<u>24 August 2001 (Friday)</u>

2:00-4:00 pm	Presentation of scientific results to field and lab staff, Kisian (Hawley)

<u>27 August 2001 (Monday)</u>

Venue:	2 locations in Asembo

Detailed presentation of results to community members and discussion

Team 1	Hawley and Odhacha
Team 2	Gimnig and Alaii / Olang'

<u>28 August 2001 (Tuesday)</u>

Venue:	2 locations in Gem

Detailed presentation of results to community members and discussion

Team 1	Hawley and Odhacha
Team 2	Gimnig and Alaii / Olang'

APPENDIX B

Scientific Papers in Preparation for the Bednet Supplement

Phillips-Howard, P.A., B.L. Nahlen, J.A. Alaii, F.O. ter Kuile, J. Gimnig, D.J. Terlouw, S.P. Kachur, A.W. Hightower, A. Lal, E. Schoute, A.J. Oloo and W.A. Hawley. "The efficacy of permethrin-treated bednets on child mortality and morbidity in western Kenya: I Study site, development of infrastructure and capacity."

Phillips-Howard, P.A., F.O. ter Kuile, B.L. Nahlen, J.A. Alaii, J. Gimnig, M.S. Kolczak, D.J. Terlouw, S. Kariuki, Y.P. Shi, S.P. Kachur, A.W. Hightower, J. Vulule and W.A. Hawley. "The efficacy of permethrin-treated bednets on child mortality and morbidity in western Kenya: II Design and methods of evaluation."

Alaii J, S.P. Kachur, W.A. Hawley, K. Shelley, J. Gimnig, H. Mwenesi, J. Vulule, B. van den Borne, B.L. Nahlen and P.A. Phillips-Howard. "Community reactions to the introduction of permethrin-treated bednets during a randomised controlled trial in western Kenya." American Journal of Tropical Medicine and Hygiene (Supplement).

Alaii, J, W.A. Hawley, F.O. ter Kuile, J. Vulule, M.S. Kolczak, J. Gimnig, B.L. Nahlen and P.A. Phillips-Howard. "Factors affecting the use of permethrin treated bednets during a randomised controlled trial in western Kenya."

Gimnig J, T. Lo, J. Vulule, L. Kamau, M.S. Kolczak, P.A. Phillips-Howard, B.L. Nahlen, A. Oloo, A.W. Hightower and W.A. Hawley. "Impact of permethrin-treated bednets on entomological indices in an area of intense year round malaria transmission."

Gimnig, J.E., M.S. Kolczak, A.W. Hightower, E. Schoute, M. Ombok, G.B. Olang, L. Kamau, P.A. Phillips-Howard and W.A. Hawley. "Effect of permethrin-impregnated bednets on the spatial distribution of malaria vectors in western Kenya."

ter Kuile, F.O., D.J. Terlouw, P.A. Phillips-Howard, W.A. Hawley, J.F. Friedman, S. Kariuki, M.S. Kolczak, Ping Shi Ya, A.J. Oloo and B.L. Nahlen. "Impact of permethrin-treated bednets on malaria and all cause morbidity in young children in an area of intense perennial malaria transmission in western Kenya."

Kariuki, S.K., D.J. Terlouw, F.O. ter Kuile, U. Venkatachalam, A.S.S. Orago, A. Hightower, P.A. Phillips-Howard, W.A. Hawley, B.L. Nahlen, A.A. Lal, and Ping Shi Ya. "Effects of permethrin-treated bednets on natural acquired immunity to malaria in western Kenya: Cellular and humoral immune responses in young children in an area with intense perennial malaria transmission."

Scientific Papers in Preparation for the Bednet Supplement (continued)

Hawley, W.A., D.J. Terlouw, J. Gimnig, P.A. Phillips-Howard, S. Kariuki, E. Schoute, M.S. Kolczak, Ping Shi Ya, A.J. Oloo, B.L. Nahlen and F.O. ter Kuile. "Permethrin-treated bednets also reduce morbidity in neighbouring control villages: Evidence for mass effect in a population based bednet study in western Kenya."

Meltzer, M.I., D.J. Terlouw, A. Odhacha, M.S, Kolczak, F.O. ter Kuile, A. Kwena, J. Alaii, J. Gimnig, B.L. Nahlen, W.A. Hawley, P.A. Phillips-Howard. "Relative wealth, poverty and permethrin-treated bednets: implications for controlling malaria in children in western Kenya."

Friedman, J.F., F.O. ter Kuile, P.A. Phillips-Howard, D.J. Terlouw, W.A. Hawley, M.S. Kolczak, A.J. Oloo and B.L. Nahlen. "Impact of permethrin-treated bednets on growth, school attendance and performance in primary school children in western Kenya."

Leenstra, T, P.A. Phillips-Howard, S.K. Kariuki, W.A. Hawley, J.A. Alaii, D. Rosen, A.J. Oloo, P.A. Kager and F.O. ter Kuile. "Permethrin-treated bednets in the prevention of malaria and anemia in adolescent schoolgirls, in western Kenya."

ter Kuile, F.O., D.J. Terlouw, P.A. Phillips-Howard, W.A. Hawley, J.F. Friedman, S. Kariuki, Ping Shi Ya, E. Schoute, M.S. Kolczak, A.J. Oloo and B.L. Nahlen. "Permethrin impregnated bednets reduce malaria in pregnancy in an area of intense perennial malaria transmission in western Kenya."

Kariuki, S.K., F.O. ter Kuile, D.J. Terlouw, A.S.S. Orago, U. Venkatachalam, A. Hightower, P.A. Phillips-Howard, W.A. Hawley, B.L. Nahlen, A.A. Lal AA and Ping Shi Ya. "Effects of permethrin-treated bednets on natural acquired immunity to malaria in western Kenya: Humoral immune responses in pregnant women and cord bloods in an area with intense perennial malaria transmission."

Phillips-Howard, P.A., M.S. Kolczak, K. Wannemuehler, J.E. Gimnig, J.A. Arudo, F.O. ter Kuile, P.D. McElroy, A.W. Hightower, J. Vulule, B.L. Nahlen and W.A. Hawley. "Epidemiology of child mortality during a randomised controlled trial on permethrin treated bednets in western Kenya."

Arudo, J., J. Gimnig, S.P. Kachur, L. Slutsker, M.S.S. Kolczak, W.A. Hawley, A.S.S. Orago, B.L. Nahlen and P.A. Phillips-Howard. "Estimation of mortality in children under 5 years using passive surveillance in rural western Kenya."

Scientific Papers in Preparation for the Bednet Supplement (continued)

Phillips-Howard, P.A., B.L. Nahlen, M.S. Kolczak, A.W. Hightower, F.O. ter Kuile, J.A. Alaii, J. Gimnig, A. Arudo, J. Vulule, A. Odhacha, S.P. Kachur, E. Schoute, D. Rosen, A. Oloo and W.A. Hawley. "Efficacy of permethrin-treated bednets in the prevention of mortality in young children in an area of high perennial malaria transmission in western Kenya."

Alaii, J., S.P. Kachur, W. Hawley, H. Mwenesi, B.L. Nahlen and P.A. Phillips-Howard. "Malaria knowledge, attitudes, beliefs and practices (KABP) among mothers of children <5 years in Western Kenya: Pre- and post-intervention perspectives."

LSHTMH-CDC collaborators. "Cost-effectiveness analysis of permethrin treated bednets in an area of intense perennial malaria transmission."

Hawley, W.A., P.A. Phillips-Howard, J.P. Clark, J. Alaii, A. Odhacha, R. Steketee, S.P. Kachur, F.O. ter Kuile, K. de Cock and B.L. Nahlen. "Implications of permethrin-treated bednets for malaria control."

DOTS Strategy for Tuberculosis Prevention and Control in Botswana

Name of Activity:	Emerging Diseases: Tuberculosis in Botswana
Dates of Activity:	October 1993 – April 1996
Location(s):	Botswana and CDC Headquarters in Atlanta, GA
Collaborating Partners:	OIRH, CDC, Botswana MOH, WHO/AFRO
Total AFR/SD Funding:	$ 223,860
Leveraged Funds:	NA

1. What was the problem or gap being addressed?

At the time the study was developed, tuberculosis (TB) was responsible for more mortality and lost productivity in sub-Saharan Africa than any other infectious agent. Since 1985 the number of TB cases in sub-Saharan Africa is as much as 50 percent higher than would have been expected, had trends from the pre-HIV era continued. This increase in TB cases is directly correlated with levels of HIV seroprevalence. The incidence of tuberculosis (TB) increases rapidly with high rates of HIV infection, and despite the availability of effective interventions, many TB programs fail to cope with the increased TB caseload. The rate of increase in case rates is inversely correlated to the quality of TB control programs.

Investigations were needed to learn more about the magnitude of the increase in TB morbidity associated with HIV infection and the ability of TB control efforts to counteract it.

2. What was the purpose of the activity?

In late 1993, Botswana had one of the highest rates of TB among African countries, despite a model program for TB control and prevention and plentiful economic resources generated by diamond mines. This activity was initiated in response to the expressed interest of the Government of Botswana in conducting operations research on ways to address the public health problem posed by TB.

The results of operations research in Botswana involving the Direct Observed Therapy Short Course (DOTS) were anticipated to assist other countries in sub-Saharan Africa and elsewhere, where TB and HIV rates are increasing, in developing more effective TB programs. Information obtained can improve resource allocation, TB strategies, policies, and programs in health in the region.

3. What were the specific objectives of the activity?

The project was intended to strengthen Botswana's national TB surveillance program and laboratory capabilities, and address issues related to the interaction of TB and certain diseases, such as HIV, in other countries. Specific objectives were to:

- estimate the extent of TB infection and of TB / HIV co-infection;
- review existing TB control program strategies; and
- recommend program and laboratory improvements.

4. What took place in implementing the activity?

In the early 1990s, throughout all of Africa, medical records were compiled by hand; an extremely time-consuming process that left insufficient time for analysis. A simple EPI-Info program was introduced at district level, where computers were available. The software was made available free to anyone who needed it, and training programs were organized on its use.

The project examined the methods to detect TB in children, a difficult task even under the most favorable circumstances.

The team of CDC researchers conducted an assessment of national TB control programs in 22 countries.

5. What were the outcomes of this activity?

- Development of new Epi-Info-based Software for Use with IUATLD / WHO TB Registration System (finalized in 22 health districts)

  In the International Union Against TB and Lung Disease (IUATLD) / WHO record-keeping system for managing TB patients, reports on incident cases are generated quarterly. Cohort analysis is performed for those smear-positive patients expected to complete treatment, during the same quarter. Such reports constitute an important management tool to assess program performance to determine future needs for materials. Compiling similar reports manually is slow, and the cohort analysis is particularly difficult to conduct accurately. To enable automatic generation of comparable information, a user-friendly, menu-driven computer program was developed, Botusa, based on EPI-Info version 6, a public-use software package obtained for minimal cost and already used in several developing countries. The computer system, based on the paper registry system, was developed by the IUATLD and used throughout the developed world. Botusa, intended for use at district level, permits essential data from patient registries to be entered and information on results of smears and therapy outcomes to be updated. It tracks

patients for whom updated information is required but has not yet been obtained. The program also calculates appropriate drug and tablet dosages by age and body weight, provides lists of patients requiring further follow-up, and includes various messages that appear automatically instructing TB coordinators on steps to be followed in particular instances. Quarterly and cohort reports can be automatically generated for the current quarter or any quarter during the preceding two years. Data collected by districts can be merged at national level, and transferred-out cases can be tracked at the national level to determine whether or not they completed therapy. The TB manual for the country is available for instant reference within the computer program.

- October 23-24, 1995, Meeting of the Tuberculosis Control Initiative for Southern Africa (SATCI), Midgard Lodge, Namibia

This meeting was attended by 20 African participants representing 12 Southern African Development Community (SADC) countries. The discussion focused on effective surveillance in TB control programs; laboratory surveillance; KABP and health facility surveys; public health education / advocacy; broader approaches to microbiology / bacteriology; and the desirability of training through workshops at national TB and chest hospitals / centers.

- November 2-12, 1994, Southern African Regional TB and HIV Conference

TB investigators from the southern African region, all members of SADC, looked at areas of collaboration for TB prevention and control in the era of HIV / AIDS in the region. Dr. Nancy Binkin, Principal Investigator (PI) on this study and Associate Director, International Activities DTBE, CDC, presented data on lessons in TB control that developing countries can gain from U.S. experience.

- Initiation of the Tuberculin Skin Text (TST) Survey

The study examined the prevalence of, and risk factors for, positive TST reactions in children aged 3-60 months in Botswana, where coverage with BCG is high. Of the 820 children tested, 92.3 percent had received BCG at birth. A total of 7 percent of children had more than 10 mm induration ("positive" TT), and 2 percent had more than 15 mm. TST positivity was not associated with age, clinical signs / symptoms, nutritional status, household crowding, batch of RT / 23 used, or previous immunization with BCG, measles, or OPV vaccines. Contact with an active TB patient (usually a grandmother or mother) was associated with a positive TST, although the association was not statistically significant. In this setting, BCG vaccination did not appear to interfere with the TST as a screening test for childhood TB infection and remains a useful adjunct in the diagnosis of pediatric TB.

6. What complementary efforts have contributed to the results of this activity?

Prior to the study, Botswana had a very active TB program with good management records, including documentation of each single dose of any drug in any location. With the hiring of a mycobacteriologist for the National Health Laboratory in Gaborone during the Fall of 1993, the Government of Botswana (GOB) established the capability to complete all testing of mycobacterial specifics in-country. Prior to November 1993, the isolation, identification, and drug susceptibility testing of M. Tuberculosis isolates from patients with active TB had been done in South Africa. As a result of this study, rates of drug resistance were shown to be very low.

Findings from separate but relevant research on TB in other countries (e.g., leprosy and its relationship with TB, and pediatric TB in South Africa) proved useful in initial negotiations with the GOB. The activity drew on other studies in African countries by the HHRAA project, to have a broader sense of what was efficacious in TB treatment and control in the HIV / AIDS era. Some programs appeared to be performing much better than others, but the reasons for such differential performance were not clear.

CDC provided financial support to upgrade the National Health Laboratory in Gaborone, and CDC's mycobacteriology laboratory developed a proficiency testing / quality control program for the laboratory. This was all done to establish a model sentinel surveillance program for monitoring drug resistance to TB medications.

In general, strong support for the study by the Ministry of Health created an environment for effective collaboration. The HHRAA project greatly facilitated the establishment of a long-term relationship with the GOB.

7. What results (impact) have been achieved to date?

Understanding the problem

The study provided information on relationships between TB and other diseases with implications for managing TB control programs. Increases in TB rates were noted in persons also infected with HIV / AIDS. Among cases of HIV infection, although the rates of TB increase, a cap can be maintained on the magnitude of increase. Insights were gained into the relationship between TB and other diseases, such as HIV infection. For example, rates of HIV infection in new patients with TB are significantly higher than in the general population and may exceed 50 percent. WHO / AFRO found this information quite useful.

Adoption and use of the Botusa program

The user-friendly and menu-driven Botusa program is based on EPI-Info version 6, a public-use software obtained for minimal cost. Botusa has been adopted by WHO and

IUATLD as a tool to support record-keeping system for management of TB patients in many developing countries. Resource persons from the Botswana TB program have provided technical assistance to districts in South Africa to adapt and use the Botusa program.

Changes in policies and programs

Protocols were developed and reviewed by the CDC Institutional Review Board, for the Botswana Ministry of Health Scientific Committee to:

- examine tuberculin skin test responses in healthy children under 5 years of age;
- examine the contribution of true smear-negative TB cases to the total TB burden;
- identify the most common etiologic agents responsible for a clinical picture compatible with TB in HIV-infected persons; and
- determine the causes of death among HIV-infected and HIV-uninfected adult and pediatric patients who die during the course of TB treatment.

Results on surveillance were disseminated. Study findings from Botswana, which offer important insights into the treatment of TB, were published in numerous scientific journals and presented at various international conferences and meetings.

As noted above, the GOB and WHO / AFRO took great interest in the research findings and their relevance to future program planning.

African capacity building

Eighteen African researchers were involved in various facets of the study, and Africans co-authored six research products. Fifty Africans were trained in the basics of computer use and Botusa software.

8. What lessons have we learned from this activity?

- Effective control of TB requires resources, political commitment, and strong international public health leadership.

- Gaps in understanding of interactions between TB and other diseases, such as leprosy and HIV / AIDS, contribute to failure of optimal TB management and control.

- Diagnostic criteria for TB in children need refinement, and a uniform scheme of data collection on parental TB status, skin test results, HIV testing, and greater efforts to obtain laboratory confirmation of TB are needed in Botswana and other south African countries. These changes would improve procedures to diagnose TB

in children and avoid unnecessary, expensive, and prolonged treatment for children who are unlikely to have the disease.

- As follow-up to the introduction and installation of software programs, e.g., EPI-Info, long-term technical assistance is mandatory to realize potential effectiveness. Provisions must be made for on-going instruction in how to use the program and maintain computers.

9. What are the next steps to capitalize on the activity?

Findings of operations research on TB in Botswana provide a sound basis for further investigations, including on the effect of the HIV/AIDS epidemic on TB transmission. The effect on the annual risk of infection of an increase in HIV-infected TB patients has been inadequately assessed. The documentation of increased levels of transmission is important for long-term planning and public health advocacy. In countries with high rates of HIV infection, community studies would be helpful to determine the relative importance of recent transmission as opposed to reactivation of TB. Additional implications for use and duration of preventive therapy also exist. The effects of the HIV epidemic on trends of TB in children and related consequences for TB in HIV-infected children need to be better understood. In general, continued advocacy is needed to promote funding for TB control programs, as well as applied research.

WHO, the IUATLD, and the Botswana TB program have teamed up and can potentially provide technical support to TB programs in other African countries in the adoption and use of the Botusa software to support information management system of TB patients. Support has already been given to the South African TB control program.

Key Informants

Dr. Nancy Binkin, formerly with CDC
Dr. Cornelia Davis, USAID/AFR/SD
Dr. Sambe Duale, SARA Project
Ms. Linda Hoffman, OIRH, HHS
Mr. William Lyerly, USAID
Dr. Roscoe Moore, OIRH, HHS
Dr. Harry Stern, CDC
Dr. Hope Sukin, USAID/AFR/SD

CDC Technical Support for Strengthening WHO/AFRO to Address Malaria, Epidemic Preparedness and Response and Disease Surveillance

Name of Activity:	Institutional Capacity Building and Dissemination (Malaria Initiative)
Dates of Activity:	December 1993-September 1998
Location(s):	Anglophone and Francophone countries in sub-Saharan Africa
Collaborating Partners	OIRH, CDC, WHO / AFRO, WHO / HQ, African Ministries of Health
Total AFR / SD Funding:	$ 718,789 (?)
Leveraged Funds:	$ 10 million from WHO Director General

Name of Activity:	Diarrheal Diseases / Cholera
Dates of Activity:	July / September 1994 – May 1998
Location(s):	Southern African countries- Malawi, Swaziland, Zambia, Zimbabwe, Mozambique, South Africa
Collaborating Partners	CDC, WHO / AFRO, Swiss Disaster Relief Ministries of Health in Africa
Total AFR / SD Funding:	$ 1,307,765
Leveraged Funds:	Swiss Disaster Relief: $1,000,000; Australian AID: $500,000; Italian AID: $205,000

Name of Activity:	Epidemic Preparedness and Response, and Disease Surveillance
Dates of Activity:	September 1998-September 2003
Location(s):	Anglophone and Francophone countries in sub-Saharan Africa
Collaborating Partners	CDC, WHO / AFRO, UNF, Swiss Disaster Relief, European Union, Ministries of Health in Africa
Total AFR / SD Funding:	$ 876,923
Leveraged Funds:	EU: $1,000,000 UNF:

1. What was the problem or gap being addressed?

Malaria. Every year malaria claims as many as 1 million lives worldwide, with an estimated 350-500 million new cases. A disproportionate share of malaria-related death and illness occurs in Africa, affecting primarily children under five years of age and pregnant women. Anti-malarial drug resistance represents the most daunting challenge to control and prevention programs in Africa. WHO / AFRO's regional activities aim to develop national capacity for improved management and drug policy of malaria. CDC's Malaria Epidemiology Branch, a partner in USAID efforts to combat malaria for several decades, provides technical support to WHO / AFRO in ongoing efforts to maximize effective responsiveness to this serious problem.

Cholera / Dysentery. Since the early 1990s, coincident with the most severe drought of the century, countries in East and southern Africa have had to cope with recurrent epidemics of severe diarrhea, due to both cholera and bacillary dysentery. These diseases have taken a heavy toll, costing the lives of thousands of people during the epidemic period and, in the longer term, through the impact on national economies. In 1993, with funding from USAID / AFR / SD, CDC joined WHO to develop and implement the Cholera / Dysentery activity in eastern and southern Africa.

Epidemic Preparedness and Response / Integrated Disease Surveillance (EPR / IDS). Despite many well-known interventions to control communicable diseases, such diseases represent a major public health problem in Africa. In most countries, ineffective disease surveillance systems, including ad hoc reporting and tracking mechanisms, are responsible for failures to detect epidemics, resulting in the spread of diseases, human suffering, and loss of lives. Among other things, weaknesses in data collection (e.g., the absence of timely and reliable data to measure geographic spread and propensity), the analysis and use of information for action, at all levels, and lack of resources and awareness about the usefulness of the system are some of the factors contributing to weak surveillance systems. And even in cases where such data may be collected, a further obstacle to controlling the spread of disease is often posed by insufficient supplies of vaccines, drugs, and commodities.

Prompted by the 1992 and 1993 cholera epidemic, the World Health Organization Regional Office for Africa (WHO / AFRO) developed a regional strategy for epidemic preparedness and response (EPR) in 1993 that included strengthening epidemiological surveillance. This strategy was adopted as a framework for cooperation by all African member states (AFR / RC43 / R7).

Then in 1996, the worst epidemic of meningitis ever reported spread from Nigeria to Burkina Faso, Chad, Mali, and Niger. These outbreaks underscored the imperative to put in place preparedness mechanisms and a coordinated response for future epidemic outbreaks. Accordingly WHO / AFRO, with support from the U.S. Agency for International Development's Bureau for Africa (USAID / AFR / SD) and other partners,

launched an initiative to enhance the ability of countries to respond to outbreaks of epidemic-prone diseases.

As part of this initiative, WHO / AFRO developed the concept of integrated disease surveillance. USAID / AFR / SD provided funds through the OIRH / PASA to CDC as a technical partner with WHO / AFRO for this work, based on its important contribution to improved disease surveillance and response to outbreaks around the world.

2. What was the purpose of the activity?

Malaria. The purpose of this activity was to offer CDC technical assistance to WHO / AFRO to improve its capacity to strengthen national malaria control programs in Africa. WHO / AFRO used this technical assistance to improve the management of its Malaria Action Program.

Cholera / Dysentery. The purpose of this first effort in epidemic preparedness and response was to work with WHO and select campaigns in southern Africa to develop and implement effective responses to cholera and dysentery epidemics in order to lower case fatality rates during disease outbreaks.

EPR / IDS. As more outbreaks of diseases other than cholera and dysentery were occurring all over Africa, the purpose of the epidemic preparedness and response (EPR) activity evolved to developing and strengthening systems to improve communicable disease surveillance and EPR in the African region. Many vertical programs now exist in several countries. Each vertical program has burdened district health teams with requirements for its specific surveillance systems. WHO / AFRO has teamed with CDC to assist countries in implementing integrated disease surveillance systems to simultaneously address different diseases at the district level.

3. What were the specific objectives of the activity?

Malaria. The general goal has been to assure effective national malaria control programs in Africa. Specific objectives comprise:

- Short- and long-term technical assistance to support countries in policy and program development, training and curriculum design, applied research, epidemiological surveillance, program monitoring, and evaluation.
- Short- and long-term technical assistance to WHO / AFRO in strengthening the research, analysis, and information dissemination capacity of its regional office; organizing and supporting a regional task force on malaria control; and developing a core of African consultants who will provide assistance to countries in the region.

Cholera / Dysentery

- Improving countries' capacities to respond to dysentery and cholera epidemics.
- Improving laboratory and epidemiologic capacity.
- Developing regional coordination of epidemic dysentery and cholera activities.
- Developing prevention measures to control epidemic dysentery and cholera, and assessing the effectiveness of prevention measures.
- Insuring that appropriate case management for dysentery and cholera is being conducted in an effective fashion.

EPR / IDS

- Improving countries' general capacity to respond to epidemics (e.g., dysentery, cholera, meningitis, and others).
- Improving laboratory and epidemiologic capacity.
- Developing appropriate regional coordination activities.
- Assessing the effectiveness of prevention measures.
- Insuring appropriate case management.
- Surveillance.

CDC has provided technical assistance to WHO / AFRO as it works with member states to design and implement an appropriate regional strategy by:

- Conducting situation analysis or assessment of existing disease surveillance and epidemic preparedness and response (EPR) systems.
- Encouraging countries to develop national plans of action for strengthening disease surveillance.
- Preparing national guidelines for integrated disease surveillance and response (IDSR).
- Training relevant health personnel in the use of guidelines.
- Assisting countries to implement IDSR.
- Jointly monitoring and evaluating the IDSR process.
- Supporting public health laboratory systems.

4. What took place in implementing the activity?

Malaria. During this activity, WHO / AFRO organized a series of training activities for malaria control program managers in sub-Saharan African countries. In addition to numerous technical missions with CDC staff, country consultations / training sessions, and applied research activities were conducted. In 1994, the African Malaria Control Task Force was formed to advocate for strengthening national malaria control programs.

Cholera / Dysentery. Members of the WHO / AFRO inter-country team and consultants made several technical assistance visits to Malawi, Swaziland, Zambia, Mozambique, and Zimbabwe to assess needs and identify priorities for preparedness and response to epidemic

diarrheal diseases. These assessments provided the data and information for developing country action plans and related policy formulation plans.

In addition, numerous operations research studies were conducted on the following topics:

- Social and environmental factors influencing the transmission of Shigella dysentery (SD1) in rural and urban areas of Zimbabwe.
- Treatment of dysentery in health centers in Mozambique.
- Dysentery incidence and modes of transmission of dysentery in Kwazulu-Natal, South Africa.
- Clinical trial of ciprofloxacin for the treatment of dysentery due to SD1 in children. This is a multi-center study taking place in Durban, South Africa and Harare, Zimbabwe.

WHO / AFRO provided technical assistance to individual countries in training national program staff, developing training materials, improving laboratory facilities and capacities, and moving the regional drug store from Nairobi to Harare. USAID funded CDC to provide WHO / AFRO with an epidemiologist and support to laboratories.

Over 50 participants from Anglophone and Francophone Africa attended an inter-country meeting on dysentery epidemics in the southern Africa region held in October 1995. Participants exchanged information and experience on the control of epidemics and the correct case management of dysentery due to Shigella dysenteriae type 1.

EPR / IDS. In collaboration with WHO / AFRO, CDC developed generic, technical guidelines for carrying out various surveillance-related functions. Such guidelines were geared for district health staff to perform necessary functions in disease surveillance, e.g., determining thresholds, appropriate response, and collecting specimens. Other objectives included developing tools to assess existing surveillance systems and laboratories and identifying their respective strengths and weaknesses.

USAID provided funding for CDC to support the technical development of WHO / AFRO, directing IDS at the district and country level through:

- Long-term posting in Harare of a laboratory expert.
- Data collection and analysis.
- Technical assistance.
- In-country operations research.

In conducting assessments, CDC works with ministries of health to adapt national tools to the district context. As can be seen in the box below, to date, 11 countries have been assessed; of these CDC has actively been involved in nearly half. WHO / AFRO anticipates that impact will be evident in 2002 when districts will begin to use the IDS tools developed for timely reporting of disease surveillance data.

CURRENT STATUS OF IDS DEVELOPMENT IN AFRICA

Assessments of Existing Surveillance System

conducted in :		planned in :	
Botswana	Namibia	Burundi	Kenya
DRC	Seychelles	Burkina Faso	Mali
Ethiopia	Tanzania	Chad	Mozambique
Lesotho	Uganda	Cote d'Ivoire	Rwanda
Madagascar	Zimbabwe	Eritrea	Swaziland
Malawi		Ghana	Zambia
		Guinea	

National Plans of Action

prepared in:		planned in :
Botswana	Seychelles	DRC
Ethiopia	Tanzania	Madagascar
Lesotho	Uganda	Namibia
Malawi	Zimbabwe	
Ghana		

Each partner, WHO / AFRO and CDC, designates a group of professionals to work together. Managers of WHO / AFRO's programs on IDS and Emerging, Re-emerging and other Communicable Diseases (EMC)[2], Vaccine Preventable Diseases (VPD), actively collaborate with CDC through meetings, workshops, and frequent interaction via telephone, e-mail, and fax. The CDC team has made several trips to Harare, and the WHO / AFRO team has traveled to Atlanta. Together, both teams have made several visits to countries.

5. What were the outcomes of this activity?

Malaria

- Training of trainers (TOT) in Cameroon, May 1994.
- A regional workshop to improve the policy and planning skills of program managers from Anglophone African countries in Kampala, Uganda, September 1994. (This activity involved dissemination of findings from a study by Peter Bloland and other researchers, "Chloroquine in Africa: critical assessment and recommendations for monitoring and evaluating chloroquine therapy efficacy in sub-Saharan Africa.")
- Development and production of WHO Information Sytems for Evaluation of Malaria Control Programmes: A Practical Guide (AFRO / CTD / MAL / 94.3, 1994).

[2] AFRO IDS and EMC programs have recently been merged into a single program called Communicable Disease Surveillance and Response (CSR), following the structure in Geneva.

- Development and production of WHO Training Guide on Monitoring and Evaluation of Malaria Control Programmes in Africa: Facilitators Guide, 1994.
- Training of Consultants to support the elaboration of National Malaria Control Programmes in Abidjan in February 1994.
- A regional workshop for Francophone program managers to improve their skills in designing and conducting operational research, Bamako, Mali, February, 1995.
- Development of WHO / AFRO's African Integrated Malaria Activity (AIMA) Project, Spring 1995.
- Workshop on Consultancy Process for Anglophone Countries, Lilongwe, Malawi, August 1995.
- Preparatory Meeting for Workshops on Monitoring and Evaluation in Malaria Control Programs for Anglophone countries, Lilongwe, Malawi, August 1995.
- Second Task Force Meeting on Malaria Control in Africa, Brazzaville, Congo, June 1996.
- Workshop on Prevention and Control of Malaria Epidemics in East Africa, Nazareth, Ethiopia, June 1996.
- Workshop on Prevention and Control of Malaria Epidemics in Southern Africa, Windhoek, Namibia, August 1996.
- Workshop on Malaria Resistance and Treatment Policy in Kenya, Zambia and Malawi, Mangochi, Malawi, August 1996.
- Conference on Anti-malarial Drug Resistance in Mozambique, September 1998.
- Development of numerous protocols and materials to track and diagnose malaria.
- Development and country-specific adaptation of Epi-Info software programs to enter and analyze data.
- In Zambia, collection of standardized data on drug efficacy to inform decisions about anti-malarial drug policy, and faciliting discussions that led to modification of policy.
- Malaria Drug Resistance Framework Meeting, Harare, May 2000.
- Joint planning meetings with other partners of the Roll Back Malaria Initiative.

<u>Cholera / Dysentery</u>

- CDC seconded an epidemiologist to WHO / AFRO for the duration of the activity.
- Over 50 persons from 14 countries participated in a 4-day meeting in October 1995 that covered numerous aspects of epidemic dysentery in Africa, e.g., preparedness; response; laboratory, research, and treatment issues; special concerns for refugees.
- Preparation of a quarterly Bulletin for Epidemic Diarrhoeal Diseases in southern Africa, to share epidemiologic and laboratory data on epidemic dysentery and cholera in southern Africa, with findings and recommendations from meetings and research projects.
- Revision of WHO Guidelines for Cholera Control, November 1996.
- Production of Laboratory Methods for the Diagnosis of Epidemic Dysentery and Cholera manual, Spring 1998.

- Final Report: "Project for Improving Preparedness and Response to Cholera and Other Epidemic Diarrhoeal Diseases in Southern Africa," Spring 1998.
- Technical support provided by WHO to the MOH in Tanzania, Zambia, Mozambique, and South Africa on cholera control.

EPR / IDS

- CDC seconded a bacteriologist for two years to WHO / AFRO.
- WHO / AFRO, WHO / HQ, and CDC collaborated on preparing a guide for assessing national disease surveillance and EPR systems.
- Joint teams provided technical support to countries in their situation analysis (assessment); to date 27 countries out of 46 have completed the exercise.
- A guide was developed to help prepare national IDSR plans of action.
- Joint teams have provided technical support to countries in preparing plans of action; to date 16 countries out of 46 have completed the exercise.
- Generic Guidelines for Integrated Disease Surveillance and Response were prepared (English and French versions). The materials were pre-tested and disseminated to countries for adaptation.
- Joint visits to priority countries were organized by WHO / AFRO-CDC to assist these countries in implementing IDSR.

In the Fall of 2000, CDC staff met with 25 district representatives in Tanzania to field test the English version of the IDSR technical guidelines. The goal was to establish guidelines that were clear, relevant, feasible, and realistic. Information resulting from this field test was used to revise guidelines and translate them, in December 2000, into French. In January 2001, they were used at a workshop in Burkina Faso and at a Task Force meeting in Harare in May 2001. The guidelines were further refined in May 2001; the final version, in both English and French, was completed in July 2001. The guidelines will be made available in electronic formats, with particular versions put on CD Rom so that individual countries may easily make necessary adaptations to their own particular situations.

Other outcomes have included the collection of information on:

- Target audiences, prior to field tests
  [CDC staff interviewed local health facilities staff about what they already know how to do, where they turn for help, etc. Limited resources pose a more significant obstacle than gaps in knowledge. Job descriptions for many local health staff do not involve analysis but concern the use and monitoring of supplies.]
- Surveillance assessments
- Laboratory capacity

During the Fall of 2001, the senior microbiologist posted for the past two years at WHO / AFRO's offices in Harare will be transferred to a WHO laboratory in Lyon, France. He has been working to assemble directors of health laboratories in Africa to form consensus on their needs, the role of a public health lab, needs for training, etc. This task

has proved challenging, since labs vary tremendously, and are often non-existent. Practical workshops and laboratory network meetings have been organized recently for WHO / AFRO blocks in Africa (East, West, South and Great Lakes blocks). Critical reagents have been obtained for certain regions.

Certain countries are slow to address IDS, but many who appreciate what surveillance can do are already investing some of their own resources in preparedness.

[Note: The tandem of collaborative work between WHO / AFRO and CDC, in areas cited above, was unavoidably interrupted during 1997 by the relocation of WHO / AFRO Headquarters from Brazzaville to Harare.]

6. What complementary efforts have contributed to the results of this activity?

Malaria. The collaboration between WHO / AFRO and USAID has strengthened capacity at the regional and country level for accelerated implementation of malaria control in the region. It enabled WHO / AFRO to develop the African Initiative for Malaria Control in the 21st Century, in collaboration with partners such as the World Bank and DFID. This initiative became the African "spearhead" of the global initiative, Roll Back Malaria (RBM).

Cholera / Dysentery. Efforts by ministries of health and others involved national government sectors, international agencies (e.g., UNHCR, UNICEF, and DHA), bilateral foreign assistance programs, and non-governmental organizations in areas such as water and sanitation, environment management, and public education may have contributed to the results of this activity in term of reduced case-fatality during cholera outbreaks in southern Africa in the mid-1990s.

EPR / IDS. The formation of a Task Force on IDSR by the WHO / AFRO director has greatly helped to speed up the process through pertinent recommendations. Partners other than USAID, such as the United Nations Foundation (UNF), have provided funds for support to WHO staff and activities, and advice for improving the program. This has improved response to epidemics in districts in West Africa and reduced case-malady rates in some countries for meningitis, yellow fever, and cholera.

CDC now has a Rapid Implementation Plan (RIP) in eight countries. Over the next 6-12 months, they plan to choose 1-3 districts per country and select a focused element of IDS with which to work, for example, surveillance for cholera and measles. Next steps involve developing case definitions, training health staff, verifying action thresholds, and knowing when lab specimens are collected and how long to continuing monitoring efforts. The choice of diseases varies by countries but would ultimately serve as a way to expand IDS.

CDC is now collaborating with the Global Alliance for Vaccination Initiatives (GAVI) Program, a coalition of different groups that targets the development of improved vaccines

for meningitis in Africa, particularly sentinel surveillance for pediatric meningitis in approximately 20 countries throughout Africa.

7. What results (impact) have been achieved to date?

Understanding the problem

Malaria. WHO / AFRO provides guidance to countries for planning, implementing, and evaluating malaria control. The effort has contributed to important improvements in clinical management of malaria cases. CDC support has been particularly helpful in developing appropriate indicators for monitoring and evaluation (M&E).

Cholera / Dysentery. While recurrent diarrheal epidemics were recognized as a problem in most East and southern African countries, the activity focused on specific aspects of the problem that were then incorporated into both national and regional programs or responses. For example, the absence of a sub-regional warehouse for rapid drug and equipment disbursement was seen as a problem this activity could address.

EPR / IDS. The rationale for IDS / EPR implementation is now well understood and accepted by member states and most partners. Generic matrix and guidelines documents were distributed to WHO / AFRO in July.

Changes in policies and programs

Malaria. Achievements of the technical partnership between WHO / AFRO and CDC include progress in standardizing testing for the efficacy of anti-malarials; developing indicators for program evaluation, conducting malaria surveillance, and treatment policy formulation, and establishing a database on drug resistance.

Cholera / Dysentery. Guidelines for controlling epidemics caused by SD1 were put in place in all affected countries. Training, resource materials, and disease management guidelines for understanding and responding to epidemic dysentery contributed to improvements in national programs.

EPR / IDS. It is somewhat premature to assess fully the impact of collaborative efforts by USAID, CDC, and WHO / AFRO. The implementation of the regional strategy at country level remains in its initial stages. However, all WHO / AFRO member states have adhered to IDS strategy. Those with prior experience conducting situation analysis have reflected the IDS approach in their national plans of action to strengthen disease surveillance.

Political commitment among ministries is vital to move forward. CDC, WHO / AFRO, and other partners are working with African governments to commit their own funds with a

view to attracting donor funding. Uganda, Tanzania, and Ghana are committed to surveillance. CDC will continue working closely with all countries over the coming year.

African capacity building

Malaria. WHO / AFRO has become a repository of technical expertise over the past decade, particularly in combating malaria. In this area, CDC support to WHO / AFRO has involved ministries of health and 100 researchers throughout sub-Saharan African countries in workshops (the first organized in Cameroon during 1994), training courses, operations research and preparing publications. From 1996-98 collaboration between the two organizations was especially productive, leading to the development of key M&E indicators and highly effective community-based activities. Two research products were co-authored by Africans and CDC staff. One WHO / AFRO staff person completed a Ph.D. program in the United States.

Cholera / Dysentery. Capacity building occurred in several areas:

- District level training materials on cholera and dysentery were developed, and two workshops were conducted in southern Africa to test these materials. The following courses are illustrative of training efforts under this activity:
    - Epidemic preparedness training was conducted in Malawi (field test), Zambia, and Swaziland.
    - Guidelines were developed, including dysentery case management and laboratory diagnosis in Malawi, Swaziland, Zambia, and Zimbabwe.
    - Training in participatory methods for environmental hygiene was conducted in Malawi and Zambia. Zambia has since replicated the course several times for district level health workers.
    - A Diarrhea Training Unit (DTU) course was offered in Zambia to increase the capacity of trained personnel in case management of diarrhea diseases. The course was for trainers of trainers (TOT) and included participants from Burundi, Malawi, Zimbabwe, Zambia, and Swiss Disaster Relief (SDR) consultants.

The activity involved nine African researchers and more than 50 Africans participating in various workshops. A score of African institutions have participated in various aspects of work over the project's duration, including the Harare City Health Department, Zimbabwe; University of Zimbabwe Medical School; King Edward Hospital in Durban, South Africa; Umgeni Water District, KwaZulu-Natal, South Africa; Community Health Sciences Unit, MOH, Lilongwe, Malawi; Queen Elizabeth Hospital, Blantyre, Malawi; Edward Mondlane School of Medicine, Mozambique; Bethesda Hospital, Ubombo, South Africa; Beatrice Road Infectious Disease Hospital in Harare, Zimbabwe; South African Institute for Medical Research, Johannesburg; Tropical Disease Research Institute, Zambia; University Teaching Hospital, Zambia, the Ndola District Council in Zambia and Uganda's Ministry of Health; Central Public Health Laboratory, Swaziland; Muhimbili

Medical center, Dar-es-Salaam, Tanzania; Tropical Disease Research Institute, Zambia; Parirenyatwa Hospital, Zimbabwe; Public Health Laboratory, Zimbabwe.

The impact of the activity has spread beyond the sub-region. Materials on cholera and dysentery developed in southern Africa were used to develop integrated epidemic preparedness and response training materials and workshops were held in West Africa and in Ethiopia, Eritrea, and Kenya.

Laboratory capacity is being developed and inter-country networks established through country technical visits Malawi, Swaziland, Zambia, and Zimbabwe.

EPR / IDS. As a new strategy, IDS has provided a learning opportunity for all those involved in partnership (WHO / AFRO, WHO / HQ, CDC, etc.). National ownership is key to sustainability. Therefore, the IDSR implementation process is about equipping health staff at all levels of the health system, especially at district level, with the necessary knowledge, skills, and attitude for adequate monitoring of priority communicable diseases and utilization of surveillance information for decision-making and action.

Relationships have been strengthened among CDC and WHO / AFRO, in specific countries, by developing something, i.e., a surveillance system, that has not existed. AFRO countries are interested in CDC working with them through all the steps of this difficult process.

The larger vision of this work has been to build on surveillance mechanisms that work, e.g., with polio eradication (especially in West Africa), gradually adding other diseases. Over time, such successful mechanisms can be translated into systems using service needs of other programs in Africa, e.g., GAVI, Roll Back Malaria, HIV / AIDS, tuberculosis, and work with ministries of health to be more entrepreneurial in developing public health infrastructures. Typically, donors plan vertically channeled efforts, then depart, leaving nothing behind. With more locally organized systems in place, a greater likelihood exists of longer-term sustainability.

The long-term posting of a field laboratory expert epidemiologist at WHO / AFRO's offices in Harare, Zimbabwe was arranged to develop laboratory and epidemiologic skills of local professionals. Ten African researchers have been involved in this activity since its beginning. One laboratory worker from the Tropical Diseases Research Center in Ndola, Zambia, spent one year at CDC / Atlanta to work on the laboratory aspects of a study to assess the role of Enterotoxigenic Escherichia cola (ETEC) as a cause of childhood diarrhoea in Zambia.

8. What lessons have we learned from this activity?

Malaria and Cholera / Dysentery

- Joint collaboration (WHO / AFRO-CDC-USAID), upon which the RBM is building, has strengthened capacity at both the regional and country level for accelerated implementation of malaria control.
- Collaboration among the same three partners has provided a platform for mobilizing resources with other external partners.
- Access to good quality anti-malarial drugs remains an obstacle at the community level.
- Skills in community mobilization must be strengthened to properly manage illness, e.g., malaria cases with an appropriate use of anti-malarial drugs.
- Further strengthening of control activities is needed at the community, district, and national levels.

Cholera / Dysentery

- Ad hoc reporting of outbreaks of disease and unplanned response, after the fact, offer countries no safeguards for keeping future epidemics in check.
- Complimentary global partnerships (e.g., USAID-WHO / AFRO-CDC) have been formed through collaborative efforts to combat epidemics. For such partnerships to remain focused on the common goals and achieve maximum effectiveness, frequent opportunities must be planned for direct communication and information exchange.

EPR / IDS

- Current IDSR activities have built on the accomplishments of the epidemic preparedness activity.
- Sensitization of all stakeholders and consensus-building are key to successfully implement IDSR.
- IDSR can take advantage of strong disease control programs already in place, such as poliomyelitis eradication in its surveillance component.
- National priorities in the scope of diseases to be monitored must be set.
- When health problems are detected through disease surveillance, the links to response must be clearly understood.
- A balance must be maintained between the need to build-up a system (long-term objective) and the need to address immediate problems.
- Conferral among clinicians and epidemiologists to develop laboratory networks is a complex process that needs nurturing, taking stock of what worked for cholera / dysentery and polio, for example, and how to build on this.
- It is important to have an advocate, e.g., for laboratories, so that their important role is not overlooked. (For example, in Uganda, CDC covers the salary for clinician receiving laboratory training. This slot was filled with someone who was involved in the Ebola outbreak and has become indispensable to the MOH.)
- Plans must be backed with economic commitment and sharing of resources.

- The partners involved in IDSR implementation need to work on joint plans of action to ensure good coordination in implementing activities and to avoid competition at country level.
- It has taken longer than expected to bring IDS to the district level; this collaborative process can only be developed slowly. USAID started supporting surveillance in 1998. The process of developing general guidelines and tools, including field-testing, extended beyond 12 months. Once developed, generic technical guidelines then must be adapted by each MOH. Some countries have been waiting three years (e.g., Tanzania) for case definition and thresholds. Confronting immediate needs, some countries will proceed to make determinations on their own and risk making mistakes.
- It is imperative to build on a plan of action developed by a country rather than something imposed by external forces. CDC and WHO / AFRO have been able to work with countries in monitoring separate pieces of their plans of action.
- A good computerized system for monitoring and reporting must be given to countries, together with training on technical procedures for set up, maintenance, and data entry and cleaning.
- Management, coordination of activities, and financial planning by the three partners proved challenging. Recommended are frequent, planned opportunities for information exchange and the preparation of joint progress reports and plans by all partners.

9. What are the next steps to capitalize on the experience of all three activities?

- WHO / AFRO should work with RBM partners to build on some of the accomplishments made with CDC's support on issues such as drug policy and capacity building for operations research.

- Building on existing surveillance programs should continue in whatever ways may be appropriate. For example, surveillance teams are looking for cases of polio in West Africa block. As they have less to do with polio, they will be able to make a shift to other diseases.

- CDC hopes to continue collaboration with GAVI, especially links to laboratories that may be expanded to address diseases other than meningitis, via data collection and specimen transport networks / systems. Currently local laboratories are limited to sentinel surveillance; so this must be expanded, by working with MOHs and IDS staff strengthening all critical networks.

- WHO / AFRO's longer-term vision is to integrate HIV / AIDS and tuberculosis into surveillance at the district level. HIV / AIDS surveillance is so weak in Africa, it is not possible for the moment to add this disease to the proposed system. As the program

matures, notably efforts of mother-to-child prevention of HIV transmission may appropriately fit into IDS.

- Robust indicators are needed to measure progress; CDC continues working with WHO / AFRO to prepare a short list of appropriate indicators measuring response, including lab confirmations (i.e., % of outbreaks for which specimens are received in appropriate labs which involves transport, doctors ordering tests, surveillance, proper collection methods, etc.).

- More donors are needed to support IDS and maintain momentum. Additional support could be encouraged with a published brochure or monograph documenting concrete results or lessons learned.

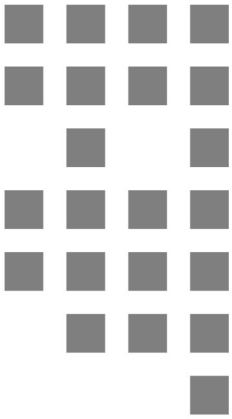
- The ongoing supply of reagents remains problematic. What is needed to confirm outbreaks is usually one laboratory at the national level, and it is difficult to stock a sufficient supply of reagents at national level. This concern, together with a source for procuring reagents and logistics for moving them, represents a constant problem. Ideally, a stock of reagents should last from six months to one year. A meeting in South Africa in early June 2001 brought together representatives from 12 countries to learn more about bacterial reagents involved in surveillance.

- 2001-2002 are critical years for IDS during which at least three early adaptor countries are needed with a system at district level. This can serve as basis for documenting practical lessons learned; now everything is constrained to theory, concepts, and wishes.

Key Informants

Dr. Edwin Afari, WHO / AFRO
Dr. Peter Bloland, CDC
Ms. Kathy Cavallaro, CDC
Dr. John Paul Clark, WHO / HQ / RBM
Dr. Connie Davis, USAID / AFR / SD
Dr. Sambe Duale, SARA Project
Dr. Mary Ettling, USAID / AFR / SD
Dr. Mary Harvey, USAID / AFR / SD
Ms. Linda Hoffman, OIRH / HHS
Dr. Yao Kassankogno, WHO / AFRO
Dr. Patrick Kachur, CDC
Dr. Lusamba-Dikassa, WHO / AFRO
Ms. Subhi Mehdi, USAID / AFR / SD
Dr. Roscoe Moore, OIRH / USPHS / HHS
Dr. Brad Perkins, CDC

Dr. Suzanne Prysor-Jones, SARA Project
Ms. Elaine Roski, OIRH / USPHS / HHS
Dr. Trent Ruebush, CDC
Dr. Rick Steketee, CDC
Dr. Hope Sukin, USAID / AFR / SD



AED

Academy for Educational Development

SUPPORT FOR ANALYSIS & RESEARCH IN AFRICA

SARA

**This document was produced by
the Support for Analysis and Research in Africa (SARA) Project,
operated by the Academy for Educational Development.
SARA is funded by the United States Agency for International Development (USAID)
through the Bureau for Africa, Office of Sustainable Development (AFR/SD/HRD),
under contract AOT-C-00-99-00237-00.**