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Community based malaria control through chemotherapy and chemoprophylaxis in Saradidi, Kenya

by D.C.O. Kaseje

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Appendix to thesis: Community based malaria control through chemotheraphy and chemoprophylaxis in Saradidi, Kenya by. D.C.O. Kaseje

ANNALS OF TROPICAL MEDICINE AND PARASITOLOGY

COMMUNITY-BASED HEALTH DEVELOPMENT: THE SARADIDI, KENYA, EXPERIENCE

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Preface

The UNDP/WORLD BANK/WHO Special Programme for Research and Training in Tropical Diseases (TDR) is a goal-oriented research and training programme with two interdependent objectives:

research and development to obtain new and improved tools for the control of major tropical diseases;

strengthening of the research capabilities of the tropical countries.

The research is conducted on a global basis by multidisciplinary Scientific Working Groups; the training and institution-strengthening activities are limited to the tropical countries where the diseases are endemic.

The six diseases initially selected for attack are malaria, schistosomiasis, filariasis (including onchocerciasis), the trypanosomiases (both African sleeping sickness and the American form called Chagas' disease), the leishmaniases and leprosy. Scientific Working Groups are also active in 'trans-disease' areas: biological control of vectors, epidemiology, and social and economic research.

Scientists interested in participating in TDR are invited to write for further information to:

The Office of the Director,
Special Programme for Research and
Training in Tropical Diseases (TDR),
World Health Organization,
Geneva, Switzerland

Foreword

The last five years have been both exciting and demanding for the Saradidi Community. A community that was once poor, passive, sick and apathetic has, in the last five years, been able to mobilize its resources and become fully involved in the process of improving its own health status.

The process of mobilization and involvement has not been easy, mainly because it has competed for the meagre resources of time, money and materials which are hardly sufficient for mere survival. Yet we can now look back as a community and say 'it was worth it all'. The achievements of the programme in reducing mortality and disease and making services accessible to the people justify every effort, however sacrificial, that the community has put into the programme.

The fruits of the programme have been reaped by everyone in the community regardless of status or of religious or clan affiliations or groupings. The whole success of the programme lies in the fact that it was conceived, developed and implemented by us. No activities were imposed from outside. This ensured relevance and appropriateness of interventions. We are grateful that even researchers did not impose ideas or activities on us. All activities were discussed with us before carrying them out, and the research activity thus became part and parcel of supportive services for our own priority areas.

Malaria research made available and accessible antimalarials which the community needs desperately. The research also demonstrated the value of a community-based malaria treatment programme, and will now support the indefinite continuance of such a system.

Complete self-reliance is still in the future; we are making steady progress, but the need for some assistance in our activities is still vital and should not be underestimated.

The Saradidi Programme has changed attitudes to health services, and has created awareness not only of the community's potential to meet its own needs but also of facilities and services that have a lasting impact on disease and mortality. The knowledge and skills planted in the community will remain evergreen for many years, and may produce a new culture in which the norms include the practice of good health.

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The Saradidi, Kenya, Rural Health Development Programme

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A primary health care community development programme was initiated in 1979 by people living in Saradidi, Kenya. The community was involved in planning, organization, setting of priorities and objectives, implementation, evaluation and benefits. This paper describes the developmental process that occurred including how the programme began, how it was organized and what it attempted to accomplish.

In 1977 the World Health Assembly adopted a resolution which stipulated that the main social target of governments and the World Health Organization should be the attainment by all people of the world by the year 2000 of a level of health that will permit them to lead a socially and economically productive life in the community in which they live (World Health Assembly, 1977). Later, an International Conference on Primary Health Care held in Alma Ata, U.S.S.R. in 1978, declared that primary health care is the key to attaining health for all. The final report emphasized that health development is essential for social and economic development (World Health Organization and United Nations Children's Fund, 1978).

At Alma Ata, primary health care was defined as '. . essential health care based on practical, scientifically sound and socially acceptable methods and technology made universally accessible to individuals and families in the community through their full participation and at a cost that the community and country can afford to maintain at every stage of their development in the spirit of self-reliance and self-determination' (World Health Organization and United Nations Children's Fund, 1978). Primary health care reflects and evolves from the economic conditions and the social, cultural and political characteristics; addresses the main health problems in the community; includes, at a minimum, the following: health education, promotion of food supply and proper nutrition, an adequate supply of safe water and basic sanitation, maternal and child health care including family planning, immunization against the major infectious diseases, prevention and control of locally endemic diseases, appropriate treatment of common diseases and injuries, and provision of essential drugs; involves all related sectors and aspects of national and community development as well as the health sector; requires and promotes maximum community and individual self-reliance and participation in the planning, organization, operation and control, and should be sustained by integrated, functional and mutually supportive referral systems; relies on health workers, including physicians, nurses, midwives, auxiliaries and community workers as applicable, as well as traditional practitioners as needed, to work as a health team and to respond to the expressed health needs of the community.

The cornerstone of primary health care is community participation. People have the right and duty to participate individually and collectively in the planning and implementation of health care (World Health Organization and United Nations Children's Fund, 1978).

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Community participation implies that decisions about health care are made by the users of health services in partnership with the providers.

Kenya has committed itself to the target of 'health for all by the year 2000'. One primary health care programme was begun by people living in Saradidi, Kenya. The community, i.e. the consumers, was fully involved in the planning, organization, implementation and cost (time, monetary and material) of all the health activities. In this paper we describe the beginnings of the programme, how it was organized, and what it attempted to accomplish.

COMMUNITY ORGANIZATION

In 1975 the Anglican Church of the Province of Kenya began a community development programme which emphasized education and the dissemination of information. About 30 per cent of the population in Saradidi belong to Anglican congregations. Therefore, many people in the area were involved in the development programme. Anglican congregations were encouraged to elect development committees.

The Saradidi Rural Health Development Programme was begun in 1979 as an intensification of the effort initiated by the Anglican Church. The programme originated in one Anglican congregation. A discussion was held among the eventual programme director (a community health physician), two medical students from the area and three community leaders. At that meeting it was realized that, to be effective, the programme should involve all those living in the area. The participants agreed to talk with other Saradidi residents both Anglican and non-Anglican about working together. The main aim of the programme would be to improve the quality of life by initiating activities to reduce disease and increase income. The community would be responsible for initiating and implementing these activities.

Interim Committee

An interim committee was elected by popular vote from the congregation. Its duty was to create community-wide awareness of the programme, to elicit total community involvement and to start community organization.

All other Anglican congregations were asked and agreed to help expand the development programme outside of the Anglican church. The interim committee publicized and popularized the idea that the community could work together in solving their health problems. This was done through informal discussions with recognized leaders in the community and other individuals, through visits to other church congregations and in clan meetings. This small group presented the idea so convincingly that, at the end of three months, many people outside the church were involved.

Villages

The interim committee involved community elders and local level government administrators in the process of mobilizing the community, defining the project area and organizing the community for action. In this area of Kenya, people live in scattered homesteads rather than in concentrated villages. To put together families which could work together in health care and development activities homesteads had to be grouped taking into account *clan* (kinship ties), *geographical* (groups of homes) and *administrative* (government) boundaries. These groups of homesteads in the first area (area A) formed 23 'villages', each consisting of from 200 to 500 households. Each village elected its own leadership, the Village Health Committee (VHC), consisting of people who would lead their villages in health, development and income-generating activities.

Seminar

Three months after the formation of the interim committee, a one-week seminar was held in Saradidi with the main objective of creating a shared understanding about the following issues: the problems in the area and the importance of each; how the community could respond to the problems and in what order of priority; the roles and responsibilities of various community groups in the programme; the activities that the community would undertake; what resources would be required and how to obtain them; and how to involve the relevant government officials in the planning process.

Three people from each of the 23 villages in the first area, local government administrators, members of the interim committee and church and other local leaders attended the seminar as participants. The village representatives usually consisted of the officers of the village health committee. A number of professionals were invited as facilitators. These included the Ministry of Health District Health Team; the regional advisor of the United Nations Children's Fund (UNICEF); the Chairman, Department of Community Health, University of Nairobi; the Co-ordinator of the Community Health Workers Support Unit at the African Medical and Research Foundation (AMREF); and the Head of the Health Education Department, Ministry of Health. The facilitators were invited by the programme leader to share their experiences and knowledge with the community leaders.

The objectives of the seminar as defined by the programme director and interim committee stated that at the end the participants should be able to:

State the functions of a Village Health Helper (VHH).
State the functions of a village health committee.
Assist in defining villages, conducting a census and registration of households.
Keep suitable records and explain to villagers the need for such information.
Educate and motivate fellow villagers.
Mobilize and organize the village community to work together in development, health and income-generating activities.
Take specific action to reduce malaria, diarrhoeal diseases, scabies, worms and malnutrition in their homes and villages.
Give reasons for child spacing.
Name development projects that could be started after the seminar.
Identify government, church and other extension workers that they could call upon for assistance in village projects.
Explain the needs for adult literacy and continuing education.
Work out a system for supporting the VHH.
Prepare monthly reports and plan ahead.

The seminar was organized and conducted in such a way that all the people involved (facilitators and community participants) would learn from each other. The participants were divided into small groups in which the following issues were explored: major community problems and priorities; possible reasons for the problems; possible solutions to problems; and what action the community was going to take to solve its problems.

The major problems discussed by groups were put to vote in plenary and the following four unanimously declared the main problems requiring priority intervention: lack of adequate water supply; malaria and other acute diseases (i.e. measles, diarrhoea and vomiting); poverty (low income), low levels of food production and high levels of malnutrition; lack of health facilities and lack of means of transport in medical emergencies.

Further discussion indicated that a majority of persons attending the seminar believed that inadequate water supply, inadequate rainfall and lack of health facilities were responsible for all the problems mentioned. The community resolved that they would try to tackle all

the problems if the government and other agencies could provide the necessary technical knowledge.

At the end of the seminar, the following objectives were agreed upon by most participants:

1. A programme centre to co-ordinate activities and to provide certain health services would be constructed using resources available in Saradidi. The centre would provide referral, logistic and administrative backup for the village-based activities and would also offer curative, promotive and preventive services.

2. Each village health committee would select two people from its village who would be trained in aspects of health care. These people would be called Village Health Helpers (VHH's). Later the name was changed to 'Nyamrerwa' ('immediate helper in trouble'), a more relevant local name. The VHH's would assist the village by providing health information, education, and some basic health services. The VHH would be supported by the village. No special qualifications were demanded of the VHH's. However, they were expected to live in the village, to be considered as mature, to be respected in the village and to remain in the community. Married people were preferred but both men and women could be selected. There were no educational requirements, nor was the ability to read or write necessary.

3. Income-generating activities would be begun at the project centre and in each village. Funds generated would be used to help community members and to support the VHH's.

4. Each village would collect stones, sand and other local materials for well construction and dig a well.

5. The impact of the programme on the health of the community would be evaluated. The indicators suggested by the community were:

Utilization of clinics by mothers and children.
Number of cases of malnutrition, malaria and diarrhoeal diseases.
Use of latrines.
Use of dish racks.
Number of kitchen gardens.
Number of infant deaths.
Birth intervals.
Signs of community cohesion/number of active groups and achievements of such groups, e.g. income-generating activities.
Protection of wells and environmental cleanliness.
Status of village committees, attendance and participation at meetings.
Adoption of appropriate technology.
Mosquito protection.
Improvement in agriculture.
Control of soil erosion.
Community feeling about adequacies of support from the project centre.

Three representatives from each village health committee formed a programme development committee which replaced the interim committee. The chairman, secretary and treasurer of the interim committee also became members of the programme committee as did the acting programme director. Since the programme development committee was so large, this group selected 14 members, including the programme director, to serve on an executive committee. The executive committee was responsible to the full programme committee but had the authority to run the everyday affairs of the programme.

The executive committee developed guidelines explaining the responsibilities of the various committees, groups and individuals involved, guidelines for programme implementation and for management of programme resources and a draft constitution. These documents were

initially written by the programme director and other community leaders, then discussed in meetings and changed accordingly.

Annual Meetings

The first Annual General Meeting was held in 1981. The meeting was open to all persons living in Saradidi. The major function of this meeting was to allow people outside the original church group to be involved in the decision-making. Voting rights were extended to members of all committees, including village health committees, members of the health scheme (see below), and individuals participating in income-generating activities (see below). Issues were decided by majority vote of those present. The constitution was discussed and approved.

Committees

Members of the executive committee (later the executive board) were elected at the annual meeting as were the programme director and the chairmen and members of the major committees.

The executive board included the programme director (as chairman), representatives of the fund-raising groups formed in Nairobi and Kisumu and a representative from the Anglican Church. The secretary of the executive board was also the manager of the centre (see below). The members were elected at the annual meeting and were given the responsibility for managing the programme.

Four programme committees were formed. The chairmen and members of all except the programme development committee were elected at the annual meeting.

The programme development committee consisted of three representatives from each village health committee, the programme director and the chairman, treasurer and secretary of the executive board. Its purpose was to monitor the progress of the programme, to develop new approaches and to solve village development problems. This committee worked closely with village health committees.

The administrative committee managed the programme's centre and clinic. All employees and volunteers of the programme were responsible to this committee.

The evangelism committee reflected the important input of different church congregations into the programme. Its function was to co-ordinate and unite the development activities of different churches and to maintain the spirit of evangelism which had initiated the programme.

The committee on income-generating activities helped to develop these activities in villages and at the programme's centre.

In addition to these committees, fund-raising groups were formed in Kisumu (the largest city in the Province) and Nairobi.

THE AREA AND PEOPLE

Saradidi is a rural area located 10 km south of the equator in Siaya District, Nyanza Province, 13 km from the shores of Lake Victoria and approximately 65 km from Kisumu (Fig.). The community occupies two administrative locations (Asembo East and Asembo West), an area of about 225 km^2. The average population density is roughly 250 per km^2. Saradidi is about 1100 meters above sea level and is hot and humid (average temperature 26·2°C, range 22–32°C). The area has two periods of heavy rainfall: March to May, called 'the long rains', and October to November, 'the short rains', receiving about 150 mm of rain annually. Considerable annual variations in onset, amount and duration of rainfall occur. Thus, rains can be insufficient or completely absent.

Almost all the streams are dry between rainy seasons. In 1982 and 1983 the rains were half of normal.

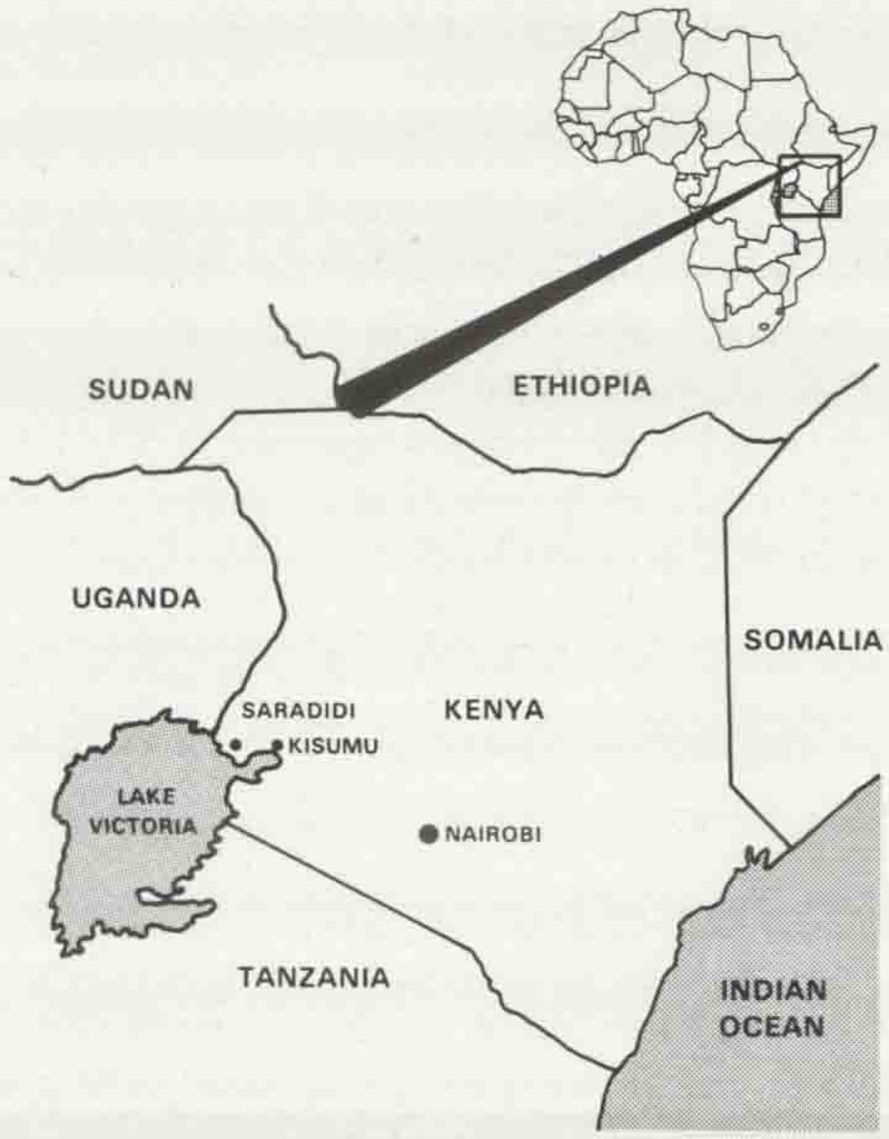

Fig. Map showing location of Saradidi.

Almost 99 per cent of the people belong to the Luo tribe. Most Luos are subsistence farmers growing maize, millet and peas as their major crops. Although the only cash crop in the area is cotton, market prices of cotton have been depressed recently. The soils range from sandy to loamy. Soil erosion, overgrazing, overplanting and other poor agricultural techniques have decreased land productivity. The necessary crop rotation is no longer done because of land pressure from the rapidly increasing population. The land is now so poor that many people are unable to produce enough food for their consumption between harvests. A survey in 1979 by medical students showed that less than 10 per cent of adults had any regular income from a salaried job or self-employment.

All roads in the area are muram; some are mere tracks. During the rainy seasons some villages are inaccessible by road. Most human waste is disposed of in pit latrines, but not every household has one. Water supply is mainly from surface, unprotected sources. During the rainy seasons, more sources of water are available. In the dry seasons, many households are more than 3 km from available water.

The 1979 Government of Kenya census (Central Bureau of Statistics, 1981), showed that the infant mortality rate was 147 per 1000 live births and the crude death rate was 21·6 in the Siaya district in which Saradidi is located. Before the project began, the nearest health facility was a small Roman Catholic mission health centre 6·5 km from the project centre and a government dispensary 13 km away. The closest government hospital was 30 km away in Siaya, the district capital.

More than 90 per cent of Saradidi residents were Christians: one-third of these were Anglican, one-third Catholic and one-third belonged to about 20 other denominations.

COMMUNITY

The community consisted of all persons living in Saradidi.

IMPLEMENTATION

The Centre

The initial executive committee recognized the need for a programme centre. The director approached five farmers (including his father) living at a likely place, who each willingly donated land. Time, labour, money and materials to construct a building were supplied by persons living in Saradidi and by interested persons from outside. Through village health committees some villages pooled their resources.

The Kenya Ministry of Health provided basic equipment and supplies for the centre. Seven people selected by the programme development committee were employed: a project manager, a clinical officer, two community nurses, a clerk/storekeeper, a groundsman and a watchman. The project manager was the team leader. These employees were supported by external funds through research grants, community development awards and others. Additional foreign full-time staff included British Volunteer Service Organization (VSO) volunteers and a water engineer. Although the centre rapidly became the physical 'heart' of the programme, village-based administrative activities remained the responsibility of village health committees.

Since referral facilities were not available in the central part of Saradidi, the community decided to set up a clinic where people would receive curative services. Users of the service paid for a membership in the 'Health Scheme' for Sh 20 ($1.40), thereby receiving services for one year or contributed Sh 5 ($0.35) per visit. The children of members were treated free, but those of non-members contributed Sh 3 ($0.21) per visit. This system was not strictly 'fee for service'. Rather, it helped the users to participate in the continuation of the service. No one was refused emergency services because they could not pay. The charges were fixed by the programme development committee according to those at the local mission hospital and to the cost of the services.

Since being built and staffed by the community, the clinic has become the major symbol of progress and of the potential to achieve. People in Saradidi have a sense of belonging to the centre of owning it. It is the centre for support of the village-based activities. The centre has become a place for the entire Saradidi area where committee meetings, workshops, seminars, board meetings and meetings with outside resource people are held. The training site for village level workers including VHH's. A base for resources and facilities near to the community for the use of technical advisers, trainers and other personnel for storage of materials (drugs, seeds, insecticides, etc.) for transport in emergencies and at other times of need and for marketing of village products. A contact point for resources from outside the community, including personnel and materials. The focal point for providing information about the programme to the community and to outsiders. The location of development and income-generating activities and the place where their development in villages was supported. The location of preventive, promotive and curative health services (including immunizations) that were not provided by the VHH. Seroiusly ill patients were referred to the centre. Mobile health services to distant parts of Saradidi were provided from the centre. The purpose of the centre was to support the community-based activities. The centre depended upon the voluntary participation of community members to provide these services and activities.

Community Organization

The basis of community organization in Saradidi was a mixture of factors, including geography, clan, religion and gender. The interim committee was active and respected, the project director was charismatic, highly educated, and motivated, almost all the people were Christian and there were early recognizable results of community efforts (such as the centre). The participation of church congregations and the common religious background of the

people were important reasons for the ability of many people in Saradidi to begin to work together.

Programme Director

The programme director was a physician with a master's degree in public health who was a member of the faculty of the Department of Community Health, University of Nairobi. He was born in Saradidi. His family was a prominent one and his parents resided in Saradidi. He was also a deacon in the Anglican church who frequently preached and in 1983 was ordained an Anglican priest.

Information, Education, Communication and Training

Seminars, workshops and meetings were held frequently at the centre and in the villages. These gatherings were considered important by the executive board to permit everyone in Saradidi to be involved in the programme if they wished. At general meetings open to everyone, different points of view were discussed, alternatives discussed, then intervention actions decided upon dependent upon the agreed priorities and upon the resources available. The open meetings (and the annual meeting which was more formal) were a forum for the executive board and programme development committee to receive community approval for proposed actions. It was during one of such meetings that the introduction of a community-based chemotherapy and limited chemoprophylaxis control programme was agreed upon. Technical advice by experts was presented at these meetings. The emphasis was on learning from each through sharing of experience.

Training was considered a major activity by the project director and the executive board. Special training activities involved the following:

Staff who were trained by the Community Health Workers Support Unit at AMREF in non-formal educational methods, such as discussion groups, role-play and dialogues. Wherever possible these methods were used in all project activities.

Village health helpers training started with an intensive two weeks introductory course (Kaseje *et al.*, 1987 *f*). Then sessions were arranged according to the convenience of the VHH trainees. Training was continuous. Communication skills were emphasized. Training was done primarily by the community nurses, but resource people from outside the project area also participated. The first group began training in 1981. By 1983, the first class of VVH's trained began to participate in the training of newly recruited VHH's.

Community leaders and VHH's visited other primary health care projects with similar objectives as a means of improving the programme. The community process was documented at every stage by diaries in which notes of all activities were kept by the project director, VHH's, members of the executive board, project committee and village health committees and trainers.

Roles

The functions of the VHH's and village health committees as agreed upon by vote in community meetings open to all residents are presented in Annex 1 and 2 respectively.

Facilitation and Supervision

Initially, training and supervision of programme activities were done by professionals who did not live in the community, but community members were later trained to assume these roles. The professional staff of the centre (nurses, clinical officer and programme manager) supervised and supported the VHH's. They received the monthly reports from the VHH's. Then they discussed with each VHH their assessment of each village's progress towards achieving programme objectives.

Evaluation

The programme director and the executive board agreed on the importance of constant evaluation to monitor progress toward objectives.

Some evaluation was done by an external evaluation team who, with permission of the community, collected information by surveys, questionnaires, open-ended interviews, or blood specimens.

However, the community was also involved in evaluation in these ways:

1. They decided in meetings open to all that evaluation was important for their programme.
2. Village programmes were assessed annually by persons from outside the village chosen by the executive board and approved by the village health committee.
3. The findings of external evaluation were presented at the annual general meetings and used in planning the following year's activities.
4. The VHH's from each village reported annually on the progress of their village. The form included objective and subjective questions.
5. Villages and/or individuals considered to have outstanding progress were recognized in meetings and sometimes presented with gifts.

Research

The Saradidi programme was not a research project but a community development programme. Research activities were initiated to measure progress scientifically, to quantitate impact on mortality and to obtain funds. Carefully collected data were necessary to determine if the Saradidi community was better off objectively and subjectively after the programme was implemented. Information was also necessary if the Saradidi approach was to be tried in other situations. The community agreed on the research component at a general meeting where the purpose was explained.

The objects of research were:

1. To objectively document the process of organization, planning and implementation of the programme.
2. To identify basic characteristics which are important for involvement in health and other development activities.
3. To determine the impact of the programme on mortality rates, morbidity rates, utilization of the services offered and changes in the knowledge, attitudes and behaviour.

Research was done with the people, not on them. Research was kept separate from the development programme itself. Committee members, VHH's and other community members were not asked to collect data other than to maintain their routine records; research information was collected by a field team. The community participated in the research process as follows:

1. All research projects had to be approved by the programme development committee. Projects were approved if they were considered beneficial to the programme and not too demanding of community resources nor considered to be harmful to the community.
2. Documentation of the process of community organization was done both by a field research team and by community leaders and VHH's. Other community members also participated. Community records and reports were part of the research data.
3. Participation in self-evaluating surveys. After agreement on the necessity for evaluation, community members formed evaluation teams to collect data on selected health indicators, and then they analyzed and interpreted the data guided by the research team.
4. All committees and VHH's were requested to keep records which were used in evaluation.

Four types of research data were collected:

1. Data collected by the field research team that was not part of the routine programme, e.g. blood slides and drug sensitivity patterns.
2. Data collected routinely by community leaders, VHH's and staff of the centre (e.g. records of meetings and home visits, clinical records, etc.) that were analyzed.
3. Data collected by both the field team and programme personnel to allow comparison, e.g. information on births and deaths.
4. Special surveys.

DISCUSSION

The people of Saradidi, Kenya were able to organize themselves to respond to their perceived health problems. To aid community development they voluntarily gave of their time, their money, their land and their experience. The aspects of the programme which appear to have allowed the process of development to occur include:

The Initiation Process

Ideas from the outside were not imposed on the community but were introduced by dialogue and discussion so that final decisions were made by the community. Thus, the community felt that they participated in all the activities and decisions of the programme. The community itself initiated the development process and determined priority health needs as well as programme objectives.

Continuous Dialogue

Information, education and communication were an integral part of the programme. Seminars, training courses and open meetings were frequent. All residents were encouraged to participate as appropriate.

Community Organization

Community organization was sensitive to existing traditional, kinship, government and church structures.

Leadership Chosen by the Community

Leaders and VHH's were elected at community meetings open to all persons living in Saradidi. Village health committees were elected by the community. Health professionals from outside as well as the staff of the centre were responsible to the elected community leaders. Through this process community members contributed actively to their own health and development.

Supervisory Activities/Facilitation

Although management activities of the programme were the responsibility of elected community leaders, guidance was available from professional personnel at the centre and, when necessary, from outside experts. Supervision was provided for the VHH's and referral capability was available.

Involvement in Research

The research grants provided funding at crucial periods of development for visible items such as the purchase of chloroquine phosphate tablets for treating malaria and salaries of employees at the programme centre. Without these resources, at the beginning, the community may have had more difficulty in mobilizing its own resources. The research projects emphasized the necessity for evaluation. The community participated in collecting information and records to determine the success in meeting programme objectives. The records helped to document community participation. All research activities had to be approved by the community before

commencing. This was done by vote in open meetings where research proposals were explained.

Emphasis on Training

Training sessions and seminars were held for VHH's, programme staff, community leaders and residents.

Role of Outside Agencies

The Ministry of Health provided not only the much-needed moral support and assurance but also professional guidance and supervision for the support staff, equipment and supplies, and a legal basis for the project activities.

The African Medical and Research Foundation (AMREF) provided guidance and advice during the initiation process, training for trainers of VHH's and training of the original group of VHH's. They also provided training materials, moral support and an avenue for exchange of ideas with other similar projects. AMREF staff helped with the participatory evaluation that was done by the community and provided overall guidance.

The Church of the Province of Kenya (Anglican Church), Diocese of Maseno South provided the umbrella under which the project operated. Thus the project was protected from destructive politics. It also provided some professional input in the area of health. Most important of all, the Church provided the spiritual context and stimulation that has been of greatest significance in the sacrificial participation that has been observed as the project has progressed.

The University of Nairobi Department of Community Health provided support and allowed the programme director time to spend in Saradidi by recognizing the programme as part of his duties.

The Saradidi rural health development programme has been successful in an environment generally extremely hostile to community participation and one with severely limited resources and opportunities. The project has succeeded because it was begun, planned, organized, implemented, managed and evaluated by the community. The benefits of the programme have accrued to the community. Outsiders have contributed in the context of partnership and dialogue. The leaders, workers and centre staff were all selected by community members or their leaders. The problems to be addressed and priorities were decided on by the community. Finally, as the project grew, the community compiled a written document explaining their objectives, the methods, organizational structure and roles of all participating groups, committees or individuals. Because of these facts, Saradidi has been described as the people's project; this is the reason for its success. The papers which follow analyze different aspects of the programme.

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ANNEX 1

Functions of Village Health Helpers (VHH's) as Decided by the Saradidi, Kenya Community

a. *Improvement of the Environment:* Help with latrine construction. Improving home and village cleanliness. Getting good water supplies and persuading people to boil water. Improving construction of homes. Getting people to make utensil drying racks. Visiting markets.

b. *Improving Use of Existing Services:* Family planning. Use of antenatal services. Immunization. Referrals to doctors or clinics. Help in getting patients to hospital. Follow-up of cases from hospital.

c. *Treatment for Illness and First Aid:* Giving medicines. Care of the sick. Detecting illness. First aid for injuries. Helping in the community clinic.

d. *Nutrition:* Giving advice on correct food. Improving methods of cooking. Growing vegetables. Home economics.

e. *Diagnosis/Reporting/Records:* Knowing the main diseases in the village. Knowing the number of children born. Knowing the number of population in the village. Reporting outbreaks of disease to staff at the centre. Passing on information.

f. *Specific Disease Control:* Malaria treatment. Detecting diarrhoea or cholera. Preventing measles and polio by encouraging immunizations. Ensuring treatment for leprosy.

g. *Home Visiting:* This is an important factor and applies to all the above.

h. *Health Education/Information/Motivation/Advice:* This covers all the above as well. Health education also should create awareness of problems. It is directed especially at prevention of disease and promotion of good health. There is emphasis on child care and giving advice to pregnant mothers.

i. *Community and Social Action:* Linking the VHC and the villagers. Linking the villagers and the Health Service. Initiating development projects. Educating people about working together on projects for progress. Taking part in meetings (baraza). Improving the villages. Starting income-generating activities.

j. *Teamwork:* With other extension workers.

k. *Continuing Education:* To attend refresher courses and keep up-to-date.

l. *Confidentiality:* To keep the individual problems confidential from other people in the village and from persons living outside.

ANNEX 2

Functions of the Village Health Committee (VHC)

a. *Planning the Community Services leading to Health:* Discussing the records of major problems. Deciding on the priorities and possible solutions. Defining the villages. Ensuring selection for training of suitable workers. Assessing village resources. Discussing funds. Seeking assistance from different extension workers.

b. *Organizing:* Co-ordinating assistance from different sources. Seeing that training is completed. Seeking new membership and funds. Interesting the community. Calling Harambee meetings.

c. *Supervision and Management:* Ensuring the good work and tactful approach of the VHH. Distributing drugs, equipment, posters, etc. to the VHH. Seeing that high risk families are attended to. Checking on the running of development projects, e.g. raising sheep and chickens. Sorting out problems at the community health centre.

d. *Measuring Progress:* Inspecting records and preparing reports.

e. *Telling the People of Results* and the need for further action. Calling a 'Baraza' to discuss progress and seeking new ideas.

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Community-based malaria control in Saradidi, Kenya: description of the programme and impact on parasitaemia rates and antimalarial antibodies

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A community-based malaria control programme initiated in Saradidi, Kenya in 1982 is described. Antimalarial treatment provided by volunteer community health workers was made available in each village. Malaria was holoendemic. Parasitaemia rates by age were high and did not change after the control programme began. *Plasmodium falciparum* was the most common species and was present alone or mixed in 98·2% of 8105 infections. Virtually all (98·5%) of 2040 blood samples collected in May 1981 were positive (reciprocal titre ≥ 80) to *P. falciparum* by the indirect fluorescent antibody (IFA) test. Seropositivity rates to *P. falciparum* in the IFA test or the enzyme-linked immunosorbent assay (ELISA) were high in all age groups and did not change significantly in longitudinal surveys or in a cohort of children zero to nine years old followed at intervals. While the malaria control programme was successful in bringing treatment to each village, malaria prevalence was not reduced. Parasitologic and serologic studies alone were not adequate to describe the impact of the community-based malaria control programme in Saradidi. Morbidity and mortality rates caused by malaria can decline, significantly improving the health of the population, in the absence of any decrease in parasitaemia rates.

Primary health care aims at making essential health care accessible to the population (World Health Organization and United Nations Children's Fund, 1978). Accessibility implies that health care is geographically, financially, culturally and functionally within easy reach of the people. To meet these needs, new ways of bringing specific health services to the communities are being explored. One approach that has been used with some success to make primary health care services universally available is community-based distribution (Kols and Wawer, 1982). In these programmes, essential services and supplies for important health problems are provided in the community by residents (often volunteers) who are not health professionals.

Malaria is a priority health problem in many parts of tropical Africa. Community-based distribution of chloroquine phosphate for treating malaria may be an effective control measure by reducing morbidity and mortality caused by the disease. To our knowledge, there have been no published reports from tropical Africa on the use of volunteer community health

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workers to diagnose and treat malaria. Analysis of such experiences would be useful in determining the factors responsible for successful programmes and identifying solutions for common problems. This paper describes a community-based malaria control programme in Saradidi, Kenya, that utilized volunteer community health workers and presents the impact of the programme on parasitaemia rates and antimalarial antibodies.

MATERIALS AND METHODS

Background

Saradidi is a rural community in western Kenya near Lake Victoria (Kaseje and Spencer, 1987). More than 99% of the population is Luo. Malaria is holoendemic in Saradidi (Roberts, 1974). The principal species is *Plasmodium falciparum*. Earlier studies in an adjacent area of Kenya suggested that malaria contributes to at least 38% of infant mortality; when fenitrothion was used as a residual insecticide to reduce the prevalence of *Anopheles* mosquitoes, malaria prevalence decreased significantly, and infant mortality rates fell from 157 to 98 per 1000 live births (Payne *et al.*, 1976).

Malaria control in Saradidi was initiated as part of community participation in health development. It began with the community's decision that malaria was a priority health problem and with the realization that both community and external resources could be mobilized (Kaseje and Spencer, 1987). Emphasis was placed on malaria as a disease rather than an infection. As one of several health activities, the community decided to try to prevent deaths and disease due to malaria.

Objective

The objective of malaria control in Saradidi was to provide prompt, appropriate treatment in each village to persons with malaria. Treatment was made available from village health helpers (VHH's). These people were volunteer residents selected and supported by the village. The VHH's were young, female, married, educated, religious and highly motivated to help their community (Kaseje *et al.*, 1987*d*). In addition to treatment of persons with malaria, the VHH's had many other responsibilities, particularly health education.

Diagnosis and Treatment

The VHH's gave chloroquine phosphate to every person who came for treatment saying they had malaria. The VHH did not screen the symptoms and attempt to decide if the person had malaria or not. The drug had to be taken in the presence of the VHH, none was to be taken home. The exceptions to this rule were those seriously ill or too sick to come or be brought to the home of the VHH; for these persons the drug was given to a family member. If a person returned the next day, the same treatment was repeated. However, if symptoms persisted on the third day, the patient was referred to the Saradidi clinic. Seriously ill patients including those who could not take oral medication because of vomiting were also referred for parenteral treatment. Blood films were not collected. Information taken by the VHH's from each person and kept as a permanent record included date, age, sex, patient's village, household and personal identification numbers, the number of pills or teaspoons of syrup given, and whether the persons had previously requested treatment from the VHH (and if so, when). If the person was not from the village, this fact was recorded.

The treatment given was chloroquine phosphate 10 mg base per kg. This dose was based on *in vivo* and *in vitro* drug sensitivity studies done before the inception of malaria control which demonstrated the effectiveness of this dose for treatment of *P. falciparum* infections in Saradidi (Spencer *et al.*, 1987*a*). Treatment was based on age, and the dose was chosen to ensure a minimum of 10 mg base per kg was given (e.g. adults received five tablets of 150 mg base each).

Chloroquine syrup containing 50 mg base per 5 ml was available for children. The programme was initiated in May 1982.

Chloroquine Supply

Chloroquine was purchased from commercial sources using funds supplied by the World Health Organization (WHO) and taken to a community-built clinic at the Saradidi programme centre. From there, chloroquine was then distributed to the VHH's. Each VHH received a tin of 1000 tablets of 150 mg chloroquine base and 500 ml of syrup of 50 mg chloroquine base per ml. To replenish their supply, the VHH's had to return to the clinic with their record book. Malaria treatment was also available from the Saradidi community clinic, two Ministry of Health dispensaries in the area and a mission hospital; however, more than half of the population lived at least 5 km from these facilities. Chloroquine could also be purchased in small shops. Before the programme was initiated, the shops were the major source of antimalarial drugs and advice on the drug and what dose to take was often given by shopkeepers (Mburu *et et al.*, 1987).

Areas

Saradidi was divided into three areas (A, B and C) based on the degree of community organization (Kaseje and Spencer, 1987). Community development began in area A in 1979, in area B in 1980 and area C began to organize in late 1981. If successful in areas A and B, the community-based malaria control programme was to be extended to area C. The epidemiology of malaria and the demographic, economic and cultural composition of the population were virtually identical in the three areas (Spencer *et al.*, 1987*h*).

VHH's were selected and trained in areas A and B. Antimalarial treatment was made available in each of the 36 villages of these areas in May 1982. The VHH's rapidly became the principal source for treatment of malaria in these villages (Mburu *et al.*, 1987). Area C served as the control area, VHH's were trained but did not provide antimalarial drugs.

Chemoprophylaxis

In area A, malaria chemoprophylaxis with chloroquine was provided to all pregnant women who wished to receive it. The dosage was chloroquine phosphate 300 mg base weekly. The VHH visited the household every two to four weeks. One weekly dose was to be taken in view of the VHH, then a sufficient supply until the next visit was left with the women.

Training

The VHH's were trained in seminars and workshops emphasizing participation by the trainees (Kaseje *et al.*, 1987*f*). The points for treatment of malaria stressed were who to treat, who to refer to the clinic, how much drug to give, how to keep records, and how to get more drugs. Sessions were conducted in Luo, the local language. Several seminars were held at various times to allow the VHH's to carry out diagnosis, treatment, record-keeping and referral; the VHH's later reported any problems encountered so that modifications could be made. The training sessions on malaria treatment ceased only when both the trainers and the VHH's felt these issues were fully understood. As new VHH's were chosen, experienced VHH's participated in the training.

Parasitologic Surveys

Parasite prevalence surveys were carried out in the study areas by a field team consisting of four technicians. Twenty-five villages (nine in area A, ten in area B and six in area C) were randomly selected in the first two surveys. Subsequently, the same villages were revisited; two were visited five times, 11 four times, six three times, one twice and five once. Schoolchildren aged six to 14 years from the school in the village were examined in the morning. Persons of

other ages from the village were examined in the afternoon by asking them to come to a central place. Surveys of two weeks each were done in November 1980, March 1981, May 1981, May 1982, November 1982, March 1983 and November 1983. Two of these surveys (May 1981 and May 1982) were done within four to six weeks after the long rains began when, theoretically, malaria transmission should have been at its peak. The others were carried out in the dry season or at the beginning of the short rains. Three surveys (November 1980, March 1981 and May 1981) were carried out before the control programme began. All persons surveyed were treated with chloroquine phosphate base 10 mg base per kg.

Thick blood smears made from fingerprick were stained with Giemsa and examined by trained microscopists. At least 100 fields were examined before a slide was called negative. Mixed infections were noted. For the first four surveys, all positives and 10% of the negatives were checked by a supervisor. This process was discontinued because the proportion of detected errors was so small (less than 0·5%).

Serologic Tests

Beginning in May 1981, blood specimens for antimalarial antibodies were collected by finger-pricks as well as the blood slide. The samples were placed on filter papers (Collins *et al.*, 1987). Filter paper specimens were stored at −20°C until examined. The numbers of parasitologic and serologic specimens differ because a serologic specimen was not taken from every person and a number of filter papers were contaminated when a freezer in the laboratory failed.

Specimens collected in May 1981 (before intervention) were eluted from filter papers and examined by the indirect fluorescent antibody (IFA) test (Sulzer *et al.*, 1969; World Health Organization, 1974; Collins *et al.*, 1987). The reaction to three antigens (*P. falciparum, P. malariae* and *P. ovale*) was tested. Each specimen was examined at dilutions of 1:80, 1:320, 1:1280 and 1:5120. A reciprocal titre of 80 or more was considered positive.

Specimens collected in March 1982, May 1982, November 1982, March 1983 and November 1983 were examined with the enzyme-linked immunosorbent assay (ELISA) (Spencer *et al.*, 1979; Collins *et al.*, 1987). *Plasmodium falciparum* parasites from continuous *in vitro* cultures were used as antigen. All samples were tested at a dilution of 1:100. This dilution was selected as the most appropriate screening dilution for population samples based on comparative studies in the laboratory (Collins, W.E., personal communication). An absorbance of 0·3 or greater was considered positive. Values greater than 1·0 were considered strongly positive with confidence limits > 95%.

Cohort

A cohort of children zero to nine years of age was followed prospectively with parasitologic and serologic specimens. Two villages in area A, two villages in area B and one village in area C were randomly selected and approximately 35 children in each village chosen by going from household to household. Specimens were examined for antibodies to malaria with both the IFA and the ELISA. Specimens were examined at two dilutions, 1:100 and 1:1000 in the ELISA. Each child in the cohort was treated with chloroquine phosphate 10 mg base per kg each time they were sampled.

RESULTS

Parasitaemia

Since results from areas A and B were very similar, the data from these areas were combined. Provision of antimalarial treatment in each village of areas A and B did not alter parasitaemia rates. The parasitologic prevalence by age after the control programme began in areas A and B combined were very similar to those in area C (Table 1). Parasitaemia rates were high even during the dry season. The prevalence of malaria infections was significantly higher in areas A

and B before the control programme began in both the rainy ($\chi^2 = 350$, $P < 0{\cdot}000001$) and dry season ($\chi^2 = 363$, $P < 0{\cdot}000001$) than after the control programme began. However, the prevalence of parasitaemia in areas A and B after beginning control measures was not statistically significantly ($P > 0{\cdot}5$) different from that in area C in either the rainy or dry seasons. The most likely explanation for the differences in areas A and B is that a change in environmental conditions occurred, resulting in lower levels of transmission; a drought began in 1982 (Kaseje, D.C.O., personal communication).

Parasitaemia rates in all age groups were significantly higher during the rainy season (Table 1). In general, children one to 14 years of age had the highest prevalence of parasitaemia, although infants less than one year old also had high rates.

TABLE 1

Prevalence of malaria parasitaemia before and after beginning of the control programme, by area, age and season in Saradidi, Kenya, 1980 to 1983

	Before control programme, dry season Areas A and B*		*After control programme began, dry season† Areas A and B*		*Area C*	
Age (years)	*No. slides examined*	*% positive*	*No. slides examined*	*% positive*	*No. slides examined*	*% positive*
Less than 1	145	53·1	213	48·4	99	49·5
1 to 5	758	68·2	1078	66·5	486	64·8
6 to 14	1256	72·5	2583	50·4	1117	48·1
15 to 29	267	30·0	972	16·2	445	20·0
30 or more	95	12·6	988	9·1	624	11·2
	2521	63·3	5834	40·6	2771	38·4
	Rainy season§			Rainy season‖		
Less than 1	59	79·7	43	60·5	18	66·7
1 to 5	527	89·0	318	77·7	141	76·6
6 to 14	1200	88·7	772	78·4	145	84·8
15 to 29	182	61·0	145	44·1	47	44·7
30 or more	181	45·9	216	38·9	35	42·9
	2149	82·5	1494	68·7	386	72·3

*November 1980, March 1981.
†November 1982, March 1983, November 1983.
‡Positive for any malaria species.
§May 1981.
‖May 1982.

Species

Plasmodium falciparum was the most common species (Table 2). It was present in 98·2% of 8105 positive slides alone or in combination with *P. malariae* and/or *P. ovale*.

IFA Tests

Results from the IFA tests done in the May 1981 survey confirmed the high proportion of infections with *P. falciparum* (Fig.) Only 31 (1·5%) of 2040 samples had a reciprocal titre to *P. falciparum* of less than 80. In contrast, 19·2% and 22·6% of the 2040 samples had reciprocal titres less than 80 to *P. malariae* and *P. ovale* respectively. The geometric mean reciprocal titre

TABLE 2
Parasitaemia by Plasmodium *species in 8105 positive slides in Saradidi, Kenya, 1980 to 1983*

Species	%
P. falciparum	87·1
P. malariae	1·6
P. ovale	0·4
P. falciparum + *P. malariae*	8·5
P. falciparum + *P. ovale*	1·8
P. falciparum + *P. malariae* + *P. ovale*	0·7

was 1066·2 to *P. falciparum*, 113·0 to *P. malariae* and 91·4 to *P. ovale*. In only 25 (1·2%) samples were reciprocal titres to *P. malariae* and/or *P. ovale* higher than those to *P. falciparum*; in 23 of these 25 the reciprocal titre to *P. falciparum* was 80 or more (but less than that of the other species).

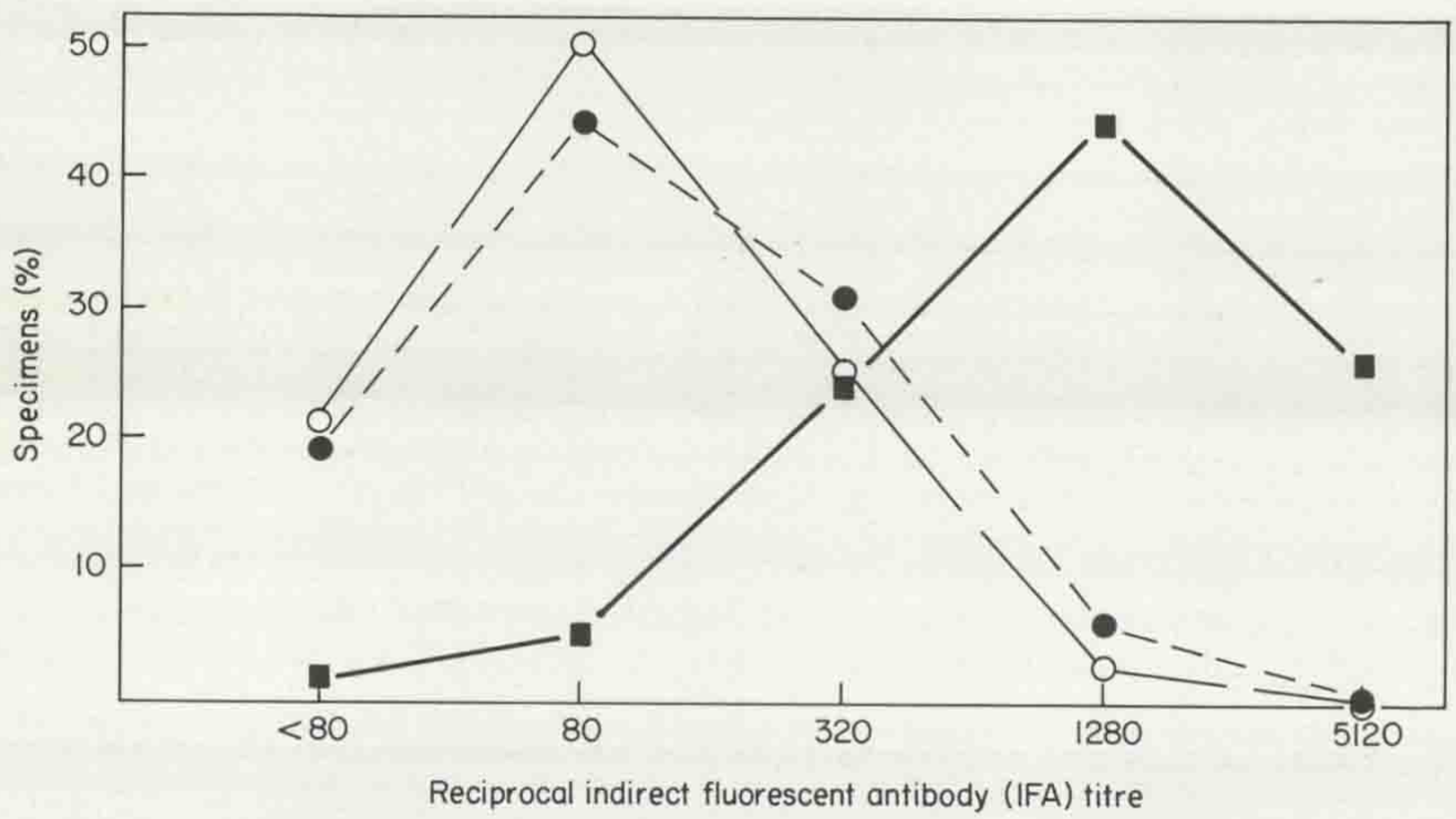

Fig. Reciprocal antimalarial antibody titres by antigen of 2040 specimens from Saradidi, Kenya in the indirect fluorescent antibody (IFA) test, May 1981. ■—■, *P. falciparum* antigen; ●– – –●, *P. malariae* antigen; ○— —○, *P. ovale* antigen.

High rates of seropositivity to *P. falciparum* were observed in all age groups (Table 3).

Serologic Surveys

Seropositivity rates to *P. falciparum* in the ELISA were high and increased with age (Table 4). When the results from areas A and B combined were compared with those from area C (the control) in surveys done after the malaria control programme began, no statistically significant difference was found in the proportion of seropositive samples in any age group.

Cohort Studies

Parasitaemia rates were high in the cohort of children followed in each survey (Table 5). Most serum samples from the cohort children were positive for antibodies to *P. falciparum* when

TABLE 3

Results of indirect fluorescent antibody (IFA) test by age in Saradidi, Kenya, May 1981

Age (years)	*No. examined*	*% positive**
Less than 1	56	85·7
1 to 5	489	96·7
6 to 14	1160	99·5
15 to 29	167	99·4
30 or more	168	100·0
Totals:	2040	98·5

*Reciprocal IFA titre to *P. falciparum* 80 or more.

TABLE 4

Results by area and age of enzyme-linked immunosorbent assay (ELISA) in serologic surveys done after inception of malaria control programme in Saradidi, Kenya, 1982 to 1983*

	Area A and B combined			*Area C*		
Age (years)	*No. examined*	*% positive†*	*% highly‡ positive*	*No. examined*	*% positive†*	*% highly‡ positive*
Less than 1	176	97·2	21·0	63	96·8	22·2
1 to 5	963	99·3	57·8	420	100·0	58·6
6 to 14	2435	100·0	80·5	858	100·0	73·8
15 to 29	840	100·0	89·0	249	100·0	89·2
30 or more	874	100·0	95·9	357	100·0	96·1
	5288	99·8	78·3	1947	99·9	74·9

*Serologic surveys combined, May 1982, November 1982, March 1983 and November 1983. All were done after the malaria control programme began.

†Optical density (OD) $\geq 0{\cdot}3$ at serum dilution of 1 to 100.

‡Optical density greater than 1·0 at serum dilution of 1 to 100.

examined by the IFA test and were highly positive by the ELISA at a dilution of 1:100 (Table 6). Seropositivity rates in the ELISA at 1:1000 dilution were lower. The higher rates of parasitaemia and seropositivity observed in area C were most likely because the entire cohort of 33 children from area C came from one village with very high transmission.

DISCUSSION

A community-based malaria control programme was begun in Saradidi, Kenya. A number of important elements of primary health care were involved in the initiation and implementation of malaria control in Saradidi. The people living in Saradidi believed that malaria caused significant death and disease in their community (Kaseje and Spencer, 1987). Many people lived long distances (often more than 15 km) from any dispensary, clinic or hospital;

TABLE 5

Parasitologic prevalence of malaria in a cohort of children examined at intervals by area, age and date in Saradidi, Kenya, 1981 to 1983

Area	Age group (years)	No. in age group at beginning	May 1981		May 1982		November 1982		March 1983		November 1983	
			No.* examined	% positive	No. examined	% positive	No. examined	% positive	No. examined	% positive	No. examined	% positive
A and B combined	0–5	47	17	100	10	100	30	80·0	30	46·7	20	75·0
	6–9	83	23	78·3	39	84·6	92	65·2	92	39·1	88	62·5
	10 or more	—	—	—	4	75·0	8	50·0	8	50·0	22	63·6
		130	40	87·5	53	86·8	130	67·7	130	41·5	130	64·6
C	0–5	10	—	—	—	—	10	90·0	10	80·0	—	—
	6–9	22	—	—	—	—	22	77·3	22	50·0	31	90·3
	10 or more	2	—	—	—	—	2	100	2	50·0	3	66·7
		34	—	—	—	—	34	82·4	34	61·8	34	88·2

*Age group at time of specimen. Birth date estimated by assuming all children at mid-point of year when first examined.

TABLE 6

Antibodies to P. falciparum *by indirect fluorescent antibody (IFA) test and enzyme-linked immunosorbent assay (ELISA) in a cohort of children by test, area and date in Saradidi, Kenya, 1982 to 1983*

		May 1982		*November 1982*		*March 1983*		*November 1983*	
Area	*Test*	*No. examined*	*% positive**	*No. examined*	*% positive*	*No. examined*	*% positive*	*No. examined*	*% positive*
A and B combined	IFA	45	100	130	96·9	130	100	70	100
	ELISA 1:100	28	100	130	99·2	124	83·9	66	81·8
	ELISA 1:1000	46	50·0	130	38·5	124	5·6	66	6·1
C	IFA	—	—	34	100	34	100	—	—
	ELISA 1:100	—	—	22	100	32	96·9	—	—
	ELISA 1:1000	—	—	34	52·9	33	48·5	—	—

*IFA reciprocal titre 80 or more; ELISA absorbance more than 1·0 (absorbance ≥ 0·3 considered positive, > 1·0 highly positive).

thus facilities for malaria diagnosis and treatment were not readily accessible. During discussions and meetings before the malaria control programme was initiated, the community developed the perception that by working together they could do something about this health problem.

The community participated in the programme. Village health committees were formed that recruited and selected the VHH's. Each village was represented in the programme committees that were concerned with development in the entire area. The VHH's were involved with other health problems as well as malaria, including family planning, maternal and child health, sanitation and health education (Kaseje *et al.*, 1987 *d*).

The VHH's were supervised and referral capability was available for patients who failed to respond to treatment or who were acutely ill. Both were supplied by personnel of the Saradidi Rural Health Clinic. The clinic was built by people living in the community. It was staffed by community health nurses, medical students, a clinical officer, and registered nurses. A physician was frequently in attendance. Transport was available at the clinic to take seriously ill patients to a hospital 40 km away. The VHH's themselves spent time in the clinic in training and participating in the various types of health services provided. The VHH's could call upon clinic personnel for help with problems and for support.

The parasitologic and serologic results demonstrate that malaria is hyper- to holo-endemic in Saradidi: *P. falciparum* is the predominant species. Despite the high levels of transmission, seasonal variations occurred in all age groups and parasitaemia rates increased significantly in the surveys done during four to six weeks after the beginning of the rainy season, when transmission levels were theoretically highest.

The malaria control activities did not decrease parasitaemia rates or the prevalence of antimalarial antibodies. Nonetheless, the programme was successful in providing antimalarial treatment. As demonstrated elsewhere (Spencer *et al.*, 1987*e*), the average number of treatments given by the VHH's per person per year was 1·24. More than 75% of persons who suspected they had malaria went to the VHH's first for treatment (Kaseje *et al.*, 1987*e*). After the programme began, the VHH's quickly became the major source of antimalarial treatment in the area (Mburu *et al.*, 1987).

Malaria control is often equated with reduction in prevalence. In fact morbidity and mortality rates caused by malaria can decline, significantly improving the health of the population, in the absence of any decrease in parasitaemia rates (Molineaux and Gramiccia, 1980). Having reduction in prevalence as an objective of malaria control programmes that originally have the sole aim of providing prompt diagnosis and appropriate treatment to persons with malaria is unrealistic. Even attempting to measure mortality rates to evaluate a programme is difficult. Specific cause of death is usually impossible to determine since pathologic examination cannot be carried out and death may have resulted from many causes. Baseline mortality rates are often not available. Mortality rates are already decreasing in many areas as health services and general living conditions improve. Similar problems exist with definition and measurement of morbidity. For these reasons, indicators such as the accessibility to treatment, utilization of services, the referral capability for seriously ill patients and treatment failures and status of drug supply may be of greater usefulness for the health services in monitoring progress of malaria control activities such as those carried out in Saradidi than more classic indicators such as morbidity and mortality.

Community-based malaria control activities in Saradidi depended upon active community participation; the involvement of volunteer community health workers who received training, support and supervision; the presence of referral capability; a recognized priority health problem; the perception that something could be done in the community and antimalarial drugs in adequate quantities. These elements should be considered where similar programmes are attempted. One important problem for Saradidi will be how to maintain the supply of drugs when external resources are no longer available. Possible solutions include charging for

treatment. Sharing of carefully documented experiences in community-based malaria control efforts such as the one in Saradidi and critically analyzing problems encountered and solutions attempted are needed for improving malaria control within primary health care elsewhere.

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The Saradidi, Kenya, Rural Health Development Programme: retrospective demographic analysis

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A census was done in Saradidi, Kenya from 1980 to 1982 as part of a community-based health development programme. The population was 42 755 (excluding 39 persons of unknown age or sex); 17·1% were less than five years old, 46·9% were below age 15, 4·7% were age 65 years or older and 19·7% were women in the reproductive years (age 15 to 44 years). The sex ratio was 86 males per 100 females due principally to migration of adult males for work. The mean number of persons per household was 4·0 and the mean village population was 764. The singulate mean age of marriage for men was 27·0 years and for women 19·9 years; 0·8% of adult men had never married. Only 0·1% of women by age 50 had never been married. Men were significantly more likely than women to be married to more than one spouse, divorce and separation was higher among men, and by age 50 about one-third of women were widows. Men had more years of formal education than women and young people of both sexes more than older people; 73·1% of men and 96·1% of women 60 years and more had never attended school. Infant mortality rates estimated indirectly ranged between 139 and 155 by area. A strong association was found between increasing education of the mother and decreased reported mortality of children. The total fertility of 6·2 was high but lower than the national average possibly because of the high rates of polygamy and primary infertility and the long periods of amenorrhoea and breast feeding which occurred after delivery. This area continues to have one of the highest levels of infant and child mortality in Kenya as well as relatively high fertility and a population with a very young age structure. This implies a continued very rapid rate of population growth which will make more difficult in the future the problems of delivering effective health services and overcoming poverty. A vigorous programme directed toward improving health is indicated which must include family planning.

Despite the acceptance by African governments of the strategy of primary health care (World Health Organization and United Nations Children's Fund, 1978) and the initiation of programmes in a number of countries to develop a cadre of community health workers, there is little information regaring the impact on health of these community level activities. Documentation is usually incomplete, anecdotal in nature or based on uncontrolled observations, and critical analysis is impossible. Thus, translating these experiences to other situations is difficult.

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A commumity-based health development programme was initiated by the people of Saradidi, Kenya, in 1979 (Kaseje and Spencer, 1987). At early planning sessions open to all persons living in the area, it was decided that a census and registration of vital events would be important for monitoring progress and for making decisions. The census and the demographic surveillance carried out provided detailed information on the population structure and on mortality, fertility, marital and education characteristics of Saradidi and permitted evaluation of the impact on mortality and fertility of the community health activities. The retrospective demographic analysis from the census is presented here.

METHODS

Background

Details have been presented earlier (Kaseje and Spencer, 1987). Saradidi is a rural area in western Kenya near Lake Victoria. Salaried jobs are few and most people are subsistence farmers. Almost all the people living there are members of the Luo tribe. The area is characterized by high infant mortality rates, a high population growth, acute land shortage, and poverty (Central Bureau of Statistics, 1981; Kaseje and Spencer, 1987; Sindiga, 1985). As part of the health development programme, the people of Saradidi organized themselves into three areas (designated A, B and C) corresponding to the degree and length of community organization. These areas were subdivided into villages based on geography, class-groups, kinship ties and church affiliations. One or more volunteer village health helpers (VHH's) were chosen and supported by each village (Kaseje and Spencer, 1987).

In May 1982, a malaria control programme was initiated (Spencer *et al.*, 1987*c*). Chloroquine phosphate to treat malaria was made available in each village in areas A and B. Treatment was provided by the VHH's. In area A, VHH's also provided chloroquine chemoprophylaxis for pregnant women. Area C served as a control area; VHH's were selected but they did not have antimalarial drugs.

Purpose

The community decided a census and registration of vital events would be important for planning and evaluation. It was considered necessary to collect baseline information about the population in order to measure the impact of the intervention (providing chloroquine phosphate for malaria in each village). In addition, a census was also necessary to determine if the demographic aspects of the three areas were comparable before the control programme began.

Census

A household was defined as people eating together. Each household was visited and given an identification number which was painted on the house. Enumeration of the population was done on a *de jure* basis. A person who was not physically in Saradidi at the time of the census or updates was considered to be a household member if other members said he/she lived there and if the person had slept in the household within the previous three months. Each household member was given a personal identification number. A complete number therefore identified the area, village, household and person. The age, sex, education and marital status of each person were recorded. Additional information collected from each woman 15 years of age and older included:

Number of children born alive living in the household.
Number of children born alive living elsewhere.
Number of children born alive who have died.
Number of pregnancies not surviving since last live birth.

Date (month, year) of last live birth (a live birth was defined as birth after which the child cried even if death occurred soon thereafter).
Whether mother was still breast-feeding since last live birth.
Whether menstruation had returned since last live birth.

A copy of the form with identifying information on each household member was left in every household.

A complete household registration and census was carried out in area A between August 1980 and January 1981, in area B between February and May 1981, and in area C between May and August 1982. The need to collect baseline information on vital events in areas A and B for at least one year prior to and one year after beginning treatment of malaria delayed initiating the census in area C (Spencer *et al.*, 1987*h*).

Field Team

The census was done by a field team consisting of one supervisor, one technician, five laboratory attendants and a driver. With the exception of the latter, all had completed at least eight years of school. All were men, all were Luo, and all, with the exception of the driver, were fluent in Luo, Swahili and English.

Training and Validation

The forms were discussed in depth with the field team until they understood the intent of each question. During the first two weeks, households were visited in the morning, and then the forms were reviewed and discussed in the afternoon to correct errors. During the first month, ten per cent of households were revisited and the census information was re-collected by a supervisor and one of the principal investigators. Forms were reviewed weekly with the supervisor and monthly with the entire field team.

Mean Age of Marriage

The singulate mean age of marriage was calculated as previously described from the proportion of males and females single in successive age groups (United Nations, 1983).

Indirect Estimates of Mortality

Indirect estimates of infant and early childhood (one to four years) mortality were calculated from information on the number of children ever born and the number of children surviving. The estimations were based on a technique developed by Brass (1975) and were calculated according to the method of the United Nations (1983). Regression equations based on the North model life tables were used. Estimated infant and early childhood mortality rates were then taken from the regional model life tables (Coale and Demeny, 1966).

RESULTS

Population

The population composition by age and sex at census separately for areas A, B and C and combined is presented in Table 1. As demonstrated the age and sex composition of the three areas was very similar. The combined population was 42 755 (excluding 39 persons of unknown age and/or sex); 17·1% were below age five, 46·9% below age 15, 4·7% age 65 years or older and 19·7% were women in the reproductive years (age 15 to 44).

Sex Ratio

Under the age of 20 there were approximately equal numbers of males and females (Table 1). However, there was a preponderance of females after age 20 in areas A and B and after age 25

in area C (Tables 1 and 2). Male/female ratios were smallest for persons aged 30 or more. The sex ratio for all ages and the three areas combined was 86 males per 100 females (Table 2).

Village Size

The mean village population was 764; 720 (range 294–1616 in 23 villages) in area A, 850 (range 405–1577 in 13 villages) in area B and 759 (range 306–1078 in 20 villages) in area C.

Household Size

At census there were 4135 households in area A, 2901 in area B and 3742 in area C; the mean number of persons per household respectively were 4·0, 3·8 and 4·1 (4·0 for all three areas).

Marital Status

Results from the three areas were so similar that data on marital status were combined. The singulate mean age of marriage for men was 27·0 years and for women 19·9 years. As shown in Table 3, in every five-year age group fewer women than men had never been married; only 0·1% of women age 50 to 59 had never been married. More than one-third of women of 50 to 59 were widowed. Men were significantly more likely than women to be married to more than one spouse and divorce or separation was higher among men. A significant fraction of men remained unmarried till aged 40; 0·8% of adult men had never married. Although the proportion of polygamous marriages was higher in older men, it cannot be determined whether this was because polygamous marriages are becoming less common in the young or because second marriages occur at an older age.

Education

Levels of formal education were similar in the three areas and the data were combined (Table 4). Men had more years of formal education than women at every age and young people of both sexes more than older people. For those of age 60 years and above, 73·1% of men and 96·1% of women had never attended school while only 2·7% of men and 18·5% of women aged 20 to 29 had never attended school.

Fertility

The proportion of women without children was high (Table 5); 9·8% of those 40 to 44 years and 7·3% of those 45 to 49 years had never had a live birth.

Crude birth rates and general fertility rates calculated from census information were similar in the three areas (Table 6). The mean number of children borne by age of the mother by area was also similar and for the total population was 3·57 (Table 7). The total fertility was 6·2 (Table 8). The highest age-specific fertility rate was 0·313 in women 20 to 24 years old.

Breast-feeding patterns and duration of amenorrhoea following pregnancy in women 15 to 44 years were assessed in the census (Table 9). The estimated median duration of breast-feeding was 19·9 months and of amenorrhoea was 10·3 months. As shown, 73·5% of women 15 to 44 years who had delivered 13 to 18 months earlier were still breast feeding; in this same age group menstruation had returned in 71·4%.

Mortality

The proportion of dead children by age of mother was similar in the three areas; overall 25·6% of children born live of these women had died (Table 7). Infant mortality rates estimated indirectly from census data were 155 in area A and area B and 139 in area C while estimated early childhood mortality rates were 30 in area A and area B and 25 in area C. The census was completed in 1981 in areas A and B and in 1982 in area C.

TABLE 1

Population of Saradidi, Kenya by area, age and sex*

Age (years)	*Area A*			*Area B*			*Area C*			*Total in three areas*		
	Males	*Females*	*Both*	*Males*	*Females*	*Both*	*Males*	*Females*	*Both*	*Males*	*Females*	*Both*
Less than 1	304	330	634	193	193	386	298	267	565	795	790	1585
1–4	1146	1151	2297	726	733	1459	934	1018	1952	2806	2902	5708
5–9	1276	1349	2625	835	897	1732	1102	1156	2258	3213	3402	6615
10–14	1211	1168	2379	740	782	1522	1129	1099	2228	3080	3049	6129
15–19	978	966	1944	687	583	1270	910	872	1782	2575	2421	4996
20–24	492	593	1085	322	435	757	652	626	1278	1466	1654	3120
25–29	332	598	930	243	411	654	293	453	746	868	1462	2330
30–34	272	371	643	208	255	463	256	396	652	736	1022	1758
35–39	221	370	591	156	245	401	181	299	480	558	914	1472
40–44	218	374	592	166	213	379	197	345	542	581	932	1513
45–49	232	388	620	148	267	415	168	306	474	548	961	1509
50–54	214	252	466	128	197	325	205	328	533	547	777	1324
55–59	196	270	466	137	195	332	187	240	427	520	705	1225
60–64	169	366	535	125	268	393	186	330	516	480	964	1444
65 or more	349	379	728	290	263	553	342	404	746	981	1046	2027
Total	7610	8925	16 535	5104	5937	11 041	7040	8139	15 179	19 754	23 001	42 755

*Obtained by census: area A in 1980 to 1981, area B in 1981 and area C in 1982. Excluded from totals area A 20 unknown sex and five unknown age; area B ten unknown sex and one unknown age; area C two unknown sex and one unknown age.

TABLE 2

Sex ratios of population (males per female) by area and age in Saradidi, Kenya*

	Area			
Age (years)	*A*	*B*	*C*	*All*
Less than 1	0·92	1·00	1·12	1·01
1–14	0·99	0·95	0·97	0·97
15–29	0·83	0·88	0·95	0·89
30–44	0·64	0·74	0·61	0·65
45–59	0·71	0·63	0·64	0·66
60 or more	0·69	0·78	0·72	0·73
Total	0·85	0·86	0·87	0·86

*From census.

TABLE 3

*Marital status by sex and age in Saradidi, Kenya**

	Per cent with marital status						
Age (years)	*Never*	*Married now (one spouse)*	*Married now (more than one spouse)*	*Divorced or separated*	*Widowed*	*Unknown*	*Total no. persons†*
MALES:							
15–19	90·0‡	0·5	—	—	—	9·4	2575
20–29	68·3	26·4	2·0	1·1	0·1	2·0	2334
30–39	8·8	68·6	17·3	4·6	0·2	0·5	1294
40–49	3·0	64·7	25·0	5·9	1·1	0·3	1129
50–59	1·8	64·0	27·9	3·9	2·2	0·1	1067
60 or more	0·8	58·3	33·2	2·0	5·6	0·1	1461
FEMALES:							
15–19	69·0	22·5	—	0·4	0·1	8·0	2421
20–29	11·0	84·8	0·1	1·9	1·5	0·6	3116
30–39	0·7	91·5	0·1	1·1	6·4	0·2	1936
40–49	0·4	81·0	0·1	0·7	17·5	0·2	1893
50–59	0·1	62·7	0·2	0·6	36·0	0·3	1482
60 or more	0·1	30·0	0·1	0·1	69·6	0·05	2010

*Three areas combined from census data.
†Excludes unknown age and/or sex.
‡Per cent of age group in marital category.

A strong association was found between education of the mother and reported mortality of children (Table 10). This pattern was observed in all age groups of mothers and in all three areas. The proportion of children reported to have died varied from 36·9% in mothers with no education compared with 18·2% in mothers with five or more years of formal education.

TABLE 4
*Education level by age and sex in Saradidi, Kenya**

Age (years)	*Per cent with education level†*					
	None	*One to four years*	*Five or more years*	*Student*	*Unknown*	*Total no. in age group*
MALES:						
20–29	2·7‡	8·7	58·8	29·2	0·6	2334
30–39	8·7	14·2	75·2	0·5	1·4	1294
40–49	28·5	22·8	46·6	—	2·1	1129
50–59	46·4	30·4	21·6	—	1·7	1067
60 or more	73·1	20·3	6·2	—	0·5	1461
FEMALES:						
20–29	18·5	18·1	57·2	4·3	2·1	3116
30–39	46·6	23·4	27·7	0·1	2·3	1936
40–49	72·0	19·0	7·6	0·3	1·1	1893
50–59	82·9	15·4	1·6	—	0·2	1482
60 or more	96·1	3·4	0·2	—	0·2	2010

*Census, three areas combined. Persons 15–19 excluded because majority were still students.
†Years of formal education completed.
‡Per cent of age group in educational category.

TABLE 5
Childless women by age group in Saradidi, Kenya*

Age (years)	*No. women*	*% without live birth*
10–14	3049	99·9
15–19	2421	76·3
20–24	1654	21·9
25–29	1462	11·8
30–34	1022	9·0
35–39	914	9·4
40–44	932	9·8
45–49	961	7·3
50 or more	3492	3·0

*From census, areas A, B and C combined.

DISCUSSION

Age and Sex Composition

The population pyramid and sex ratios observed in Saradidi are similar to others reported from tropical Africa and Kenya (Bradley *et al.*, 1982*a*; Brass *et al.*, 1968; Molineaux and Gramiccia, 1980; Sai, 1984; United Nations, 1979; van Ginnekin *et al.*, 1984*b*). Compared with many western countries (Sai, 1984; Population Reference Bureau, 1983), the population was characterized by a high proportion of children under 15 years, a low proportion of adults 65

TABLE 6

Number of births, crude birth rates (per 1000 population) and general fertility rates (per 1000 women 15–44 years) by area calculated from census in Saradidi, Kenya*

Area	*Crude birth rate (no. of live births)*	*General fertility rate† (no. of live births)*
A	42·4 (702)	211·8 (693)
B	37·3 (412)	189·5 (406)
C	41·7 (632)	209·6 (627)

*1980 to 1981 for area A, 1981 for area B and 1982 for area C. Calculated from questions to women about date of last live birth. Rates are based on reported live births in previous 12 months.

†Births for women less than 15, more than 44 or of unknown age excluded in calculation of general fertility rates.

years and older and a high proportion of women 15 to 44 years. As expected, the population structures of the three areas were remarkably similar.

The observed excess of females to males at all ages (except less than one year), particularly over age 20, and the differences from expected values in the age pyramid are probably due to differential net migration rates by age and sex. Many adult males migrate from Saradidi to seek work but leave their families. Misreporting of age is a common problem to demographic surveys done in tropical Africa (Brass *et al.*, 1968), but the vast differences in the proportion of males and females in the working age group cannot be attributed to differential age misreporting.

The results are supported by the 1969 and 1979 National Census in which the sex ratios from Siaya District were almost identical to those found before. In an analysis of migration patterns from the 1969 census, almost 10% of the population of the Nyanza province (that of Saradidi) were living in other provinces (Ominde, 1975). The sex ratio in urban areas of Kenya is very high reflecting the net in-migration of males.

Marital Status and Education

There was no attempt to separate distinctions in marital status. Thus it is likely that multiple marital categories such as free union, consensual union, customary marriage, religious and civil marriage were all included. As in most African cultures marriage has a definite meaning in Saradidi though difficult to define in general terms. The people easily distinguish a single from a married person.

Almost everyone in Saradidi gets married. When compared with females, males were less likely to get married, many at a later age and were more likely to have more than one spouse. The decreasing proportion of men with multiple spouses in younger age groups could be due to the fact that polygamy is decreasing or to the fact that men only take a second spouse when they are older, more affluent and when the wives of deceased relatives or friends become available. Only 18·2% of women 40 to 49 years were widowed, divorced or separated. This low proportion is similar to those found in other tropical African societies where polygamy is high (Brass *et al.*, 1968). The high rate of polygamy may be a contributing factor to the low sex ratio since many men may need to go elsewhere for wives as well as to the fact that a significant fraction of men remain unmarried till the age of 40. It is erroneous to calculate the number of married women per 100 married men because only men living in Saradidi were included; many men have migrated out for work leaving their families.

TABLE 7

*Mean number of children and proportion of children who have died by age of mother and area in Saradidi, Kenya**

Area A			*Area B*			*Area C*			*All*		
No. women	*Mean no. children born*	*Dead children*	*No. women*	*Mean no. children born*	*Dead children*	*No. women*	*Mean no. children born*	*Dead children*	*No. women*	*Mean no. children born*	*Dead children*
966	0·37	18·5	583	0·28	18·3	872	0·24	14·2	2421	0·30	17·2
593	2·00	18·3	435	1·81	18·0	626	1·83	18·2	1654	1·88	18·2
598	3·90	19·0	411	3·45	22·9	453	3·52	19·1	1462	3·66	20·0
371	5·32	23·9	255	4·98	25·6	396	4·93	21·0	1022	5·09	23·2
370	6·85	27·3	245	6·14	27·6	299	5·84	25·4	914	6·34	26·8
374	6·82	30·9	213	6·67	30·3	345	7·14	26·5	932	6·90	29·1
388	6·90	31·4	267	7·12	34·7	306	7·28	28·9	961	7·08	31·5
3660	3·72	25·9	2409	3·51	27·5	3197	3·55	23·7	9366	3·57	25·6

*Obtained from census: area A in 1980 to 1981, area B in 1981 and area C in 1982.

TABLE 8

Age specific and total fertility areas A, B and C combined in Saradidi, Kenya*

Age (years)	*No. women*	*No. children born in previous 12 months*	*Period fertility*
15–19	2421	310	0·128
20–24	1654	518	0·313
25–29	1462	424	0·290
30–34	1022	256	0·250
35–39	914	139	0·152
40–44	932	79	0·085
45–49	961	20	0·021
Total	9366	1746	1·239

Total fertility = 6·2 = (1·239 × 5).
*Calculated from census information on date of last live birth.

TABLE 9

Proportion of women still breast-feeding and whose menstruation has returned by months since last live birth*

Months since last live birth	*No. women†*	*% still breast-feeding*	*No. women†*	*% whose menstruation has returned*
Less than 1	82	97·6	82	13·4
1–3	453	92·5	450	12·0
4–6	455	91·4	450	22·7
7–12	874	85·5	854	47·8
13–18	769	73·5	755	71·4
19–24	550	41·5	547	86·1
25–30	461	22·1	460	95·4
31–36	273	12·5	273	96·7
37 or more	3195	0·5	3194	98·7

*8405 women 5 to 44 years were interviewed in areas A, B, and C combined.
†Number of women 15 to 44 years responding to question from census.

The calculated singulate mean age of marriage for men and women were similar to those found in other areas of Africa (Brass *et al.*, 1968). The method is affected by unreliable age reporting. In addition, it can be only used in a population where the proportions married at specific ages have not been appreciably affected by migration. In general, in data from Africa there is marked under-reporting of females in their teens and an over-reporting of females over 20. Although there may have been unreliable age reporting in Saradidi, there is no evidence to suggest that migration has affected the proportion married in any age group.

In Saradidi, males have had more years of formal education than females. In both sexes the young have had more education than those older. In Kenya today all children are required to

TABLE 10

Proportion of children reported dead by age and education of mother in Saradidi, Kenya*

Age of mother (years)	Education of mother†								
	None			*1–4 years*			*5+ years*		
	No. women	*Total children*	*% dead*	*No. women*	*Total children*	*% dead*	*No. women*	*Total children*	*% dead*
15–19	81	75	30·7	147	97	13·4	720	509	14·3
20–24	201	453	24·9	273	611	18·7	1032	2011	16·5
25–29	374	1324	26·3	290	1081	20·2	749	2788	17·2
30–34	377	1772	28·7	245	1262	23·3	381	2061	18·1
35–39	525	3142	28·9	208	1378	26·9	155	1098	21·4
40–44	628	4143	31·8	202	1444	26·3	91	721	20·5
45–49	735	5056	33·5	158	1256	26·5	53	393	21·6
50–54	618	4237	38·2	142	1061	31·3	16	125	24·8
55–59	610	4252	42·1	86	664	34·5	7	38	31·6
60–64	912	6232	48·1	45	346	33·2	4	38	42·1
TOTAL	5061	30 686	36·9	1796	9200	26·1	3208	9782	18·2

*Areas A, B and C combined from censuses. The census was done in area A in 1980 to 1981, in area B in 1981 and in area C in 1982.

†Excludes mothers who were still students or with education unknown.

complete seven years of school. However, these data suggest that the compulsory education requirement may be enforced more with males than with females at the present time. In 1983, Kenya and Mauritius were the only countries in the African region to have approached the 100 per cent school enrolment target (Sai, 1984). The 0·3% of women 40 to 49 years old who said they were students could have been attending training programmes sponsored by the Saradidi community development programme.

Childlessness

The observed rate of primary infertility observed was high similar to other African countries (Belsey, 1976). This is consistent with a study of infertility in Kenya based on world fertility data which noted there was a higher proportion of childlessness in the coastal areas of both Eastern and Western Kenya (Heinin *et al.*, 1979). This seemed to be correlated with polygamy and presumably is related to high rates of venereal disease.

Fertility

There were no significant differences by area in crude birth rates or in general fertility rates. Crude birth rates were high although lower than the 45·7 reported from Machakos, Kenya (van Ginnekin *et al.*, 1984*b*) or the 53 recently reported for the whole of Kenya. The reported total fertility from the year of 6·2 is less than the values of about 8·1 previously reported from Kenya and less than those of 7·6 reported in the same district in 1969 and 1979 (Anker and Knowles, 1982; Central Bureau of Statistics, 1980). The number of children born during the past year was calculated from the census question which asked each woman 15 years of age and older the date of the last pregnancy. It is possible that there was under-reporting of births occurring in the previous year either because of the date of birth was misclassified or because the birth was not recorded (in some households this information was provided by someone other than the mother). There is no reason to suspect that fertility in Saradidi has been

decreasing significantly. The high rate of polygamy, the relatively high frequency of primary infertility and the prolonged period of breast-feeding and amenorrhoea observed probably contributed to fertility rates being somewhat lower than the national average.

Mortality

In the census, the education level of the mother was a powerful determinant of reported mortality rates in children this confirming earlier studies in Kenya (Mosley, 1985). Data from Kenya suggest that child mortality differentials between regions of Kenya can largely be explained by differences in maternal education and level of household poverty. The infant mortality rates estimated from the census were higher than those in Machakos or Kenya as a whole (van Ginneken *et al.*, 1984*b*; Heinin *et al.*, 1979; Central Bureau of Statistics, 1980). The infant mortality rates calculated in this study were very similar to those found previously in Siaya District and emphasized that this district has one of the highest infant mortality rates in Kenya.

CONCLUSIONS

The three areas were very similar with regard to age and sex composition of the population, marital and educational characteristics and mortality and fertility rates. The potential for community development in Saradidi, Kenya, must be viewed in the context of these demographic, social and economic factors. Siaya district, the one in which Saradidi is located, continues to have one of the highest levels of infant and child mortality in Kenya. The findings in Saradidi indicate the need for a vigorous programme directed towards improving health. An important element of this must be family planning since the high fertility level undoubtedly contributes to the high infant and child mortality. More importantly, this high level of fertility, coupled with a very young population age structure, implies a continued very rapid rate of population growth which will make more difficult in the future the problems of delivering effective health services and overcoming poverty.

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Impact on mortality and fertility of a community-based malaria control programme in Saradidi, Kenya

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Mortality and fertility rates were measured from 1981 to 1983 by prospective registration of vital events as part of a community-based malaria control and health development programme in Saradidi, Kenya. There was no obvious effect of providing chloroquine phosphate for treatment of malaria in each village on mortality or fertility rates. Crude death rates were 13·1 in the year before intervention (1 May 1981 to 30 April 1982) and 12·3 after intervention (1 September 1982 to 31 August 1983). Neonatal mortality increased from 36·8 per 1000 live births pre-intervention to 49·1 during intervention. There was a slight decline in post-neonatal (one to 12 months) mortality (72·8 to 67·0) and a significant drop in early childhood mortality (25·2 to 18·2). The change in mortality rates in these two age groups were fully explained by a high rate of measles mortality in the pre-intervention period. Measles accounted for 35·7% of 284 reported deaths in infants one to 12 months of age and for 40·9% of 230 deaths in children one to four years old. There was little change in reported malaria-specific mortality rates in infants and young children most likely because of a high level of chloroquine use for treatment of presumptive illness. Perinatal mortality by area ranged between 60·4 and 81·3 pre-intervention to 79·5 to 97·2 after the control programme was instituted. Crude birth rates by area remained stable at about 40 and general fertility rates were about 200. Both pre-intervention and during intervention infants were significantly more likely to have died without medical consultation than children one to four years. However, 79·2% of 284 infants and 90·7% of 193 children died in spite of having consulted a health worker prior to death. The data suggest that a measles vaccine programme would significantly reduce mortality rates in infants and young children. The fact that the majority of infants and young children died in spite of receiving medical attention indicates both the inadequacy of curative medical services in this high mortality setting as well as the necessity for promoting preventive health measures.

There is almost no information from Africa on the impact of community-based disease control activities on mortality rates. The situation is complicated by the fact that mortality rates in Africa are, in general, decreasing (World Bank, 1985). Malaria in tropical Africa has been generally characterized as uniform with intense transmission, high adult immunity and high infant mortality rates (Macdonald, 1957). A project carried out in western Kenya from 1972 to

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1976 suggested malaria was a major cause of mortality (Payne *et al.*, 1976). Infant mortality rates decreased from 157 to 93 per 1000 live births and crude mortality rates from 23·9 to 13·5 deaths per 1000 population following a decrease in malaria prevalence after household residual spraying with fenetrothion. However, other studies have suggested that the picture of stable malaria in Africa may not be uniform; there appears to be variation in malaria epidemiology in different localities with morbidity being lower than expected and malaria-specific mortality rates low (Vaisse *et al.*, 1981). The change has been attributed to increased availability of antimalarial drugs. These findings contrast with expectations and have important operational significance.

In malaria control through primary health care (World Health Organization and United Nations Children's Fund, 1978), the first responsibility of the health services is to reduce deaths and disease due to malaria where malaria is a public health problem; this is usually approached by making prompt diagnosis and appropriate treatment readily available. Treatment may be community-based and provided by peripheral community health workers. Often a reduction in mortality rates is considered to be the primary target based on the assumption that malaria-specific mortality is high. There is need to investigate this approach in different epidemiological situations and under varying types of community-based malaria control efforts.

People living in Saradidi, Kenya began a community-based health development programme in 1979 (Kaseje and Spencer, 1987). Malaria was considered to be an important public health problem by the community; therefore malaria control was given high priority. In an effort to reduce disease and deaths due to malaria, chloroquine phosphate treatment for malaria was provided in each village (Spencer *et al.*, 1987*c*). Malaria control in Saradidi began in May 1982. Mortality and fertility rates were measured before and after the control programme began.

METHODS

Background

As presented in detail earlier (Kaseje and Spencer, 1987), Saradidi is a rural community located in western Kenya near Lake Victoria. The people are relatively homogeneous; virtually all belong to the Luo tribe and the vast majority are Christians. Poverty, rapidly increasing population leading to land pressure, water shortage and communicable diseases including malaria, measles and gastroenteritis are major health problems.

Areas

In an effort to do something about their perceived health problems, the community organized itself and began a community development programme. Saradidi was divided into three operational areas (designated A, B and C) which corresponded to the duration and degree of community organization and participation. The areas were subdivided into villages, groups of households located near each other with similar clan groups, kinship ties and church affiliation. One or more volunteer village health helpers (VHH's) were chosen and supported by each village.

Intervention

A malaria control programme was initiated in May 1982 (Spencer *et al.*, 1987*c*). VHH's in areas A and B were given chloroquine phosphate to provide treatment for malaria. Area C was the control area. In order to evaluate the impact of malaria control on mortality and fertility, a census and longitudinal registration of vital events were carried out.

Census

A complete household registration and census was done in each area as previously described (Spencer *et al.*, 1987*h*) (Fig. 1). Each person was given a unique identification number based on area, village, household and personal number. A copy of the census form was left in every household.

Longitudinal Registrations of Births, Deaths and Migrations

After the census, each household was revisited at six to nine month intervals and information on births, deaths and migrations recorded. The field team went house-to-house in succession. The interval between revisits depended on how long it took the field team to revisit the other households.

For census updates in every household, the team took the previous census form and asked about each individual again in order to determine if they had died or migrated. Then residents were queried about births and in-migrations. The census form was updated and left in the household for the next visit.

Information on each vital event was recorded as follows:

1. *Births*—date of birth, number born (e.g. twins), condition at birth (alive, dead), sex, place of birth, fate to date (e.g. died after birth) as well as age, parity and date of last delivery of the mother. An individual identification number was given.
2. *Deaths*—identification number, date of death, age, sex, date of birth, place of death, who was consulted and cause of death, if known.
3. *Migration*—age, sex and whether in- or out-migration.

Information was collected from household members present. For births and deaths of infants and children, the mother was the source in more than 90% of the instances.

A birth after which the child died was considered to be a live birth even if death occurred soon thereafter. Births of resident mothers were included even if birth occurred outside the area. Likewise all deaths of residents were counted including those occurring when the person was away from Saradidi. A special effort was made to identify infants who had been born then subsequently died since the previous visit to the household.

Migration was related to the household. Out-migration from a household was recorded if other household members considered migration to have occurred or the person had not slept in the house for the previous three months. Similarly in-migration to a household was considered to have occurred if the person was not recorded as a resident, other household members felt in-migration had occurred and the person had slept in the house during the previous three months. Date of migration was not recorded since pre-testing suggested this date was difficult to recall. Therefore, all migration was considered to have occurred at the midpoint of the interval possible. Information on migration was used to determine mid-period populations used as denominators for mortality and fertility rates.

Field Team

The field team consisted of one supervisor, one technician, five laboratory attendants and a driver. All were men and all were Luo. With the exception of the driver, all had at least eight years of formal education and were fluent in Luo, English and Swahili. From Monday to Friday of each week they lived in Saradidi. They were known to people living in Saradidi and accepted by them as evidenced by discussions by one of us (D.C.O. Kaseje) with persons living in different villages.

Training and Validation

The forms were discussed in depth with the field team until they understood the intent of each question. During the first two weeks, households were visited in the morning and then the forms were reviewed and discussed in the afternoon to correct errors. For the first six months,

five per cent of census and update households were revisited and the information was re-collected by a supervisor and one of the principal investigators. Discrepancies were discussed with the field team. From January 1983 through December 1984, two team members visited a five to ten per cent random sample of households on a continuing basis and re-collected the information on vital events. They spent one day each week in the village in which the other members were currently working. No evidence of significant under-reporting of deaths, births or migration was found; the error was less than five per cent.

Prospective Registration of Vital Events

To determine the impact of the malaria control programme on mortality and fertility, rates were calculated from the prospective registration of vital events for two periods (Fig. 1):

1. *Pre-intervention year*. Baseline data were available from areas A and B from 1 May 1981 to 30 April 1982. The VHH's began to provide chloroquine for treatment of malaria in May 1982. The census was not completed in area C until May 1982 in order not to excessively prolong the study period. Thus no baseline longitudinal information from the pre-intervention year was available from area C.

2. *During intervention year*. A full year following initiation of malaria treatment in the villages extended from 1 September 1983 to 31 August 1984. Data from this period were available from all three areas, A, B and C. The four-month interim after the baseline registration period was to ensure that treatment was available in each village and that all community members were aware of the intervention before beginning the second year of demographic measurements.

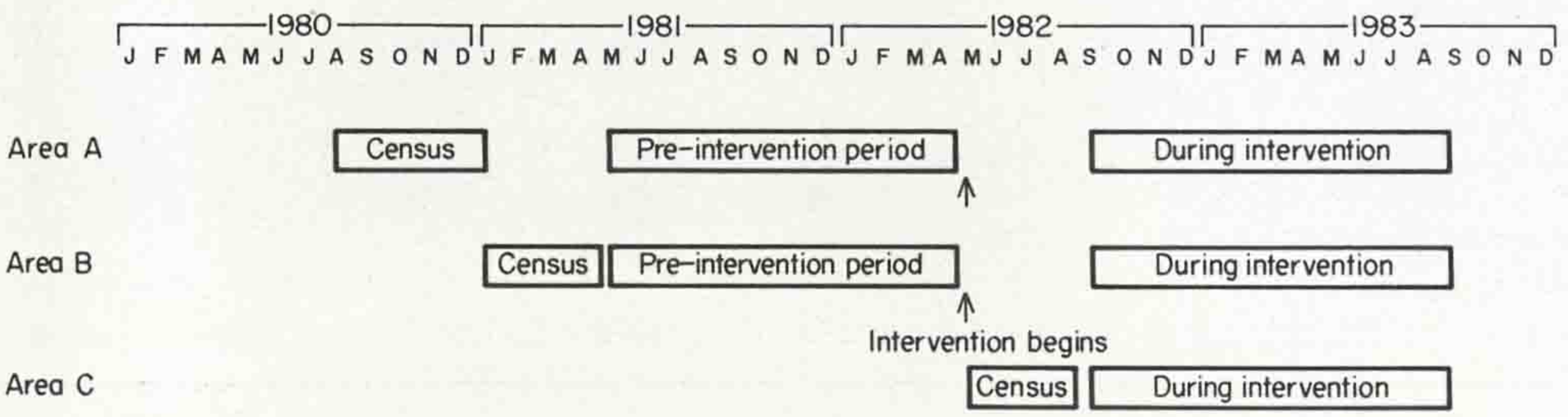

Fig. 1. Chronological sequence of census and registration of vital events in Saradidi, Kenya.

Stillbirths

The proportion of pregnancies ending in non-live births was recorded. Information was collected only about stillbirths of fully formed infants. These were assumed to be more than a 28-week gestation. There was no special procedure for the detection of early pregnancies in the registration process. However, a large proportion of pregnant women attended antenatal clinics and were followed there by two members of the field team (Spencer *et al.*, 1987*g*).

Mortality Rates

Standard age-specific mortality rates were calculated per 1000 births (infant) or per 1000 calculated mid-year population.

Fertility

Crude birth rates per 1000 mid-year population and general fertility rates per 1000 women 15 to 44 years at mid-year were calculated.

RESULTS

Mortality

The mortality rates from areas A and B proved almost identical and thus the data were combined. There was a small decline in the crude death rate in the period during intervention in areas A and B. On closer examination, it is clear that there was no obvious effect of providing chloroquine in each village (intervention) on neonatal mortality nor on mortality rates in persons five years of age or older (Table 1). Neonatal mortality increased from 36·8 per 1000 live births pre-intervention to 49·1 during intervention while there was little change in the rates of older children and adults.

TABLE 1
Number of deaths and mortality rates by age and period

	Areas A and B combined				*Area C*	
	*Pre-intervention**		*During intervention**		*During intervention**	
Age	*Mortality rate*	*(No. deaths)*	*Mortality rate*	*(No. deaths)*	*Mortality rate*	*(No. deaths)*
0 to 28 days (neonatal)	36·8	(43)	49·1	(66)	42·5	(29)
1 to 12 months (post-neonatal)	72·8	(85)	67·0	(90)	71·7	(49)
1 to 4 years (early child)	25·5	(105)	18·2	(88)	17·3	(37)
5 to 14 years	2·6	(23)	2·6	(25)	2·5	(12)
15 to 44 years	2·6	(28)	2·7	(34)	1·5	(9)
45 and more years	22·0	(107)	21·1	(106)	17·4	(47)
Unknown	—	(1)	—	(1)	—	—
Total	13·1†	(392)	12·3†	(410)	11·2†	(183)

*Pre-intervention period 1 May 1981 to 30 April 1982; during intervention 1 September 1982 to 31 August 1983. Intervention not provided in area C.

†Crude death rate for year.

There was a slight decline in post-neonatal (one to 12 months) mortality and a significant drop in early childhood (one to four years) mortality rates. However, the decline in mortality rates in these two age groups appears to be fully explained by a high rate of measles mortality in the pre-intervention period which declined in the period during intervention (Table 2). In areas A and B combined, reported measles-specific mortality rates in infants decreased from 30·8 per 1000 live births pre-intervention to 20·1 during intervention and reported measles mortality in early childhood from 14·3 per 1000 mid-point population to 4·3. Additional evidence that this decline in mortality is probably not attributable to the intervention comes from area C which did not have treatment and yet had reported death rates similar to those in areas A and B during the same period (Tables 1 and 2).

The effect of measles on early childhood mortality rates in this area is seen clearly in Fig. 2. There was an increase in the number of reported measles deaths from July to November 1981. Measles was responsible for 35·7% of 224 reported deaths in infants one to 12 months of age and 40·9% of 230 deaths in children one to four years old (Tables 1 and 2).

TABLE 2

Cause-specific mortality rates per 1000 and number of deaths by age, period and area in Saradidi, Kenya*

	Area(s)	*Measles*	*Malaria*	*Non-measles non-malaria*	*Total*
AGE LESS THAN 1 YEAR†:					
Pre-intervention‡	A and B	30·8 (36)§	6·8 (8)	71·9 (84)	109·6 (128)
During intervention‡	A and B	20·1 (27)	7·4 (10)	88·5 (119)	116·1 (156)
	C	24·9 (17)	4·4 (3)	84·9 (58)	114·2 (78)
AGE 1 TO 4 YEARS‖:					
Pre-intervention	A and B	14·3 (59)	0·2 (1)	10·9 (45)	25·5 (105)
During intervention	A and B	4·3 (21)	2·3 (11)	11·6 (56)	18·2 (88)
	C	6·5 (14)	1·4 (3)	9·4 (20)	17·3 (37)

*Reported cause of death.

†Per 1000 births during period.

‡Pre-intervention 1 May 1981 to 30 April 1982. During intervention 1 September 1982 to 31 August 1983. Intervention not provided in area C.

§Number in parentheses is number of reported deaths. Other number is rate per 1000 live births or per 1000 mid-point population.

‖Per 1000 mid-point population in age group.

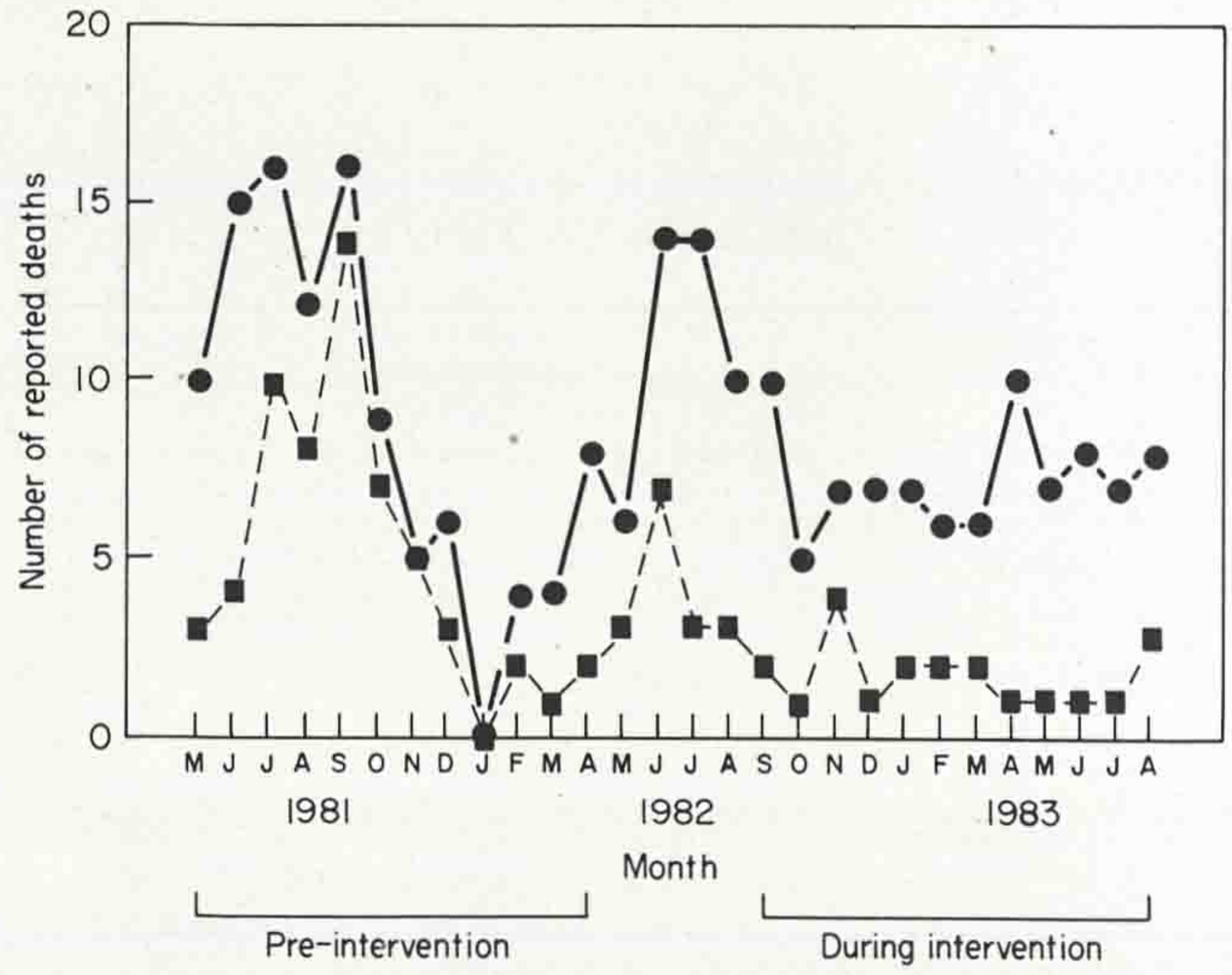

Fig. 2. Reported total and measles deaths by period in Saradidi, Kenya. ●—●, total reported deaths; ■--■, reported measles deaths.

In contrast to measles-specific mortality there was little change in reported malaria-specific mortality rates in infants and young children (Table 2). Reported malaria-specific mortality was lower in children one to four years than in infants. Providing chloroquine in each village did not appear to have any impact on malaria-specific nor general mortality rates in infants or children. Likewise, as shown in Table 3, no effect of the intervention on perinatal mortality was apparent even in area A where chloroquine prophylaxis was made available to pregnant women (Table 3).

TABLE 3

Perinatal mortality rates by area and period in Saradidi, Kenya

	*Pre-intervention**		*During intervention**	
Area	*Perinatal mortality rate†*	*(No.)*	*Perinatal mortality rate†*	*(No.)*
A	60·4	(46)	87·6	(79)
B	81·3	(40)	79·5	(45)
C	—‡	—	97·2	(73)

*Pre-intervention 1 May 1981 to 30 April 1982; during intervention 1 September 1982 to 31 August 1983.

†$\frac{\text{No. stillbirths} + \text{no. deaths within 7 days}}{\text{No. stillbirths} + \text{no. live births}} \times 1000$.

‡Not examined.

Fertility

There were no significant differences in crude birth rates or general fertility rates when the three areas were compared (Table 4). There was no obvious effect of the intervention on the fertility rates in areas A and B.

TABLE 4

Crude birth rates (per 1000 population) and general fertility rates (per 1000 women 15–44 years) by area and period in Saradidi, Kenya

		Crude birth rate (no. of live births)			*General fertility rate (no. of live births)**		
Period	*Area*	*A*	*B*	*C*	*A*	*B*	*C*
PRE-INTERVENTION (1 May 1981 to 30 April 1982)		39·9 (716)	37·9 (452)	—†	193·5 (708)	196·5 (450)	—
DURING INTERVENTION‡ (1 September 1982 to 31 August 1983)		41·2 (823)	39·1 (521)	41·8 (683)	202·8 (821)	193·0 (519)	210·7 (678)

*Births for women less than 15 and more than 44 years or of unknown age excluded in calculation of general fertility rates.

†Not measured.

‡Intervention not provided in area C.

No consistent seasonal pattern of births was observed (Fig. 3). This was true even when three-month running averages were calculated.

Persons Consulted during Illness

The VHH's were infrequently consulted prior to the death of infants or small children one to four years either pre-intervention or during-intervention (Table 5). Both pre-intervention and

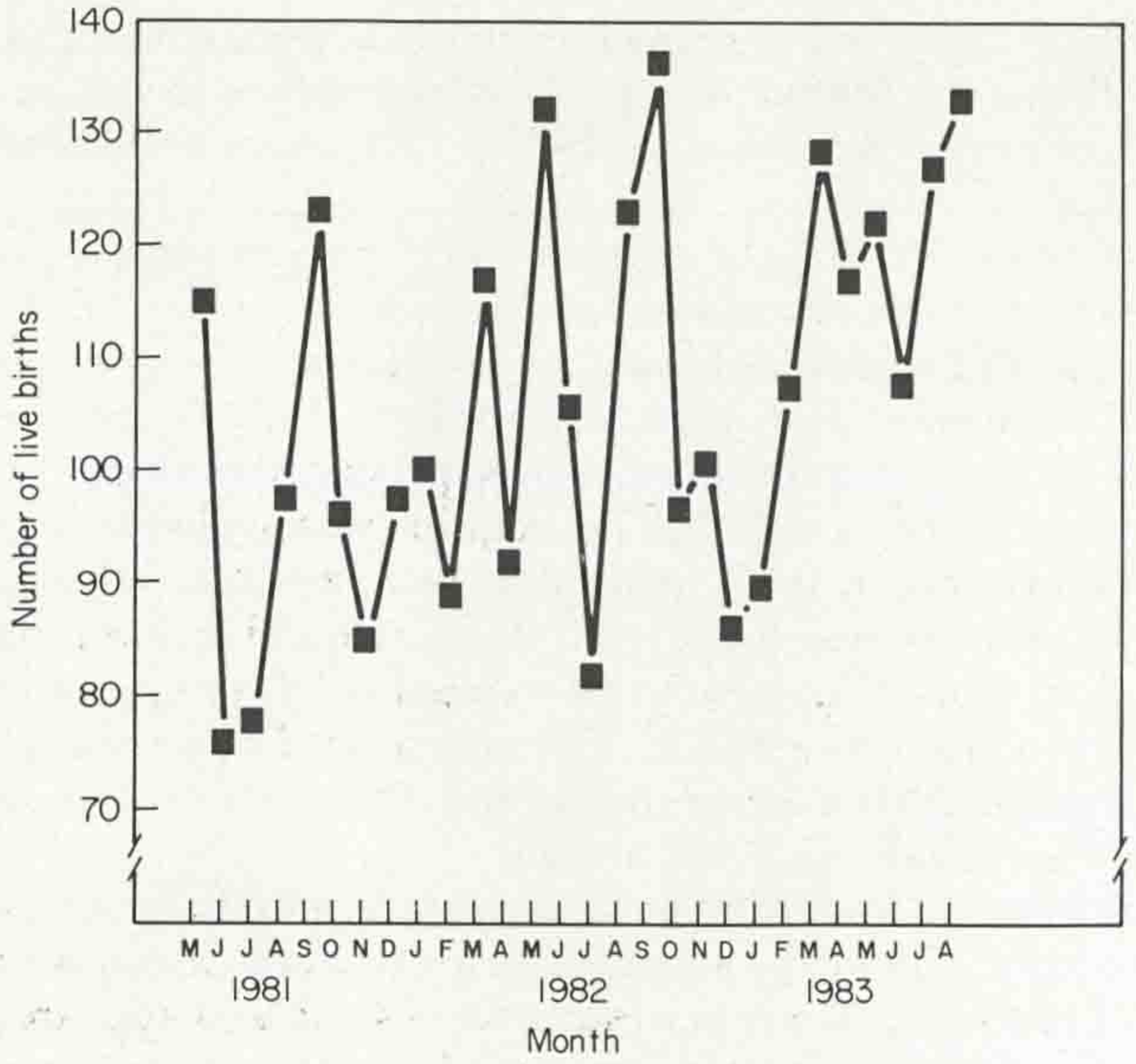

Fig. 3. Live births by month and period in Saradidi, Kenya.

during intervention, infants were significantly more likely to have died without medical consultation than children one to four years. However, 79·2% of infants and 90·7% of children died in spite of having consulted trained medical personnel prior to death.

TABLE 5

Persons consulted during illness in infants and children who died in Saradidi, Kenya

Persons consulted	*Infants less than one year*		*Children one to four years*	
	*Pre-intervention**	*During intervention**	*Pre-intervention*	*During intervention*
Village health helper	1·6	0·6	0·9	2·3
Saradidi clinic or government dispensary	26·6	53·2	38·1	42·0
Hospital/physician	39·1	19·2	45·7	18·2
Traditional doctor	3·9	0	1·9	2·3
More than one of above	4·7	12·2	7·6	26·1
None	21·9	14·1	3·8	6·8
Unknown	2·3	0·6	1·9	2·3
	128	156	105	88

*Pre-intervention 1 May 1981 to 30 April 1982; during intervention 1 September 1982 to 31 August 1983.

DISCUSSION

The purpose of this investigation was to assess the effect of a community-based malaria treatment and prophylaxis programme on mortality. This impact was assessed by a prospective measurement of the age-specific mortality rates for two 12-month periods before and after

the malaria control programme was implemented in two population groups, as well as measuring mortality rates during the intervention in a concurrently followed untreated area which was similar in other respects (Spencer *et al.*, 1987*h*), but where antimalarial drugs were not provided in each village.

There was no evidence that the community-based malaria control programme had any effect on overall mortality rates or malaria-specific mortality rates. In the 12-month period during intervention mortality rates in the control area (area C) were similar to those in other areas (areas A and B). The most likely reason for the lack of any detectable effect is that there was already a high level of chloroquine use for illness presumed to be due to malaria before the programme was initiated even in area C. Chloroquine was available in Saradidi before the programme (Kaseje and Spencer, 1987): in local shops, at a mission clinic and at two Ministry of Health dispensaries. The decrease in the crude death rate and in the mortality rates observed in children one to four years of age could be explained by an epidemic of measles which occurred during the pre-intervention year. The indicator of cause of death was very crude. However, the results suggest that malaria was not the most significant cause of death in infants nor in children one to four years of age in Saradidi.

There is other information from Africa which also indicates that malaria-specific mortality rates may in fact be lower than expected even in areas where malaria transmission is high (Vaisse *et al.*, 1981). In an earlier study in western Kenya, malaria appeared to be a significant cause of mortality (Payne *et al.*, 1976). However, it is likely that the availability of chloroquine has increased significantly since then. The overall reduction in mortality between the years reflected in the census (Spencer *et al.*, 1987*h*) and the current prospective registration of vital events may have been due to a decrease in deaths due to malaria. However, without measurement of disease-specific mortality rates, decreases in mortality due to malaria control may not have been detected due to generally decreasing rates. If there is a sub-population of children with multiple excess risk of dying (e.g. from malnutrition, measles, malaria, diarrhoea, etc.), removal of one factor may not reduce the risk of mortality, the same child might die from another cause. This might have been the case in Saradidi.

Infant and early childhood mortality rates were very high in this population despite the fact that the infant mortality rate in Siaya district in which Saradidi is located has declined from 220 in 1959 to 181 in 1969, and 147 in 1979 (Central Bureau of Statistics, 1981). During that time expectation of life at birth increased to 46·2 years and the crude death rate decreased to 21·6. Similar changes occurred in other parts of Kenya (van Vianen and van Ginneken, 1984) and in other countries in Africa (Bradley *et al.* 1982*b*; Sai, 1984). The decline in mortality that has occurred means Kenya now has one of the lowest infant mortality rates in sub-Saharan Africa (Sai, 1984; World Bank, 1985) yet the rates remain unacceptably high.

There was extensive variation in mortality rates in the 1979 census in Kenya; for example, infant mortality rates by district ranged between 38 and 153. Data from Kenya suggest that child mortality differentials between regions of Kenya can largely be explained by differences in maternal education and level of household poverty (Mosley, 1985). Thus most of the decline in mortality can be accounted for by trends in economic development. In the Saradidi census, education level of the mother was a powerful determinant of reported mortality rates (Spencer *et al.*, 1987*h*), thus confirming earlier studies in Kenya. Indicators of poverty were not measured directly but Saradidi is relatively homogeneous economically (Kaseje and Spencer, 1987). It has been suggested that government development policies which affect the social and economic circumstances of families at the household level will result in direct effects on mortality risk (Mosley, 1985).

Crude birth rates and general fertility rates obtained from registration of vital events remained almost constant during the period of observation. Rates in the three areas were similar. Crude birth rates were high although lower than those recently reported for other areas and for the whole of Kenya (Central Bureau of Statistics, 1980; van Ginneken *et al.*,

1984*a, b*; Sindiga, 1985). There was no evidence of significant under-reporting of births during the validation of a ten per cent sample of households. Possible reasons for the lower fertility rates include the high rates of polygamy and primary infertility and the long periods of amenorrhoea and breast-feeding after delivery observed (Spencer *et al.*, 1987*h*).

Only where a specific disease has a high prevalence coupled with a high fatality rate among otherwise healthy persons will a disease-specific intervention likely have a significant demographic impact (Mosley, 1985). The malaria control programme appeared to be effective in providing antimalarial treatment as indicated by utilization of the VHH's and consumption of chloroquine (Kaseje *et al.*, 1987*e*; Spencer *et al.*, 1987*e*; Mburu *et al.*, 1987). However, despite indications that people were obtaining malaria treatment from VHH's, decreasing mortality rates could not be proved to be an effect of malaria control. Collection and analysis of precise mortality rates is expensive and determination of aetiology is difficult in areas where multiple diseases are present at death and where medical facilities are limited.

Standard mortality rates may not always be the best indicators for evaluation of community-based malaria control programmes such as the one in Saradidi by the health services (Chen, 1986). Information such as the proportion of ill persons receiving treatment, the consumption of chloroquine, utilization of treatment and accessibility to treatment may be equally or more important than mortality rates in evaluating programme effectiveness. The malaria control programme in Saradidi was successful by these other parameters. The process of community development can be accompanied by a reduction in mortality rates. When a number of health-related processes are occurring, it is difficult to ascertain the relative importance of one alone. In addition, careful measurement of age-specific and/or cause-specific mortality rates is difficult, time-consuming and expensive and baseline data may not be available for comparison.

The most striking finding was the frequency with which measles was reported as a cause of death; overall 35·7% of all deaths in infants one to 12 months of age and 40·9% of all deaths in children one to four years old were accounted for by measles. Earlier studies suggested that people in Saradidi can recognise measles and can distinguish measles from other diseases (Spencer *et al.*, 1987*f*). These results imply that highest priority should be given to increasing coverage with measles vaccine and other immunizations. From these data such an intervention would be expected to have a major impact on mortality rates in these age groups.

The analysis of use of medical facilities and personnel revealed that 79·2% of infants under one and 90·7% of children one to four years old died in spite of having consulted trained health workers, mostly at a clinic or hospital, prior to death. The fact that these infants and children died in spite of receiving medical attention indicates both the inadequacy of the curative medical services in this high mortality setting as well as the necessity for promoting preventive health measures.

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Community leadership and participation in the Saradidi, Kenya, Rural Health Development Programme

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Community participation and leadership in initiating and implementing a health development programme in Saradidi, Kenya were examined. Organization of the area into villages had to be sensitive to existing community organizational structures such as geography, religion, kinship and administrative boundaries. The lowest level government leaders did not always have the support of the community. Some groups such as women and those who were not wealthy were not always included in leadership positions; these people, however, were often most aware of certain village problems. In Saradidi, women's groups were important for community development; they supported the volunteer community health workers and carried out many village health activities. Many village health committees did not function effectively. Village health workers were supported principally by the programme centre. Village income-generating activites were not very successful. Group involvement in income raising ventures proved to be inefficient; many ended up as income draining activities. Village group income projects must be well selected relative to the skills and resources available and the ability of the product to be marketed; only exceptional ones should be encouraged. Those based at the programme's centre were more successful perhaps because of a greater investment in skills, money and marketing. Age was an important factor in accepted leadership roles in Saradidi; most effective leaders were more than 45 years of age. Village health helpers volunteered a significant proportion of their time despite poor support by village health committees and no financial remuneration. The central project structure and the training they received compensated for the lack of guidance by village health committees.

A community health development programme was initiated in 1979 in Saradidi, Kenya, as the community's response to its problems (Kaseje and Spencer, 1987). The 'community' of Saradidi consisted of all residents. The main aim of the programme was to improve the quality of life through activities to reduce disease and increase income. The community was responsible for initiating and implementing these measures.

The Saradidi programme was one of primary health care and followed the guidelines issued at the International Conference on Primary Health Care held in Alma Ata, U.S.S.R. in 1978 (World Health Organization and United Nations Children's Fund, 1978). The cornerstone of primary health care is community participation. With some outside support, the people of Saradidi organized themselves to participate in solving their problems. The community discussed their health problems, developed a consensus on priority needs, identified available resources, explored possible solutions, implemented control activities and evaluated the results.

Community participation in Saradidi was both a 'means' and an 'end'. It was considered the best means for solving public health problems. In addition, community participation was

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viewed as critical for developing a self-reliant community and thus became one goal of the programme (e.g. an 'end').

The process of community participation (e.g. who was involved, how, in what activities, why, when) in Saradidi was documented. The results are presented here.

METHODS

Background

As presented elsewhere in detail (Kaseje and Spencer, 1987), Saradidi is a rural community in western Kenya located near the shores of Lake Victoria. More than 99% of the people are Luo and more than 90% are Christian. To facilitate health and development activities, families were grouped into villages taking into consideration clan, geographical, administrative and religious boundaries. The total population on census was 42 794; there were 56 villages in all (Spencer *et al.*, 1987*h*). Each village selected and supported two or more Village Health Helpers (VHH's). These individuals were volunteers given the major responsibility for day-to-day health activities of the village (Kaseje *et al.*, 1987*d*).

The community was divided into three operational areas (A, B and C) based on the length and extent of organization. Area C was the last to begin the programme and therefore the least organized. In May 1982, a malaria control programme was initiated in areas A and B (Spencer *et al.*, 1987*c*); the VHH's provided antimalarial treatment and chemoprophylaxis.

The programme was managed by an elected Executive Board with area-wide representation (Kaseje and Spencer, 1987). The four major committees were programme development, administration, evangelism and income-generating activities. Each village elected a Village Health Committee which was responsible for health activities and for support to the VHH's.

Community Organization and Participation

Information was collected in two ways:

1. *Reports and records*. Regular reports and records were collected at the programme centre from 1980 through 1984. These included reports and minutes from meetings held in the villages (particularly those of the village health committees), records from community income-generating activities initiated to raise funds, monthly reports from the VHH's describing their activities in their villages, and reports and minutes of general committees including the Executive Board.

2. *Random sample investigation*. In February and March 1984 a study was carried out in 46 villages; all those in areas A and B and ten (of 20) in area C. All villages could not be visited because of time and resource constraints. The investigation was designed to determine (a) the extent government leaders and influential people or natural leaders occupied positions of leadership at village and central levels of the programme; (b) how traditional social organizations like the clan and subclans influenced village unity and participation in the project; (c) how much the programme organization interfered with the traditional community organization; and (d) the status of the income-generating activities in each village.

Information was collected by two male residents. Both were under 30 years of age, one with eight years of formal education and the other with 12. A questionnaire with open-ended questions was developed to guide interviewing and to ensure that the same information was obtained in each village. In addition to asking direct questions, the interviewers stimulated discussion and probed for additional relevant information. People interviewed were encouraged to talk freely about the various issues. Pre-testing and standardization of the questions were done. Interviews were carried out in Luo.

The interviewers first interviewed the village leaders (the Jaduong Gweng) in each village. These men were unpaid government assistants to the chief; they were known to all people in the village. Then the interviewers talked with at least five other people from different parts of

the village identified at random while walking through the village. Small groups of people frequently gathered as the interviewer approached one individual; this was encouraged since it increased the sources and validity of the information. The names of the five most influential people in each village were derived from the consensus among those interviewed. Forty-five (of 126) randomly selected VHH's were also interviewed.

Information collected included the age, sex and position in the programme of the village leader(s); the name, age, sex, occupation and position (if any) in the programme of the five most influential people in the village; the attitude towards the project of the five most influential people; dates of the last and next village health committee meeting; village income-generating activities with income, current status, whether person in charge was paid, number of members and what the income from income-generating activities was used for; subjective estimates of village unity with causes of disunity, the unifying issues, efforts to solve problems and the persons consulted or requested to help in solving problems; information about the village such as whether it was one village before the programme; if not, how was it changed and how has the change affected the people; how many large and small clans were represented in the village and how this has affected community participation; and did village leadership change when the project began and, if so, how were new leaders chosen.

RESULTS

Organization for Community Participation

Village boundaries. The unit of community organization was the 'village'. However, the concept of 'village' in Saradidi has undergone a series of changes. Historically, a whole clan (i.e. descendants from one man) lived in one area, strongly fortified and guarded. Movement in and out of this community was limited to females through marriage.

With colonization, increasing population, and economic demands, these nuclear settlements broke down. The sons from the clans moved further away to have access to more land. They took their wives and children with them. These new communities became subclan settlements. Initially, the boundaries of subclans were clear. Most subclans in the same general area usually belonged to the same father clan. Later people from different subclans began to intermingle.

The concept of clan was still very strong in Saradidi. There were clans one could marry into and those into which one could not marry, depending on whether the clans shared a common ancestor that could be traced in the family trees. Contact between in-law clans was guarded by norms.

At the beginning of the programme, some form of community organization in units of manageable size was considered to be essential to ensure full participation and proper management. The decision was made by village leaders and the programme development committee that these units should be made up of groups of people who could work together, i.e., had a sense of belonging together, taking into consideration politics, administrative boundaries, geography, terrain and clan. The unit, now called the 'village', that developed may have been very different from the original 'villages' before the programme. It was not possible to organize solely on the basis of clans since they were scattered in subclan groups. In one area, it was possible to find two subclans: one with 20 households and another with nearly 100 households. In this situation, the two subclans were formed together in one village. Changes in 'original villages', however, were only made where necessary.

The survey revealed changes in village boundaries in only eight of the 46 villages. Parts of three original villages were found to have been included in other villages, four villages were found to have parts of other villages added to them, and one village was found to have combined two villages that were originally separate. Thirty-eight villages (82·6%) retained their original boundaries.

Effects of change of boundaries on participation. In some of the villages the new organization influenced participation in project activities. Of the 46 villages surveyed, 32 were made up of more than one subclan. The likelihood of conflict between subclans was only mentioned in five villages. However, sharper conflict was likely when two clans found themselves within the same boundaries. For example one village had enveloped two in-law clans because it was felt that neither was large enough to be a separate village. These two could not work together because of animosity between members and had to be split by the programme development committee so that they became two smaller villages in the project structure.

In most villages the problem of rivalry or conflict between subclans was overcome by selecting representatives, officials and VHH's from the different subclans in the village. Rivalry between different subclans, however, did not always lead to negative results. In four villages, each subclan tried to do better than the other and so they believed that their rivalry was actually helping them.

The functional concept of 'village' as introduced by the programme was well accepted by the community since the villages were established by accepted leaders who understood the community.

Leadership

The traditional leader of the 'village' in Saradidi was the clan head. Each homestead had a household head. From these household heads were selected 'Elders' who looked after the welfare of the village; these were almost always men. The community development programme introduced the concept of Village Health Committees (VHC's). VHC members were elected by people in the villages and had the responsibility for their village's health and development activities. Each VHC was supposed to plan development for its village, to guide the village in health actions and to monitor progress. The VHC's led the villagers in selection of the VHH's, and were supposed to support and supervise them. These committees did not replace the existing traditional and government leadership. The government selected a chief for each location who was assisted by a number of assistant chiefs according to population size and number of sublocations. In each village there were one or two unpaid assistants called 'Jaduong Gweng'; the Jaduong Gweng was also usually one of the village elders.

The three types of administration or leadership for each village, the government, the Jaduong Gweng and the VHC's complemented each other in their responsibilities; e.g., law enforcement was left to the government leaders while health and development became the responsibility of VHC's and elders.

Jaduong Gweng (village elders). There were 69 Jaduong Gweng in the 46 villages surveyed. All of them were male; 52 (75·4%) were 50 years of age or older, 14 (20·3%) were 40 to 49 years old, and only three (4·3%) were in their 30s.

The Jaduong Gweng named their responsibilities as maintenance of law and order, promotion of development activities and encouragement of contact between people and the government by arranging meetings and inspection tours. Promoting the construction and use of pit latrines was named by eight Jaduong Gweng as one of their major responsibilities.

Of the 69 Jaduong Gweng, 37 (54%) were not members of the VHC in their village. Of the remaining 32 Jaduong Gweng, 22 were members only and ten held key posts; four were chairmen or vice-chairmen, two were treasurers, and four were secretaries.

Few of the Jaduong Gweng had a position in the programme structure outside the village; two (2·9%) were either secretary or chairman of a subcommittee of the programme. Thus the Jaduong Gweng were not involved in the decision-making and implementation of the programme.

Influential people in the village. There were 229 people listed as influential in the 46 villages. Most were men, only 41 (17·9%) were female; 152 (66·4%) were 50 years of age or older; 49 (21·4%) were 40 to 49 years; only 27 (11·8%) were in their 30s and only one was below age 30.

The occupations of the 229 individuals were diverse. The largest category was farmers (44·1%), a common occupation in Saradidi. Businessmen and traders (14·0%) exercised influence because they usually had more money than their farming neighbours. Teachers (10·9%), churchmen (10·5%) and government employees (8·7%) had influence by virtue of their employment status since less than 10% of the adult population have salaried jobs. Six (2·6%) of the recognized leaders were employees of the programme. The others included 12 (5·2%) retired persons, one ex-district commissioner, four doctors and three university lecturers.

These village leaders were very involved in the village health committees (Table); 106 (46·3%) were members and 46 (20·1%) served as officers. In contrast, they were not very involved in the administration structure of the community development programme itself; 168 (73·4%) held no position.

TABLE

Position of named influential people in 46 selected villages on the village health committees and in the Community Development Project, Saradidi, Kenya

Position	*Village health committees no.*	*Community development project* no.*
None	75	168
Member	106	49
Chairman/Vice Chairman	19	7
Secretary/Vice Secretary	13	0
Treasurer/Vice Treasurer	14	0
Not Stated	2	5
Totals	229	229

*Includes overall project committee as well as working committees.

The effect of the leaders' involvement in the programme was difficult to determine. There was no obvious correlation between involvement of recognized village leaders and functioning of the village health committees. In two villages where the two Jaduong Gweng were officers in the VHC and where all the five influential people were on the VHC, the committees were active as evidenced by the fact that regular meetings were held and there were income-generating activities. In two other villages with the same level of involvement by the leaders, there was little activity.

The village health committees. The VHC's were planned to be very important in the structure of the community development programme. The VHC's were supposed to keep the people in the village informed of progress, to motivate them to do things to improve their health and to provide a link between the village and the programme centre. Most important, the VHC's were to support, to supervise and to assist the VHH's in their village. The VHC's were supposed to meet once a month and submit a monthly report of their activities to the Executive Board.

There was great variation in the activity of the VHC's surveyed; 31 of 46 VHC's had met within the month preceding (January to March 1984) and 21 had scheduled another meeting within one month of the last one. However, 15 (32·6%) villages had not held a meeting in at least one year and one of these had not met for two years.

The annual general meeting involving the entire community was scheduled for April 1984. The fact that the work of the VHC's was to be reviewed at this meeting is one reason many of

the VHC's held meetings in February and March. Most VHC's have not submitted monthly reports.

The 23 committees from the villages first organized (area A) were rated from A (best) to D (worst) in 1980 and again in 1984 by the programme director, two community health nurses, the education specialist and a social scientist according to the following:

1. Frequency of meetings during the year of assessment.
2. The number of decisions made and implemented.
3. The presence of development activities in the village and their impact.
4. Support and assistance to the VHH's as reported by the VHH's, including financial support, moral support, advice and help with problems and advice.
5. The regularity of reports submitted to the Executive Board.

Out of the 23 VHC's rated, seven (30·4%) were rated D from the 1984 survey which meant they were virtually inactive and six (26·1%) were rated C which meant they had held at least a meeting within the last two months preceding the survey. Villages rated C and D also had no income-generating activities or if they had, these were very poor. Eight (34·8%) VHC's were rated B which meant they had held meetings frequently in 1980 and 1984, had a reasonably successful income-generating activity and were reported to be supportive to their VHH's. Only two (8·7%) VHC's were rated A and these had achieved a score of A since 1980. These two villages also had strong women's activity groups which ran the income-generating activity. In one village the women's group existed before the programme began and it has continued to grow. Between 1980 and 1984, there was little change in the ratings; four villages improved, two were worse and 17 remained the same.

The VHC's were to provide leadership support for the VHH's including initiating health-related development projects planned with the VHH's, advising the VHH's and solving their problems. Meetings of the VHC were to be a forum for the VHH to communicate ideas for discussion. Seven of the 45 VHH's interviewed stated that their VHC did not help them in any way.

Programme Development Committee. This committee which consisted of representatives from each VHC was supposed to meet every two months to discuss village programmes; meetings have been held regularly and this committee has actively supported village health activities. Even representatives of VHC's which were rated D and C have continued to attend the Programme Development Committee meeting.

The Executive Board. The Executive Board had overall responsibility for the administration, organization and implementation of the community development activities. The programme director was chairman. The decisions of this board influenced the whole community through the VHC's and the VHH's. The Executive Board has continued to meet regularly.

Specific Activities

Income-generating activities (IGA's). Each village was supposed to identify, select and implement an IGA in their village. The IGA was to provide each village with income to support their health activities, including their village health helper. At the time of the survey, only 23 (50%) of the 46 villages had begun an IGA. Of these, eight were inactive, ten were considered to be weak and five were moderate to strong. The IGA's were poultry raising, growing vegetables, handicrafts, fishing and beekeeping.

Poultry raising was often chosen because it gave the highest returns on investment and was not as dependent on weather as other activities such as growing vegetables. However, initial investment was high as were the recurrent costs. Many villages began with local breeds of birds donated by IGA group members from their home stocks. These poultry did not give as high yields as the exotic birds but were easier to manage under local conditions. Most of the villages with successful IGA's raised poultry. Successful in this context meant that the IGA existed and

that group members were doing them regularly. However, no village IGA's have earned significant income.

Horticulture projects have proved difficult to start and many villages which began these have stopped them. Since 1982 there has been a drought in Saradidi which has largely destroyed agricultural efforts in the area, including food production.

Pottery, handicrafts and carpentry were found to require many hours of involvement per member and skills had to be precise if goods were to be marketed. Cash returns were low and the goods frequently were slow to sell since markets were limited. These activities, therefore, have not been profitable. Lack of technical knowledge had made beekeeping difficult. Supplementary training was conducted but there was no followup.

None of the villages have been able to pay their VHH's regularly. The two villages ranked A have given their VHH's some payments from their IGA's as tokens of appreciation.

People in the village. VHH's identified different village groups as sources of support. Men in the villages donated money for specific projects. Women individually and in women's groups worked with the VHH's in training sessions, immunization campaigns, sanitation efforts and entertaining visitors. Children carried messages and did odd jobs. The centre staff contributed to the work of the VHH's by providing training, organizing work plans and solving their problems.

Utilization of services. Health services provided at the programme centre and the mobile maternal and child health clinics have been well utilized. About 80% of the residents have paid to join the 'Health Scheme' enabling them to participate in all health services provided by the clinics; non-members are assessed a fee for each use but no-one is refused needed services. Other services offered by the programme including vocational training, workshops, seminars and evangelical meetings, have always been well attended.

Attendance at meetings. Community participation has been high in meetings organized by the central programme; village-based meetings, however, have been poorly attended.

Donations. In Kenya, cash donations are given in 'harambee gatherings'. This system is used nationwide as a means of complementing government efforts. If a project (e.g. school building) needs money, a date is set aside when people come together to donate the money. There are speeches about the project to encourage donations. For this reason harambee donations were not new to the Saradidi community. Buildings, including the programme centre and clinic were constructed from donated money, material and labour. However, cash was not plentiful in this population. Many people have donated in kind; time, labour, goods and materials. Activities needing skilled or semi-skilled input could not be provided by most people since they lacked the necessary training. The project area was large (about 225 km^2) and it was difficult for people to travel from one end to another to participate.

The amount of time and labour volunteered for village projects has not been well-documented but has been substantial. The fact that most village projects have not succeeded has dampened enthusiasm in some villages.

Committee members especially the Project Development Committee and Executive Board have continued to give time and energy in attending meetings, communicating information and overseeing implementation of decisions.

The VHH's have continued to function voluntarily (Kaseje *et al.*, 1987*d*). In four years only four of 126 have dropped out; two for family reasons, one because she lost interest and one who went for further training. However, all VHH's would like to receive payment in kind or in cash for their services.

Financial base. The programme has been labelled a 'people's programme'. There has been some external financial aid for specific activities such as purchasing antimalarial drugs for malaria control. The community has realized that external assistance will not continue indefinitely and has initiated discussions on ways to continue health services after external aid is withdrawn. One way being discussed is for people to begin to pay for drugs.

In 1984, the community was expected to begin paying for all health services (curative, preventive and promotive including family planning) offered by the programme. Income was to be used to purchase drugs, etc. A 'Health Scheme Membership' has existed since 1981; members pay one fee for the family entitling them to all services offered while non-members pay a small fee for curative services at the centre. However, the money generated has been insufficient alone to maintain the services.

Unlike those in the villages, the income-generating activities organized at the programme centre have made a profit. The most successful have been poultry-raising, carpentry and tailoring. Products have been marketed outside Saradidi.

DISCUSSION

The results demonstrate active community participation in the Saradidi Community Rural Health Programme. This experience illustrates a number of important issues that must be considered when initiating and implementing similar community-based programmes.

Conditions Favourable to Community Participation

In Saradidi these included: (1) the idea of the development programme was initiated within the community and not by outsiders; (2) the programme was led by a respected, energetic, charismatic director who was a public health physician and who felt community participation was vital; (3) decisions were taken at traditional community meetings open to all residents; (4) the people were ethnically, religiously and politically reasonably homogeneous and many had similar economic situations; (5) local resources were mobilized and the community was motivated to donate land, time, labour, materials, goods and money; (6) outside resources were available for training, for family planning services and for malaria control which were all highly visible components of the programme; (7) the development programme encouraged participation; (8) support was available at the centre, from the Executive Board and from the Programme Development Committee; (9) community needs were readily identifiable; (10) and there was a readiness for change. These conditions favourable to community participation are similar to those experienced elsewhere (World Health Organization and United Nations Children's Fund, 1977; Bugnicourt, 1982).

Community Organization

As shown here, community organization for development programmes must be sensitive to the existing community structure. Mixing of clans in one village appeared to hinder participation since it went against established societal norms governing interactions between clans. Where subclans were involved, it was important that they all be represented in the leadership.

Decision-making

In Saradidi, community members participated in setting health priorities (Kaseje and Spencer, 1987). The process of 'problem identification' occurred in traditional meetings and seminars in which all residents of Saradidi were invited to participate. The majority of speakers were the recognized community and programme leaders. VHC's were totally responsible for village activities; their members were elected by the village residents. Villages were represented in the Programme Development Committee and the Executive Board. All programme officers were community members. Subgroups in the community were represented at different levels of the programme.

Implementation

Community members participated in the work of the programme as members of committees, on income-generating activities, by providing labour for sanitation projects and as VHH's.

Saradidi residents contributed money, materials, goods and time for many programme activities. Information was provided in meetings to indicate the different needs of villages or subgroups in one village. Administration and co-ordination were done by community members. The salaried staff of the centre lived in Saradidi and were responsible to the Executive Board. Local people led and were members of all committees.

Participation in Benefits

All residents of Saradidi were eligible for health services provided in the villages, in mobile health clinics and at the programme centre. Although a small fee was requested for Health Membership Schemes, those who could not pay were still provided with the services. In the villages, treatment for malaria was free to all (Spencer *et al.*, 1987*c*).

Leadership

Selection of leaders is crucial for continued community participation of others (Bugnicourt, 1982; Cohen and Uphoff, 1977; World Health Organization and United Nations Children's Fund, 1977). Leaders in the Saradidi programme were elected by community members. The lowest level government official, the chief, did not always have the support of the community.

Age appeared important; leaders tended to be more than 45 years old. There is great respect for age in this and other communities in Africa.

The decision on whether to include women and peripheral groups such as the poor, certain castes, etc., in leadership roles is a difficult one and must be considered by the entire community if the decision is not to create difficulties. In Saradidi, the fact that the community was relatively homogeneous, culturally and economically minimized this problem.

VHH's

The volunteer community workers were chosen by the people living in the same village. In Saradidi, the VHH's have been accepted by the people they serve. They have extended services to community members who otherwise might have been excluded. Virtually all have continued despite not being paid and lack of support from the village health committees.

Problems

Village health committees in Saradidi have not functioned as expected; in some villages they became inactive. The reasons are not known and are being investigated. Village income-generating activities have largely become income-draining activities. Group involvement in income-raising activities has proven inefficient in the village. Those at the programme's centre were more successful perhaps because there was a larger population upon which to draw and a greater investment of skills, money and marketing. Group projects must be well selected and only exceptional ones encouraged. Lack of technical skills has been a major impediment in these activities and failure has dampened enthusiasm. Not every person participated actively. However, there was no indication that a significant proportion of residents did not have access to the benefits or did not participate. It would be of interest to examine the characteristics of non-participators in more detail.

CONCLUSIONS

The most visible successes of the Saradidi programme include the centre with its clinics, seminars, workshops, income-generating activities; the malaria control programme providing treatment for malaria in each village; the VHH's; and the family planning programme. None of these would have been possible without community participation.

A number of reasons have been advanced in favour of community participation (White, 1982). The experience in Saradidi supports many of these:

1. More will be accomplished. Conventional government services were little involved in the development process and did not reach the community adequately. Virtually all impetus came from the community, although technical expertise was provided from sources outside the area, including the Government.

2. Services can be provided at lower costs. Government health services were free but were too far away. Thus, while the cost to the community of the programme was higher, the benefits were greater. Volunteers contributed heavily in Saradidi. Because the community was involved, individuals were willing to contribute their resources, both financial and in kind.

3. Participation has intrinsic value for the participants. The development programme itself has been an obvious powerful force in reducing feelings of alienation and powerlessness in Saradidi. Acceptance (tolerance) of local problems may be predicated on the feeling that nothing can be done. In Saradidi, the programme changed some of these attitudes of helplessness.

4. Participation can be a catalyst for further development. Because of community interest, the original programme has expanded in area, in services offered, and in community health problems tackled.

5. Participation leads to a sense of responsibility for the project. Certain Saradidi residents felt this way. The programme was initiated in the community and not from outside. Thus clearly the 'community' was responsible. However, some people were not involved in the programme.

6. Participation guarantees that community priorities are addressed. However, in Saradidi the resources (including external ones) that were available and could be mobilized influenced the selection of the health problems to control.

7. If users are involved in the selection and designs of technical systems, these details will be better adapted to their needs than if these decisions are made by outsiders without consultation. In Saradidi, the only major technical decisions involved the type of pit latrines and wells most appropriate for the area.

8. Use of indigenous knowledge and expertise is encouraged. This occurred in planning and implementation of the programme. Problems arose where necessary skills were lacking, such as in income-generating activities. The implication is that where local expertise can be utilized, the technology introduced will be more effective.

9. Community participation decreases dependence on professionals because many health services can be provided by trained community volunteers. However, Saradidi was fortunate to have local expert back-up, such as two community nurses, a public health physician and a health educator plus outside help when needed. It is unlikely that these efforts could have been sustained without such expertise.

10. Understanding of the situation increases. There is little doubt that increased awareness helps people understand better the constraints preventing solutions to their problems and also what to do about their problems. Although not documented rigorously, this process clearly occurred in Saradidi. The process of organization itself appeared to be a powerful force for change.

This experience in Saradidi is relevant for other communities attempting development programmes. Careful description and analysis of other experiences in community participation should be encouraged.

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Characteristics and functions of community health workers in Saradidi, Kenya

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A community-based health development programme in Saradidi, Kenya had 126 village health helpers (VHH's) for the 56 villages. These volunteer health workers lived in the community and served a total population of about 43 000 in an area of 225 km^2. Each VHH served a maximum of 100 households averaging 4·0 persons. Conditions imposed by the community were that the VHH be perceived to be a mature person, to be compassionate and to have a desire to help people and to live in the village. Literacy or formal education were not requirements. VHH's were chosen and supported by the people who lived in their village. Characteristics of the 126 VHH's were that 96·8% were women, 99·2% were married, 75·4% were between 25 and 39 years of age, and 80·2% had at least five years of formal education (only 7·1% had none). The VHH's spent an average five to ten days each month on programme activities in addition to their other responsibilities which included preparing meals, cleaning their homes, carrying water and firewood from long distances, caring for their children and cultivating food for their family. Each VHH visited about 15 households per month, spending one to two hours on a visit. Problems experienced by a random sample of 36 VHH's included difficulties due to lack of transport, lack of medicines, slowness of the community to accept new ideas, distance from project clinic, lack of food in the village, weak village health committees, and no payment for services. The main support for the VHH's came from village women individually, women's groups, and the central programme committee. Village Health Committees did not provide effective support. Nevertheless, in four years only four of the 126 VHH's dropped out of the programme. The main reasons that 36 VHH's reported for continuing to volunteer were as follows: the continuous training they were given was beneficial (mentioned by all); they agreed to serve the villages and did not want to go back on their word (36·1%); they liked the work (19·4%); they felt they have an impact on the health of people in the village (16·7%); the allowances they sometimes receive (22·2%); and personal development (13·9%). The characteristics and responsibilities of community health workers in Saradidi were similar to those elsewhere. The ingredients for a successful volunteer programme such as this one are present in many areas. At a minimum, a strong programme centre, community support, back-up for problems, referral capability, on-going training, systematic supervision, on-the-job evaluation and a sense of purpose must be provided. While financial remuneration is preferred, payment in kind and by training and other community support may be sufficient to sustain the effort.

The utilization of community health workers to extend health services to the underserved population, to support the community in identifying their own health needs and to help the community take actions to solve their problems is central to primary health care (World Health Organization and United Nations Children's Fund, 1978; World Health Organization, 1984*a*; Ofosu-Amaah, 1983). The community health worker is supposed to serve as a link between the community and the health services. This innovative concept of involving the

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community has given a new dimension to the provision of health care. Despite the appearance of much literature on the community health worker, there has been a dearth of sharing of experiences in a systematic way (Ofosu-Amaah, 1983; World Health Organization, 1984*a*). Careful documentation of experiences is necessary to improve the development and the effectiveness of community health workers.

This paper describes the characteristics and functions of community health workers in a community-based health development programme carried out in Saradidi, Kenya (Kaseje and Spencer, 1987). Based on the experience in Saradidi, this analysis identifies characteristics that determine an effective community health worker and the activities that are most appropriate for them to carry out.

METHODS

Background

A community-based health development programme was begun in 1979 by the people of Saradidi, a rural area in western Kenya near Lake Victoria (Kaseje and Spencer, 1987). The community organized the area into villages based on geography, kinship ties (clan), religious affiliation and government boundaries. Each village elected a village health committee and selected one or more village health helpers (VHH's). These were volunteer community health workers who lived in the community. By 1983 there were 126 VHH's. They served a total population of more than 43 000 in 56 villages distributed over a total area of about 225 km^2 (Spencer *et al.*, 1987*h*). The VHH's were the core of health activities and were the individuals most responsible for implementing the development programme.

Data Collection

Data were obtained in the following ways:

1. Records of personal information (age, sex, education, etc.) collected when each VHH was selected.
2. Retrieval of information from the records of VHH activities which were submitted to the project once every month.
3. Results of a survey carried out in July 1983 on a random sample of 36 VHH's for assessment of attitudes, important activities, training, support by village, reasons for continuing and problems encountered. The survey was done by a female Luo-speaking social scientist well known to the VHH's. With the exception of those items included for identification, the questions were open-ended.

RESULTS

Selection and Support

VHH's were selected by their village, generally by the Village Health Committees (VHC's) formed in each village (Kaseje and Spencer, 1987). The only conditions imposed for someone to qualify as a VHH were that they be perceived to be mature, compassionate, and have a desire to help the people in the village and that they live in the village. There were no formal education requirements nor was it required that VHH's be able to read and write.

These conditions were determined by discussion and vote at a meeting open to all residents of Saradidi. What has emerged, then, is a group of people with varying ages and educational attainments. All were volunteers and all were to be supported by their village. Although salaries were not to be paid, each VHH was to receive payment in kind; cash donations were to be given for some of the services rendered.

Sex and Marital Status

Most of the VHH's were female; only three of 126 were males. Virtually all of them were married, the exception being one who reported herself as divorced.

Occupation

Most (120) of the 123 female VHH's were housewives and subsistence farmers; two were tailors, and one was a nursery school teacher. The three males were subsistence farmers. All these people resided in Saradidi over most of the year and they knew all or most of the people in their villages.

Age

The oldest VHH was aged 64 years while the youngest was aged 21 years. Only 12 (9·5%) were age 24 or less. Most (78 or 61·9%) VHH's were between 25 to 34 years old; 17 (13·5%) were 35 to 39; and 19 (15·1%) were age 40 years or more (four of these were 50 years of age or older).

Education

Although it was not required that a VHH be literate, most of them were better educated than other residents of the community. The majority of VHH's (101 of 80·2%) had finished five or more years of formal education; 35 (27·8%) had had eight or more years. Only nine (7·1%) VHH's never had any formal education, but even these had attended adult literacy classes so that they could read and write to a certain extent; 16 (12·7%) VHH's had between one and four years of education.

Activities of the VHHs

The activities expected of the VHH's were decided by the community members' meetings open to all Saradidi residents (Table 1) (Kaseje and Spencer, 1987). To appreciate the responsibilities of the VHH's, one must examine the tasks of the average woman in Saradidi; these are arduous. Most women in Saradidi do the following each day: care for children; clean the homestead; cultivate food for the family (involves long hours of work daily during planting, weeding and harvesting seasons); cultivate cash crops for sale; carry water to the house (usually from 3 to 10 km away); collect firewood (often from long distances); prepare at least two hot meals for the family per day; serve their in-laws who often live nearby and participate in village activities.

Most of each woman's day was already committed to these activities. Handicrafts and related activities were usually accomplished as the women walked, collecting water and firewood. The female VHH's had all the responsibilities of women and mothers and, in addition, were asked to perform the functions of their volunteer job.

The VHH's were supposed to be available to people living in the village at any time of the day and even received calls at night. They provided chloroquine phosphate to any person wishing treatment for malaria (Spencer *et al.*, 1987*c*). Thus, a female VHH could be asked to leave her work in the field to come and give malaria treatment or for another task such as to assist in delivering a child. Several hours each week had to be reserved for home visiting. During these visits she could be asked to help people in environmental health improvements, such as digging pit-latrines or garbage pits, constructing dish-racks and clearing bush and stagnant water from around homesteads.

In addition, VHH's were requested to keep accurate records of the activities to be submitted to the programme. The VHH's also participated in training, assisted in mobile health clinics and worked at the programme clinic. Most spent five to ten days each month on the health programme's activities.

By 1983, many VHH's had been performing these tasks voluntarily for more than four years. The original plan was that each village would pay its VHH's from the income they

obtained from the income-generating activities. In fact, through 1983 no village in Saradidi had financially supported any VHH on a regular basis.

Training

The process of training the VHH's and methods used are described elsewhere (Kaseje *et al.*, 1987*f*). All VHH's had received training. Of the 36 VHH's selectively interviewed only one had been a VHH for only one year; 12 had served for two years, 11 for three years and the remaining 12 for four years. Training by the project has been continuous; six VHH's had received training over a period of less than one year, 22 for one to two years, four for three years, and four for four years. Many, 22 (61·1%), had also been trained as midwives (traditional birth attendants).

TABLE 1

Activities of the village health helpers in Saradidi, Kenya*

1.	Home visiting
2.	Environmental health education
3.	Promoting utilization of maternal and child health clinics (immunizations and antenatal care)
4.	Treatment of malaria
5.	Antimalarial chemoprophylaxis for pregnant women (in selected villages only)
6.	Health education in village meetings and in schools
7.	Family planning education and services
8.	Serving as midwives
9.	Weighing newborns in the village
10.	Recording vital events (births and deaths)
11.	Nutrition education
12.	Participation in meetings
13.	Encouraging development in village and participation in income-generating activities
14.	Visiting and advising the sick
15.	Participation in project clinic and mobile clinics
16.	Attending training sessions
17.	Preparation and submission of monthly reports
18.	First aid and other first-line treatment of the sick in the village

*As decided in meetings open to all residents of Saradidi.

Size of the Population VHHs Serve

Each household in the project area was numbered. Each person had a unique number identifying the area, the village, the household and the particular person. The average number of people per household in Saradidi was 4·0 and the average village size was 764 persons (Spencer *et al.*, 1987*h*).

Each VHH was supposed to be responsible for a maximum of 100 households. Thus many villages had two or more VHH's. Of the 36 VHH's interviewed, two said that they served 250 people or less, 15 said they served between 250 and 500 people and 19 said they served more than 500 people. In addition to the people from her/his village, the VHH could provide services to others. Some malaria patients and family planning clients came from even beyond the boundaries of the project area or the VHH's area of operation because they knew that some health services were available in Saradidi.

Activities as a VHH

The VHH's were supposed to submit monthly reports on all their activities to the staff at the programme centre. A summary of VHH activities from June to September 1983 is shown (Table 2). This period was chosen because it was the one for which many VHH's had submitted reports. However, as shown, only 49 of 126 VHH's submitted reports. The need for reports and the importance of each type of information required from the VHH's was emphasized to them in their training. However, few VHH's have submitted reports regularly, especially when they did not clearly understand the use of the information on which they were supposed to report.

TABLE 2

Summary of village health activities by village health helpers from monthly reports from June–September, 1983 in Saradidi, Kenya

Month	*No. VHH reporting*	*Average no. home visits made*	*Average no. meetings attended**	*Average no. family planning contacts made*	*Average no. family planning acceptors*	*Average no. people treated for malaria*
June	35	16·8	1·7	12·9	2·0	94·5
July	42	16·6	1·5	10·8	1·1	79·4
August	45	18·9	1·4	10·1	1·4	85·8
September	49	11·9	1·2	10·3	2·3	71·9

*Meetings frequently involve all day.

During household visits, the VHH discussed a wide range of issues with household members. With the family she identified health problems and planned solutions. These visits usually occupied one to two hours. Therefore the VHH could not visit more than two homes in one afternoon. Each VHH visited about 15 households each month and thus needed an average of seven months to visit all her 100 households. However, additional discussions on health issues occurred when people came for malaria treatment and health advice.

The VHH's also attended more than one meeting each month. The VHH often walked to these meetings and could be away from home all day. Each VHH also made over ten family planning contacts per month; 1·7 of these on average became acceptors.

VHH's in 36 of the 56 villages provided chloroquine phosphate for treatment of malaria (Spencer *et al.*, 1987*c*). This practice reduced congestion at the health service delivery points and decreased distances travelled and the time before beginning treatment.

A summary of the activities of one VHH for one month is given as an example (Table 3).

ATTITUDES

Important Activities

The 36 VHH's surveyed considered home visiting and disease prevention activities, treatment of malaria, promotion of maternal-child health clinic attendance, environmental health education, nutrition education and recording of vital events as their most important activities. They said the home visits were an important element in establishing contact with people and in identifying health problems. The VHH's reported that mothers talked more freely in their homes especially about family planning. Other important activities identified were malaria control and treatment, village health committee responsibilities and assisting with home childbirths.

TABLE 3
Activities of one village health helper for February 1983*

Date	*Disease prevention activities*	*No. of contacts for family planning*	*No. of family planning acceptors*	*Maternal child health*	*No. of home visits*	*Meetings*
2 February 1983	Started new latrine	4	1	2	4	—
4 February 1983	Two new dish-racks	2	—	4	4	Women's group
8 February 1983	One garbage pit	3	1	2	4	—
12 February 1983	Cleaning home No. 73	4	2	1	4	—
20 February 1983	Boiling drinking water home No. 121	2	1	—	4	—
24 February 1983	Nutrition teaching	3	1	2	2	—
27 February 1983	One dish-rack	4	2	3	3	—

Summary

Seven days on home visiting; one new pit latrine started; three new dish-racks built; one new garbage pit dug; one meeting attended; 22 family planning contacts; eight family planning acceptors; 14 maternal-child health contacts; 25 homes visited.

*Not included are malaria treatments given.

However, the VHH's said they considered all their functions to be important. On occasion, the VHH's were requested to participate in the research activities. They viewed their involvement in such studies, i.e., sample surveys which were not part of their normal routine, as least important.

Use of Training

The following topics covered in their training were considered by the VHH's to be the most useful and are listed in order of stated importance: malaria control and treatment; family planning; nutrition education; disease prevention; home visiting; antenatal and postnatal care; immunizations; conducting home deliveries; home hygiene; first aid; treatment of simple diseases and identification of disease (diagnosis). The VHH's training consisted of discussions, role play, field work, talks/lectures, demonstrations and the use of audio-visual aids (Kaseje *et al.*, 1987*f*). All of the VHH's said they needed more training.

Problems as a VHH

In the sample survey the VHH's were asked to list the problems they encountered in their work (Table 4).

VHH's were frequently called at night or during inclement weather. The VHH's were not provided with equipment such as flashlights, raincoats or gumboots for movement in such conditions.

The programme area was large (about 225 km^2). For many people in Saradidi, the programme's clinic was more than 5 to 10 km away and no transport was available in the village. The VHH's found the lack of transport and distance a hindrance when they had to refer people to family planning clinics, to maternal and child health clinics or when someone was seriously ill.

People came to the VHH's with many different health complaints. The VHH's said they felt inadequate in many instances since for most problems they could offer only advice; chloroquine phosphate for treatment of malaria was the only drug they had available.

TABLE 4

Problems that village health helpers perceive as hindrance to the performance of their responsibilities in Saradidi, Kenya

	% mentioning
1. Lack of transport, e.g. ambulance, bicycles	94·4
2. Difficulties in getting around at night or during rain (no flash light, gumboots or raincoat)	83·3
3. No first aid kit	83·3
4. People take long to understand and accept new ideas	55·6
5. Does not have drugs for other diseases—only malaria	50·0
6. Project clinic too far from her village	41·7
7. Nutrition—lack of food so malnutrition	41·7
8. Too many diseases in the village	41·7
9. Village not united, people do not attend meetings	27·8
10. Environment hygiene—some people still not using latrines, dish-racks, etc.	27·8
11. Husband's interference in family planning activities	25·0
12. Weak or non-functioning village health committee	22·2
13. Lack of development in the village	22·2
14. Water problems—village has no safe water	22·2
15. Lack of teaching materials	19·4
16. No payment for the work they do	19·4
Total number	36

A serious drought beginning in 1982 had led to inadequate food and water supplies in Saradidi. Teaching about nutrition and hygiene were difficult when food and water were scarce.

The VHH's were mothers and wives who volunteered their much-needed time to help the community. Some of them (seven of 36) said that they would like to be paid, especially for delivering babies. Village income-generating activities were supposed to produce funds to pay the VHH's but no VHH had yet been paid at the time of the survey.

The staff at the centre were the persons relied upon by most of the VHH's to solve their problems; 29 of 36 said they went to the centre first. Although the VHC's were originally intended to fulfil this role, only five VHH's said they went to these committees; two would go to the assistant chief. Thus the VHH's looked first to the centre and not to their own village.

Co-operation with Other People in the Village

The 36 VHH's who participated in the sample survey were asked how different categories of people influence their work. Their responses are as stated below for each category:

The Programme Development Committee was supposed to develop work plans for the programme, advise villages on development and solve village problems. Many VHH's said they worked together with the programme committee in these activities.

The village health committees were intended to call village meetings, organize and supervise village development projects and advise the VHH. However, seven of the 36 VHH's said that they never worked with the village health committee because it was inactive and a total of 31 VHH's said their village committee was less supportive than expected.

The elders in the villages were responsible for interactions with the government, advising on development, calling meetings and disseminating information, promoting health and keeping law and order. Seventeen of 36 VHH's said that they worked frequently with the village elders.

Men in the village gave money for development projects.

Women in the village supported development through women's groups, were an important source of moral support for the VHH's, held meetings to raise money, gave donations, entertained guests and were the persons most responsible for implementing the health advice. Women's groups were an important community development resource in many villages.

Children in the village carried messages, gave personal encouragement to the VHH and helped with tasks such as cleaning the environment.

Programme centre health staff provided training, advice, referral services, mobile clinics, help with problems and supervised and evaluated the VHH's.

Most VHH's mentioned support from the centre health staff, women and children in the village. From these three groups, the VHH's received training, co-operation, appreciation and much needed boosts to encouragement; they were the three most important groups for the VHH's.

Reasons for Continuing as a VHH

The VHH's were asked why they have continued as VHH's; their responses are shown, (Table 5). All of them found the training to be so beneficial to themselves and their families as well as to the community that they were willing to continue working despite lack of financial support.

TABLE 5

Reasons for continuing as a village health helper in Saradidi, Kenya

Reason	*% mentioning*
Training	100
Desire to help in the village	36·1
Family planning allowance	22·2
Likes the work	19·4
Effect/impact on the village	16·7
Personal development	13·9
Total number	36

The second major reason given was that the VHH's had agreed to serve the villages when they were chosen and would not like to go back on their word. Some of them added that they like the work as well as the training they receive. Another reason for continuing is that they felt they have had an impact on the life and health of their village. Monetary gain, i.e. occasional allowances, was also a reason for continuing for those who receive them.

The VHH's believed community training and health education had changed many traditional but erroneous beliefs. Some of these beliefs reported changed as a result of VHH training are as follows: children should not eat eggs; children with measles should not eat meat, eggs, etc.; kwashiorkor/marasmus are incurable; there is no need to attend antenatal and immunization clinics; hospitals cannot treat measles; a pregnant mother cannot breastfeed and family planning produces abnormal children.

DISCUSSION

The characteristics and responsibilities of VHH's in Saradidi were similar to those of community health workers elsewhere (Ofosu-Amaah, 1983; World Health Organization, 1984*a*).

Sex

Almost all the VHH's in Saradidi were women. However, the requirements for VHH's as agreed upon by the community did *not* state sex. The responsibilities of the VHH's included many of those traditionally relegated to Luo women such as the health care for small children and environmental sanitation. Because they were women, the VHH's were able to discuss more fully with women in the community sensitive issues such as family planning. Women in Saradidi are more likely to be in the household during the day.

Both males and females have functioned effectively as community health workers. There are generally cultural preferences or biases regarding the question of sex; there may be traditional association of certain functions with a particular sex. The choice of sex should be based upon local conditions. After programme implementation has begun, evaluation of effectiveness should be done. Selection criteria may then need to be modified to require the selection of a female or male.

Age

Experience in many countries suggests that mature, middle-aged individuals (35 to 55 years of age) are more effective community health workers. Although most of the VHH's in Saradidi were 25 to 39 years old, their age did not seem to hamper their effectiveness. Maturity was one criterion for the VHH's selection. The VHH's were chosen by their village health committees. Thus they were accepted by the community. It is possible that in some societies, the young may not be well accepted.

Education

The level of education of community health workers ranges from none to university graduation. In general, their educational level is equal to or slightly higher than that of their community; this is considered appropriate. It is generally accepted that some minimum level of literacy is necessary for the community health worker to keep records, to relate to the health system and to undergo the training programme. In Saradidi, the VHH's were more educated than most women (Kaseje *et al.*, 1987*d*). More than half of those surveyed had been trained as traditional birth attendants. Formal education is respected in Saradidi. Increased education can be an asset for the community health worker unless it interferes with acceptance of the person by the community.

Community Support

A 'guiding principle' in development of community health worker programmes is that some form of viable community organization is necessary to establish an operational relationship between the community and the government (developmental agencies including the health sector) (Ofosu-Amaah, 1983; World Health Organization, 1984*a*). Acceptance by the community depends on the selection process and on the standing of the trainee in the community.

Successful support groups have certain characteristics:

1. They are representative of the communities they serve. Choice by election ensures adequate representation and is a valuable mechanism for educating the community about the functions of the group and the community health worker. Inclusion of women and 'vulnerable' groups such as the poor, the illiterate and certain ethnic groups and castes is important for representation but may be controversial in its effect on the group.
2. Meetings are frequent, at least once each month. Community health workers participate actively.
3. Responsibilities are broad and are not limited to selection and support of the community health worker. Two common requirements are planning of community health activities and management of funds raised by the community.

4. Training is provided (usually by health centre staff) in fields such as social preparation, social adaptation, activity planning and management, financial management, specific health topics, drug sale and management as required, and how to plan and conduct meetings.

In Saradidi, the major support for VHH's has come from programme centre staff and committees. Other important groups which supported the VHH's were women (and women's groups) and children. Village health committees have not been effective in Saradidi except for occasional activities such as needs assessment and selection of the VHH and have not provided adequate support to VHH's. A strong central programme staff and committees fulfilled this need. It is clear that without some sort of back-up the VHH's would not have continued to serve.

Acceptance by the Community

Since village members were involved in the selection process and in planning the responsibilities, the VHH's were readily accepted by the community.

Preparation of the Community

One weakness of many programmes is that selection of the community health worker, although done by leaders of the community, is done early at a time when the community and community leaders have at best an unclear, preliminary understanding of what the person is supposed to do. Because of this, there may be a lack of interest, expectation and involvement of the community.

This situation did not occur in Saradidi. The community organization was accomplished before selection of VHH's. The responsibilities of VHH's were developed in open community meetings. During preparation, formal and informal discussions were held throughout the area. The process of community preparation was probably extremely important in the success of the programme.

Responsibilities

The major tasks community health workers are expected to perform are very similar in different countries and have been shaped to a large extent by the declaration at Alma Ata. (World Health Organization and United Nations Children's Fund, 1978). Tasks almost universally required include first-aid; treatment of accidents and simple illnesses; dispensing of drugs; antenatal and postnatal advice and motivation; childcare advice and motivation; nutrition motivation and demonstration; promotion of immunizations; promotion of family planning; motivation for environmental sanitation, personal hygiene and general health habits; communicable disease screening, referral and prevention; referral of seriously ill patients, treatment failures and difficult cases; maintenance of records and compilation of reports; home visits; and participation in community meetings.

The VHH's in Saradidi were no exception to the general rule that community health workers are asked to do too much. The priority of health problems, other responsibilities, the distance to travel, the terrain and technology involved should be considered in deciding on duties. The experience in Saradidi emphasizes that community health workers should be asked only to perform activities of direct relevance to their work. Collection of information should be limited to that which is essential to the activities of the individual for a purpose which is well understood. The VHH's in Saradidi felt that participation in research projects curtailed their ability to perform more important responsibilities for the community.

Population Coverage

The population served by VHH's in Saradidi (about 500 people) was similar to that elsewhere. The fewer and less time-consuming tasks are, the larger the population that can be covered. Population limits need to be well-defined.

Training

The continuous training offered in Saradidi was important to the VHH's; it was participatory and non-formal (Kaseje *et al.*, 1987*f*). Experienced VHH's participated in the training of new ones. Alternative methods other than lectures such as role-playing, dialogue, discussion groups, and skill development were emphasized.

Motivation

The major motivation for continuing to work was training. This was mentioned by all VHH's queried. Other reasons given included desire to help the village, the recognition and appreciation received, the impact they feel they have had on the village, the personal development that occurred, and the expectation that someday they might be paid. In four years, only four (3·2%) VHH's have dropped out.

The importance of continuous training cannot be over-emphasized. Training in Saradidi provided an important motivation for the VHH's to continue, even in the absence of financial support. However, all VHH's hope that they will receive cash payment. If this occurs in Saradidi, it is more likely to come from individuals or households that use the services than to come from the village health committees.

It is obvious that community health workers would like to be paid. However, in many areas this will not be possible. In Saradidi, training was a form of payment as was the prestige. Alternative ways to pay community health workers 'in kind' need to be explored. The best way to do this is to carefully document experiences.

Supervision

Supervision in specific activities was provided by nurses and other personnel of the programme centre. They visited the VHH's on a regular basis and performed on-the-job evaluation as well as help with problems. Village health committees did not fulfil these roles as expected.

Referral

Seriously ill patients were referred to the programme centre or to a Ministry of Health hospital 40 km away. The VHH's also received help with problems at the centre. This support was crucial for continuation of the programme.

CONCLUSIONS

The homogeneity of the Saradidi community, the community preparation and organization that occurred prior to selection of VHH's, the support of the programme director and staff at the centre, and the continuous training provided have contributed to the success of the programme. The ingredients for a successful volunteer programme such as this one are present in many areas. At the minimum, a strong programme centre, community support from women's or other groups, back-up for problems, referral capability, on-going training, adequate supervision, on-the-job evaluation and a sense of purpose must be provided.

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The training process in community-based health care in Saradidi, Kenya

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Community health workers from a community-based health development programme in Saradidi, Kenya, were trained beginning in 1980, using participatory training. Training was considered high priority by the community. The process of training was geared to local problems, perceptions, situations and resources. The content of training was based on perceived health problems in the community and on responsibilities agreed upon by the health workers. Training was done in or near the villages where the participants were living and working. Concrete actions that could be taken to solve local problems were emphasized. The trainers were people who understood local problems, lived in Saradidi and were known to the trainees. Community leaders and members participated in the training as did some community health workers after completing their training. Evaluation indicated significant changes in the trainees' knowledge, practices and behaviour.

Community participation in primary health care often involves volunteer community health workers (World Health Organization and United Nations Children's Fund, 1978). Although it is agreed that the roles and performance of community health workers are directly related to the training they receive, there is no consensus as to what constitutes appropriate training (Ofosu-Amaah, 1983; World Health Organization, 1984*a*). Interest in the training of community health workers is recent, the training has been in many cases experimental and there has been little careful evaluation (Li *et al.*, 1983–1984). Differences in local public health problems and in social and economic conditions require and have resulted in wide variations in training procedures and content. Because of the importance of peripheral workers in health development programmes, it is vital that training experiences be carefully documented and critically analyzed so that the lessons learned can be useful in other situations. A community-based health development programme in Saradidi, Kenya, provided such an opportunity.

MATERIALS AND METHODS

Background

As previously presented in more detail (Kaseje and Spencer, 1987) Saradidi is a rural community in western Kenya near the shores of Lake Victoria. In 1979, the residents of Saradidi began to discuss how they themselves could solve some of their health problems. The community, which consisted of all persons living in Saradidi, organized itself and established a system of leadership. Villages were established from groups of households based on kinship

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and clan ties, geography, church denomination and government administrative boundaries. Community leaders at all levels were chosen by popular vote in open meetings (Kaseje and Spencer, 1987; Kaseje *et al.*, 1987*a*). Village health committees were elected in each village. A programme centre including a clinic was built and staffed.

The cornerstone of community health development was the work of volunteer village health helpers (VHH's) chosen and supported by each village (Kaseje *et al.*, 1987*d*). The only requirements made by the community for those considered for selection as VHH's were that they be perceived to be mature, compassionate and have a desire to help the people in the village and that they live in the village. No formal education was necessary nor was it a requirement that the person be able to write and/or read although these skills were considered to be helpful. From the beginning of the programme, continuous training was considered to be a priority for the health development programme by the community; this was emphasized in the community meetings open to all residents (Kaseje and Spencer, 1987).

Who was Trained

The VHH's were the main trainees. However, community leaders and programme centre staff received an introduction to the programme to enable them to understand the training objectives and how the training was to be carried out so that they could support the VHH's more effectively.

By 1984, 126 VHH's had been chosen by their villages: 96·8% were women, 99·2% were married, 75·4% were age 25 to 39 years and 80·2% had at least five years of formal education (only 7·1% had none) (Kaseje *et al.*, 1987*d*). Four groups of VHH's had completed training through July 1984, and a fifth one was undergoing training. Each class numbered about 25. The class was divided into four groups (six to eight people in each including trainers), which met at different sites in the area.

Venue

The training was located as close to the villages of the trainees as possible so that it was carried out within the environment of the problems under discussion. The VHH's, most of whom were mothers, were expected to continue with their normal household activities. The division of each class into four small groups made it easier to locate training near the villages of the participants. Thus, the VHH's could return home after each daily session.

Duration

The VHH's were given two weeks of introductory training followed by two one-day sessions each month and a one-week workshop each year until they had received at least three months' total training (spread out over two years). Supplementary training sessions of one or two days each month continued intermittently after the three-month experience. These were carried out at the programme's centre. Timing was flexible and always determined by the trainees. Training was suspended during any period of intense household socioeconomic activities such as the planting, weeding and harvesting seasons.

Trainers

Training content, methods and activities were developed with an education specialist and a community health physician both of whom belonged to the Saradidi community; they also participated in training sessions and were particularly involved in the training of the trainers. Two community health nurses who were full-time staff members did much of the training. Other trainers included local residents, programme staff such as the clinical officer and community leaders.

From 1983, VHH's who had previously received training began to participate as trainers. The training of trainers was done through seminars and workshops held at the programme's

centre. Facilitators from the Ministry of Health, the University of Nairobi, the United Nations Children's Fund (UNICEF) and the African Medical Research and Education Foundation (AMREF) were involved on occasion in seminars for trainers.

Training Methods and Materials

These were made deliberately flexible to fit the age, education and social status of the trainees. The process was problem-oriented leading to the development of skills and was based on sharing of experiences in response to specific problems posed. The training programme had broad objectives and a curriculum but did not identify specific activities.

The aims of training were:

1. To help VHH's identify and respond to the important health problems confronting them in their villages, e.g. 'what can I (we) do about children who die of fever in this (my) village', deliberately avoiding abstract concepts and generalizations.
2. To teach *specific skills* needed for *specific situations*, e.g. 'how do I prepare oral rehydration fluid for children suffering from diarrhoea and vomiting in my village and what do I teach their mothers'; the aim was to teach the correct way to exercise this skill in Saradidi.
3. To respond to and build upon community needs, perspectives and programmes, e.g. learning sessions led to specific actions and activities in the village. The trainer usually began with problems that the VHH's and the community could do something about, such as sanitation; the trainees agreed to go and do a particular action.
4. To develop the empirical analytical skills appropriate to the situation of VHH's in their individual villages by teaching, through analysis of common village health problems, the appropriate information needed in the situation, the reason the problem occurs and what can be done about the problem. Trainees did not attempt to teach theoretical concepts and intellectual strategies but a 'common sense' approach.
5. To make learning a group activity in which individual members were supported by the efforts and experience of the whole group, not to focus on individual learning needs.

Training was participatory and based on co-operative discussions. All sessions were conducted in Luo, the major language. The trainer participated as a member of the group. Experiences of trainees were elicited, shared and extended in an attempt to identify, analyze and suggest solutions to their health problems. The sessions included discussions on how to identify patients who should be referred (e.g. those who failed initial treatment and/or were seriously ill).

Role of Trainers

The main roles of the trainer were to organize sessions for learning; to direct discussions based on perceived public health problems; to provide information when requested; and to choose skills to be learned.

The trainer set the stage for learning to take place by:

1. Providing a good learning atmosphere: friendliness; seating conducive to participatory learning (in a circle); grouping to allow normal conversation; trust, equality and opportunity for everyone to share, with guidance and appropriate inputs from the trainer.
2. Posing the problem for discussion in a way that would provoke response. This 'starter' or 'stimulus' was either a picture, a poster, a play, a song, a story or some other appropriate object used to present a health problem existing in the village, e.g. a picture of village members using an unprotected water source. The presentation was followed by discussion questions to stimulate answers from trainees.
3. Setting up a session for the practice of skills (e.g. taking birthweights).
4. Discussing specific ways of translating the ideas into action in the respective villages.

5. Reviewing, summarizing, and evaluating what each trainee had learned and organizing a follow-up discussion of what the trainees had done or tried to do in their villages as a result of the health problems discussed in the previous session.

Training Process

The 'problem-posing' aid or 'starter' was followed with a series of questions to elicit problem identification, its dynamics in the local situation, personalization of the problem, analysis and feasible solutions to it. The following questions were usually asked following each presentation of a problem:

1. 'What did you see (or hear)'? Each trainee responded. This question was intended to help them identify the physical elements of the 'starter'.
2. 'What was happening'? This question evoked the dynamics of the problem, i.e. the factors causing the problem and how they interacted.
3. 'Does it happen in our village'? By answering this question, the problem was personalized bringing it into the realm of practical experience and reality.
4. 'Why does it happen'? 'What causes it'? 'What can be done about it'? These questions allowed analysis of the problem.
5. 'What can *we do* about the problem'? This led to identification of practical solutions to the problem.

The first two questions delineated the nature of the problem, its scope and environment and the last three brought the problem to the personal level, analyzed possible causes and elicited suggestions for possible solutions.

The group learning approach and sharing of experiences enabled differing opinions among the VHH's to be explored and resolved through the discussions. The trainers lived in Saradidi and many had been born there; they knew its health problems well and the resources available. The trainer guided the group in agreeing on a common line of action. Helpful concepts from the VHH's were encouraged by the trainer, harmless ones ignored, and harmful ones dealt with in group discussion. The trainer tried to develop a sense of mutual confidence and trust with the VHH's.

Content

The content of the training course covered three main areas: new knowledge, demonstration and practice of skills, and discussion of what to do with the knowledge and skills acquired.

The topics to be covered and length of time allotted for each were selected through:

1. Discussion with the community members and community leaders concerning the main health problems they experienced (symptoms, diseases, behaviour or beliefs with which they were familiar).
2. A community diagnosis survey to validate results of discussions with the community. This was done by health personnel (medical students from the University of Nairobi) and by VHH's during their two weeks of introductory training. The results of the survey did not differ significantly from the identified major problems in discussions with the community.
3. Topic areas that community members agreed were responsibilities of the VHH's (Kaseje and Spencer, 1987), including: Water supply and home hygiene (the need to boil water and keep homes clean). Food production, proper feeding and assessment of how well children are fed (how to produce more food, assessment of growth by regular weighing of babies). Communication of new ideas to villagers in a way that leads to relevant action (communication that was not authoritarian but participatory). Gathering information, keeping records of events and writing reports to show impact of efforts (use of forms developed together with the community residents). Mother and child health care services including immunization, home delivery and family planning (the need to use these services and where to go to get them). Simple treatment for common diseases, such as malaria, diarrhoea and

vomiting and worms. Control endemic communicable diseases, including malaria, measles and cholera. Family planning practices.

4. Enumeration of the responsibilities that VHH's were expected to undertake in dealing with the important public health problems and the knowledge and skills necessary for them to carry out the activities.

5. Gathering and preparation of problem posing aids. Some of these aids and materials, e.g. songs, stories, plays and posters, were developed together with the trainees as part of their learning process.

Evaluation

The results of training on the knowledge of the VHH about selected indicator topics (e.g. family planning), on the attitude, behaviour and skills of the VHH and on their impact at the village level were evaluated. To measure knowledge of new ideas communicated in the training and the impact of the training on attitudes, tests were given before beginning training and then after completion. Post-tests were done immediately after initial training and then again at two years. To assess change of behaviour and impact at the household and at the village level the community health nurses who supervised the VHH's visited the villages of the first 22 VHH's trained and five randomly selected households in each village.

The trainees evaluated the training and trainers in terms of the relevance of the course content, how well the trainer helped the trainees to learn and which aspects interfered with their learning. VHH's also suggested ways to improve learning; useful suggestions by trainees were then incorporated into subsequent training sessions.

RESULTS

Knowledge Assessment

Tests taken immediately before and after introductory training sessions showed statistically significant increases in mean scores by the 103 VHH's tested (Table 1). One group of 23 VHH's was still undergoing training and was not included. The increase was not affected by age, sex or educational level of the VHH's. Only in persons 20 years of age and less were the differences between scores not statistically significant. Only seven (6·8%) of the VHH's had post-test scores less than 50; one of these could not read or write and scored only eight, another scored 20, a third 32 and the other four scored from 40 to 49. Tests of knowledge conducted two years after initial training demonstrated continued success of the training process (Table 2).

Practices

The first 22 VHH's (all were women) trained were assessed concerning their health behaviour and activities in the village after the completion of two years training. The following factors were examined in this assessment: Family planning, breastfeeding and child rearing practices in her family. The presence, condition and use of a latrine, rubbish pit, plate-rack, and appropriate technology devices in her household. The presence of a kitchen garden and other personal development activities in the home. Cleanliness of her compound and whether she had planted trees. The use of maternal and child health services and presence of a clinic card if she had a child under five years of age or if she was pregnant. The presence and progress of the village project and the frequency at which her village health committee met. Her skills in and frequency of home visiting, preparing and submitting monthly reports. Skills and practice of recording deaths, births, visits and malaria chemotherapy. Skills and practice of health information and education in various village meetings, church groups, women's groups and schools. Knowledge of the sick and problems in the village.

These items were scored on a scale from 1 to 10. Scoring was done by the trainer and the chairman of the executive board. Five (22·7%) VHH's scored less than 50, 13 (59·1%) scored

TABLE 1

Mean and range scores before and immediately after the introductory training session. Village health helpers (VHH's) by age, sex and education, Saradidi, Kenya, 1980–1983

		Pre-test		*Post-test*			
	Number	*Mean*	*(range)*	*Mean*	*(range)*	*Paired t-test*	*P value*
AGE (years):							
Less than 20	5	80·2	(56–95)	86·2	(80–92)	1·22	0·29
21–30	57	66·3	(0–98)	79·6	(40–98)	6·21	0·0001
31–40	32	62·8	(0–98)	77·6	(8–98)	4·14	0·0002
40 or more	7	68·0	(36–88)	82·4	(60–96)	3·82	0·009
Unknown	2	77·5	(65–90)	81·5	(65–98)		
Total	103						
SEX:							
Male	3	83·3	(80–90)	90·7	(85–95)	3·14	0·009
Female	100	65·8	(0–98)	79·2	(8–98)	7·84	0·0001
Total	103						
EDUCATION (years):							
None	4	51·0	(0–88)	63·5	(20–96)	4·35	0·022
1–4	13	53·4	(0–84)	67·5	(8–98)	2·83	0·016
5–8	68	64·6	(0–98)	76·5	(40–98)	5·84	0·0001
9 or more	18	79·1	(56–98)	89·0	(76–98)	4·15	0·0007
Total	103						

TABLE 2

Mean difference between pre-score and post-score two years after initial training by age and education

	Number	*Mean difference in scores*	*P value*
EDUCATION (years):			
None	4	12·5	0·022
1–4	13	13·1	0·102
5–8	74	11·5	0·0001
9 or more	26	6·3	0·0001
Total	118		0·0001
AGE (years):			
20–29	57	10·3	0·0001
30–39	45	11·6	0·0057
40 or more	14	11·1	0·0033
Total	118	11·0	0·0001

from 50 to 75 and four (18·2%) scored more than 75. Based on the training content, all VHH's were expected to score above 75.

Since the family planning was discussed in depth in the training sessions, the utilization of family planning methods among VHH's was assessed at the beginning of training and a similar assessment was carried out in 1983 as another indicator of changes in practice following training. There was an increase from seven (6·1%) to 44 (38·3%) of 115 VHH's practising family planning (Table 3); the change was statistically significant ($\chi^2 = 34{\cdot}49$, $P < 0{\cdot}0005$). The pill was the principal family planning method used.

TABLE 3

Family planning methods reported used by village health helpers (VHH's) before (1980) and after training (1983)

Method	*% VHH's using**	
	1980 (pre-training)	*1983 (post-training)*
Pill	1·7	26·1
Condom	—	9·6
Abstinence/rhythm	2·6	8·7
Coil	—	1·7
Foam tablets	—	—
Sterilization	0·9	0·9
Breastfeeding	0·9	—
At least one method	6·1	38·3
No method	93·9	61·7
Number	115	115

*Some used more than one method.

Changes in the Village

The first 22 VHH's trained were assessed on their impact on the village. Assessments of five randomly selected households were done as part of routine supervisory visits; the VHH's did not know which household would be visited. The nutritional and immunization status of children under five years of age, the knowledge and use of maternal-child health/family planning by mothers in the households and the presence, state and use of latrines, rubbish pits, plate-racks, appropriate technology devices and kitchen gardens were examined. The frequency of village health committee meetings confirmed by minutes of meetings, and the presence and state of village income-generating projects were also scored.

Ten (45·5%) VHH's scored less than 50 out of a possible hundred and 12 (54·5%) from 50 to 74. Even if all the events had occurred since the inception of the programme, the impact at the village level appeared modest and it was decided that more effort was required by the VHH's and village health committees for health improvement in the individual households.

Evaluation of Training

The course content, the teaching methods of the trainers, the 'starter' and teaching sessions were adjusted based on the evaluation done by trainees. Changes in the teaching aids, the timing of specific sessions and the choice of local materials (e.g. for nutrition and maternal health) based on these assessments, were implemented. The trainees' evaluation forms were

reviewed by the education specialist, the public health physician and the programme's executive board.

DISCUSSION

The training process in Saradidi was successful in changing knowledge and practices as demonstrated. The methods used are relevant for consideration in other similar situations.

Duration

Following an introductory training session of two weeks, the training of VHH's in Saradidi was continuous occurring for several days each month. In one sense it was more continuing education than training. When 'training' was finished, the VHH's participated as trainers. Seminars and workshops were frequent. The training they received was the major reason that VHH's gave for continuing their responsibilities even when not adequately supported in the village (Kaseje *et al.*, 1987*d*). It has been noted that duration of training for community health workers is often set on the basis of financial or personnel availability or in a random manner rather than on an estimation of the time required to adequately train them to perform their job (Ofosu-Amaah, 1983). Accumulated experience suggests that it is helpful if initial training is quickly followed by a period of practical work in the community (Li *et al.*, 1983–1984). Brief initial training can be very effective as long as refresher courses are regular and supervision is continuous and appropriate.

Venue

The location of training near the homes of VHH's was important because it enabled them to continue their family responsibilities and it permitted training to occur in the environment where they would be working thus exposing them to local health problems and local conditions. Where community health workers are trained in specialized centres, they may not be provided with necessary experience in the local setting where they will be working, there are often transportation problems, the centralization limits the number of trainees at any one time, the cost is higher, family and community identity are disrupted and absence from the home is longer (Ofosu-Amaah, 1983; Li *et al.*, 1983–1984).

Content

The content of training in Saradidi was based on perceived health problems in the community and on the responsibilities the VHH's were expected to undertake. It considered the knowledge, attitudes, skills, motivation and expectation of the VHH's as well as expectation of the population to be served. Experience has shown that omission of training in communication skills and management is a major weakness of many training programmes for community health workers (Ofosu-Amaah, 1983; World Health Organization, 1984*a*). These topics were included in Saradidi as part of the sessions on specific skills for specific jobs. Since the content of training was identified by community members in sessions open to all residents: the community considered the content to be important. Past experience has indicated that the curriculum for community health workers must be adopted to the health problems and traditional health practices of the community and concentrate on specific tasks that the workers will be expected to perform (Storms, 1979; Li *et al.*, 1983–1984). The 'target' community should be actively involved in assessing its own health needs.

Teaching Methods

Various educational techniques and methodologies have been developed for training of community health workers. Comparative analysis of techniques has not been published (Ofosu-Amaah, 1983; World Health Organization, 1984*a*). In Saradidi, the main approach

was to minimize barriers to communication by making the training process a dynamic one emphasizing participation (both verbal and non-verbal) (Kessing, 1981). This process in which the target audience actively participates helps in the assimilation of new ideas because these are presented in a form to which the trainees can relate. The participation method also minimizes the effects of culture since new information is introduced in the context of the trainees' environment and in a form consistent with their perception and their concepts of self and the world. As demonstrated here, this process was successful in changing some of the trainees' knowledge and behaviour regarding health practices such as family planning.

The training activity was also part of a dialogue initiated not only within the training groups but within the whole community. Continuing communication was maintained between community members and health professionals; the information coming from trainers was thus adapted to the needs of the community and presented in ways relevant to identified specific needs. Approaches to training differ widely. In successful programmes teaching methods are selected so that they are most appropriate to the desired changes in attitude and behaviour and to the target population (Li *et al.*, 1983–1984).

Teaching Materials

The use of an audiovisual aid as a 'starter' to stimulate discussion around individual experience and reality was a key aspect of the training process. Pictures, posters and flow charts (developed by the trainers) were frequently used. Local familiar educational materials were utilized, where possible. More extensive audiovisual aids appropriate to the educational level of the VHH's in Saradidi would have been desirable.

Trainers

The trainers in Saradidi were community health nurses, programme staff or community residents (including respected community leaders). From 1983, VHH's who had been trained participated as trainers. There was an attempt to increase areas of common experience between trainers and trainees. Trainers were introduced to material and the training process in seminars and workshops. In some instances, teachers of community health workers have been selected on the basis of availability and expediency rather than on vocational aptitudes, knowledge and motivation. This was not the case in Saradidi. Providing specific training for trainers of community health workers, particularly professionals such as physicians and nurses, to enable them to select teaching methods, construct curricula and supervise students in service situations appropriate to the level of the community health worker has been shown to be important (Cernada, 1983–1984; Ofosu-Amaah, 1983; World Health Organization, 1984*a*).

Evaluation

Training programmes for both trainers and trainees need to be periodically evaluated to allow necessary changes to be made (Kaseje *et al.*, 1987*f*). Assessment by the trainees themselves is an important component of this process. In Saradidi, evaluation identified weaknesses in the teaching programme. Changes in content, teaching aids, the 'starter', teaching methods and schedules were made based on these assessments.

CONCLUSION

The participatory approach to the training of community health workers was found to be effective here. The emphasis on local public health problems and solutions and on teaching methods appropriate to the VHH's was important. This training experience in Saradidi utilized techniques similar to successful programmes elsewhere (Storms, 1979; Li *et al.*, 1983–1984). The size of the training group was restricted to allow close instructor–trainee

contact. Trainers had undergone training themselves and understood local problems. The trainer encouraged active trainee participation in 'learning-by-doing' and continually stimulated the trainees to improve on the way things were done in the past. The programme provided the VHH's with continuing instruction, systematic supervision (by programme staff) and on-the-job evaluation. These training activities have been shown to be crucial to the success of community-based programmes like the one in Saradidi and should be considered in planning similar programmes elsewhere.

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Malaria chemoprophylaxis to pregnant women provided by community health workers in Saradidi, Kenya. I. Reasons for non-acceptance

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Chloroquine prophylaxis for malaria was available free of charge to pregnant women in Saradidi, Kenya. The drug was supplied by village health helpers (VHH's). However, only 29·1% of 357 pregnant women seen in antenatal clinics from 1983 to 1984 were on chemoprophylaxis. One hundred and seven pregnant women not using antimalarial chemoprophylaxis from 22 villages were interviewed in June 1984 to determine the reasons. Age (mean 26·9 years), parity (mean 4·5 children), occupation (96·3% subsistence farmers and housewives) and education (median five to seven years) of the 107 respondents were similar to other women in the area. Previous pregnancies had occurred in 92 women; for 15 this was the first pregnancy. The last pregnancy had resulted in a live birth for 81 (88·0%), a stillbirth for nine (9·8%) and a miscarriage for two (2·2%); 21 (22·8%) of the 92 had experienced a miscarriage or stillbirth at some time (15 once, five twice and one woman four times). Malaria was the most frequent mentioned (28·6% of 21 women) cause of the last stillbirth or abortion. The major reason for not taking chemoprophylaxis was lack of awareness that the service was available (53·3% of 107 women). Other reasons were fear of chloroquine-induced itching (10·3%), the VHH had no drug (8·4%), the VHH had not advised her to take drug (8·4%), the woman was 'not sick' (7·5%), the woman was 'lazy' (6·5%), she had not been advised by clinic so was afraid to mix medicines (3·7%) and chloroquine was 'bad for pregnancy' (1·9%). The results suggest that the Saradidi programme has not been effective in providing malaria chemoprophylaxis to pregnant women even though malaria is perceived as an important cause of abortions and stillbirths. Most pregnant women interviewed were not taking chloroquine for logistical or organizational reasons. The responses elicited suggest problems in training and communication. Asking VHH's to give malaria chemoprophylaxis to pregnant women in addition to their other responsibilities was too difficult for many of the VHH's. Providing chemoprophylaxis in antenatal clinics may be more effective.

Women living in holoendemic malarious areas such as Saradidi, Kenya, frequently develop increased prevalence and severity of malaria infection during pregnancy (Brabin, 1983, 1985; McGregor, 1984). Complications are more severe and more frequent in women pregnant for the first time (primigravidae). The peak prevalence of infection occurs at 13 to 16 weeks gestation (Brabin, 1983). Infants, particularly first children, born to mothers infected with malaria have lower birth-weights and are at increased risk of perinatal and neonatal infections. To prevent this morbidity, antimalarial chemoprophylaxis is recommended for pregnant women (World Health Organization, 1984*b*). The optimal way to give chemoprophylaxis to pregnant women in tropical Africa within the resources available has not been determined. One possibility is the use of community health workers to provide antimalarial drugs to pregnant women. However to our knowledge there is no published information on the

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effectiveness of this method of delivery. A community-based malaria control programme in Saradidi, Kenya, provided information on the acceptance by pregnant women of antimalarial chemoprophylaxis given by volunteer community health workers. When acceptance was found to be lower than desired, a survey was done to determine the reasons.

METHODS

Background

As presented in detail previously (Kaseje and Spencer, 1987), Saradidi is a community in western Kenya near the shores of Lake Victoria. In 1979 the residents of the area began to organize themselves in order to do something about their health problems. Malaria was considered a priority problem and a community-based malaria control programme was initiated in May, 1982 (Spencer *et al.*, 1987*c*). One objective of the programme was to provide malaria chemoprophylaxis to pregnant women in area A, one of the three subdivisions of the programme, and to evaluate its effect on morbidity.

All pregnant women in the 23 villages (total population 16 560) of area A were encouraged to take chloroquine phosphate base 300 mg weekly for prophylaxis of malaria. The information that pregnant women should take chemoprophylaxis for malaria and where it could be obtained was made available in community meetings in each village or in antenatal clinics. The chloroquine was supplied by village health helpers (VHH's) in each village (Kaseje *et al.*, 1987*d*). These individuals were volunteers chosen and supported by the people in their village. Pregnant women either reported to the VHH or were identified by the VHH during home visiting or social gatherings. The VHH introduced the idea of chemoprophylaxis if the woman was unaware of the programme and completed a record card for the woman if she wished to take chloroquine. Chemoprophylaxis was to be started as soon as the pregnancy was known and continued for three months after delivery. The VHH visited the woman every two to four weeks; the dates the pregnant woman was visited and given chloroquine were recorded. One weekly course was to be taken in view of the VHH and a sufficient quantity of the drug then left to cover the woman until the next visit.

During a survey at maternal and child health clinics in 1984, it was found that only 104 (29·1%) of 357 pregnant women from area A were taking chemoprophylaxis. To determine why such a high proportion of pregnant women were not receiving chloroquine, a survey was carried out in June 1984.

Sample Selection

No complete list of pregnant women was available. The name of pregnant women attending antenatal and postnatal clinics held in Saradidi were recorded but these lists did not indicate whether women were on chemoprophylaxis. In addition, not all pregnant women were followed in antenatal clinics.

Each VHH was visited to obtain the names of pregnant women not taking chemoprophylaxis or recently delivered (<3 months) women who did not take it. If there were none, the interviewer walked through the village looking for these women. Pregnant women not on prophylaxis or lactating women who did not take it were easily identified in all villages except the one where the programme centre was located. One day was allocated for interviewing women in each village.

Data Collection

A short, structured questionnaire which took an average of 30 minutes to complete was administered. The five interviewers were all residents in Saradidi. Their supervisor was a social science student at the University of Nairobi. All five interviewers could read and write in English and were fluent in Luo, the principal language of Saradidi. The questions were

translated into Luo. The supervisor and interviewers had to agree that the question asked in Luo meant the same as the one in English. Mock interviews were done among the interviewers and trainer; then each interviewer went out in the community to interview one woman. The results of these pretests were discussed, and the questionnaires were further modified. To ensure that the questions were asked in a uniform way, each interviewer used a copy of the Luo translation in interviewing.

Information collected from each pregnant woman interviewed included: village, age, education, occupation, parity, date of last delivery, outcome of last pregnancy and record of attendance at an antenatal clinic. Then each woman was asked if she knew the VHH provided antimalarials to pregnant women; if she was getting medicine from the VHH and if not, why not; if not receiving medicine against malaria would she like to do so; did she know any pregnant woman taking such medicine; did she think it necessary for pregnant women to take medicine to protect against malaria and why; had she ever had an abortion or stillbirth, and if so, what were the symptoms preceding these events.

RESULTS

Study Population

A total of 107 women were interviewed in 22 villages (mean 4·9, range 1–10). The mean age was 26·9 years (range 14–42 years) (Table 1). In one village no pregnant women not taking chemoprophylaxis could be identified. A large proportion (29·9%) of the women had received no education at all although most (46·7%) had five to seven years of formal education (Table 1). Younger (⩽29 years) women had more average years of formal education than older women. None of the women 30 years or older had completed more than seven years of formal education, and none of those 40 or older had finished more than four years of school.

TABLE 1

Distribution of pregnant women not on malaria chemoprophylaxis by age and education in Saradidi, Kenya, 1984

Age (years)	*Education*				
	None	*1–4 years*	*5–7 years*	*≥8 years*	*Total no. (%)*
14–19	2	1	11	3	17(15·9)
20–24	3	5	17	6	31(29·0)
25–29	6	1	9	3	19(17·8)
30–34	13	3	10	—	26(24·3)
35–39	5	1	3	—	9(8·4)
40 or more	3	2	—	—	5(4·7)
Total No. (%)	32(29·9)	13(12·2)	50(46·7)	12(11·2)	107

Only four (3·7%) women were salaried: three were teachers and one owned a small shop (duka). The remaining women (96·3%) were subsistence farmers and housewives.

Only 15 (14·0%) were expecting their first child (Table 2). The highest number of previous deliveries was 15 and the average parity was 4·5. Four women had a baby who was under one year of age; 15 had babies under two years of age; 36 women had babies between two and two and a half years and for 37 the youngest child was more than two and a half years old.

TABLE 2

Parity of 107 pregnant women not receiving malaria chemoprophylaxis in Saradidi, Kenya, 1984

Parity	*% Women*
0	14·0
1–3	24·3
4–6	29·0
7–9	27·1
10 or more	5·6

The education level attained, occupations and parity by age of these women were similar to those of other women of the same age in this community (Spencer *et al.*, 1987*h*).

Antenatal Clinic Attendance

Only 56 (52·3%) women said they were attending an antenatal clinic; 18 of these 56 were attending one at the Saradidi community health programme centre. The others were attending clinics at Ministry of Health facilities or the mission hospital.

History of Miscarriages and Stillbirths

There were 92 women with previous pregnancies. The last pregnancy had resulted in a live birth for 81 (88·0%) women, a stillbirth for nine (9·8%) and a miscarriage for two (2·2%).

A miscarriage or stillbirth had been experienced at some time by 21 (22·8%) of the 92 women. For 15 this had occurred once, for five twice and one woman had suffered four stillbirths and abortions. Malaria was the most frequently mentioned problem preceding the last non-live birth (Table 3).

TABLE 3

Event preceding last non-live birth in 21 pregnant women with a history of previous stillbirth or abortion in Saradidi, Kenya, 1984

Event	*No. women*
Malaria	6
Pain then bleeding	5
Fever and headache	2
Fatigue/accident	2
Other/no symptoms	4
Did not recall	2

Reasons for not using Chemoprophylaxis

The major reason for not taking chemoprophylaxis was lack of awareness that the service was available; 57 (53·3%) women gave this reason (Table 4). For the 50 women who knew the VHH's provided chloroquine to pregnant women for prevention of malaria, fear of

chloroquine-associated pruritus was the most frequent response given (11 women, 22% of 50). Nine women (18%) from two villages said the VHH's told them there was no drug each time they went to her for chemoprophylaxis. When contacted, the VHH's said they had exhausted their supplies of chloroquine but had as yet not found time to go to the Saradidi clinic for more. Nine women (18%) stated that the VHH's in their villages had not advised them to take chemoprophylaxis for malaria and eight women (16%) said that there was no reason to take drugs if a person was 'not sick'. Seven women (14%) said they were 'too lazy' to go to the VHH's and four women (8%) hesitated to take chemoprophylaxis since it was not prescribed at the antenatal clinic, and they were afraid to mix medicines from the clinics (usually iron supplements) with those provided by the VHH's. Only two women (4%) refused malaria prophylaxis because they believed chloroquine caused stillbirths and abortions.

TABLE 4

Reasons 107 pregnant women gave for not receiving malaria chemoprophylaxis from village health helpers (VHH's) in Saradidi, Kenya, 1984

Reason	*% of women*
Unaware of service	53·3
Chloroquine causes itching	10·3
VHH had no drug	8·4
VHH had not advised her to take	8·4
Not sick	7·5
'Lazy'	6·5
Not prescribed by clinic so afraid to 'mix' medicines	3·7
Chloroquine bad for pregnancy	1·9

Of the 107 women, 75 (70·1%) said they would like to begin malaria chemoprophylaxis, 16 (15·0%) said they did not want it and 16 (15·0%) were not sure. Eleven of the 16 who clearly did not want to take chloroquine were concerned about associated itching, two thought the drug caused abortions and stillbirths, two could see no use for taking chemoprophylaxis, and one said she had been advised against chemoprophylaxis by another health worker. Eighty-six (80·4%) women considered chemoprophylaxis against malaria to be important during pregnancy.

DISCUSSION

These results demonstrate that the Saradidi programme has not been effective in providing malaria chemoprophylaxis to pregnant women even though malaria is perceived as an important cause of abortions and stillbirths. The vast majority of the 107 pregnant women interviewed were not taking weekly chloroquine because they did not know it was available, because the VHH had no drug, because the VHH did not advise them to begin or because they were hesitant to mix medicines from an antenatal clinic with those from the VHH. All these responses suggest gaps in training and communication both among the VHH's and within the community.

The fear of toxic reactions to chloroquine was an important reason for failing to comply with chemoprophylaxis recommendations. The two such reactions mentioned were chloroquine-

associated pruritus and chloroquine-related abortions and stillbirths. Itching due to chloroquine occurs in Saradidi in about 20% of adults (Spencer *et al.*, 1987*b*). Pruritus may be so severe that the people do not want to take chloroquine even for treatment of symptomatic malaria. No evidence exists to substantiate that chloroquine in usual doses for treatment of malaria causes either abortions or stillbirths in tropical Africa (Bruce-Chwatt, 1986). Nonetheless, this belief occurs in Saradidi and appears difficult to change, particularly because both of these events occurs frequently.

These results suggest that antimalarial chemoprophylaxis to pregnant women may be better provided at antenatal clinics than by community health workers. We speculate that the additional task of providing antimalarial prophylaxis with chloroquine to pregnant women may have overloaded some of the VHH's. These women have extensive public and private responsibilities (Kaseje *et al.*, 1987*d*). The rationale of chemoprophylaxis must be carefully explained initially and detailed questions answered on subsequent visits. The immediate benefits of chemoprophylaxis are more difficult to understand than are those of treatment. Visiting the household of each pregnant woman every two weeks is time consuming. Some pregnant women are not identified by the VHH. In practice the concept of chemoprophylaxis was not introduced well to pregnant women. All these reasons probably contributed to the lower than desired success rate in Saradidi. Nonetheless, the responses suggested that most pregnant women in Saradidi would be interested in taking chloroquine chemoprophylaxis to protect themselves against malaria. Thus, alternative methods to provide chemoprophylaxis in this setting need to be explored. We suggest that providing chemoprophylaxis in antenatal clinics will be more effective and has the advantage that follow-up of the infants in maternal and child health clinics can be facilitated.

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Malaria chemoprophylaxis to pregnant women provided by community health workers in Saradidi, Kenya. II. Effect on parasitaemia and haemoglobin levels

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To determine the effects of chloroquine phosphate (300 mg base weekly) chemoprophylaxis for malaria provided by volunteer village health helpers (VHH's), pregnant women attending antenatal clinics in Saradidi, Kenya, were examined each month. Parasitaemia, haemoglobin level, and the presence of urinary 4-aminoquinolines were determined at each visit. The age composition and parity of women taking chemoprophylaxis were not statistically significantly different from those of the other women.

A total of 104 (29·1%) of 357 pregnant women from 23 villages where chemprophylaxis was provided by VHH's said they were taking it. Women 30 to 44 years of age (43·9% of 82) were more often taking prophylaxis than those younger (25·1% of 271) ($P<0·0005$).

An additional 573 pregnant women to whom regular chemoprophylaxis was not provided from 33 control villages were also examined at least once. When compared with those from women not taking prophylaxis, blood samples from pregnant women on antimalarial prophylaxis had lower parasite rates (17·7% of 265 compared with 26·2% of 1700, $P<0·005$), higher haemoglobin levels (59·1% of 127 were $\geq 10·0\ g\ l^{-1}$ compared with 49·7% of 1111, $P<0·05$), and a higher mean haemoglobin level ($9·95\ g\ dl^{-1}$ compared with 9·62, $P=0·019$) and urine samples were more often positive for 4-aminoquinolines (15·7% of 255 compared with 8·3% of 1656, $P<0·0005$). For women with two or more parasitologic samples, 69·6% of 79 pregnant women on prophylaxis had no parasites found on any visit compared with 51·6% of 516 women not on chemoprophylaxis ($P<0·005$).

Parasitaemia rates in samples from 317 infants were high (37·3% of 1047). Infection was present in 2·3% of 43 samples from infants less than one month and by four months of age 49·6% of 135 samples were positive. Although samples from infants whose mothers said they were taking chemoprophylaxis had a lower prevalence of parasitaemia (32·6% of 190) than those from the other infants (38·4% of 857), the difference was not statistically significant.

Although community-based delivery of antimalarial chemoprophylaxis by VHH's appeared to be successful in reducing parasitaemia and increasing haemoglobin levels, antenatal clinics may be a better way of providing chemoprophylaxis to pregnant women. The additional responsibility may be too much for community health workers. At the clinic chemoprophylaxis can be presented as part of comprehensive antenatal care. After delivery, care can then be extended to the infant.

The consequences of malaria in pregnant women living in holoendemic malarious areas such as occurs in many areas of sub-Saharan Africa differ markedly from those occurring in pregnant women in areas of low endemicity (McGregor, 1984; Brabin, 1983). In tropical

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Africa, pathologic effects from malaria are significantly more frequent in women pregnant for the first time (primigravidae) and parasite frequency, parasite density and the prevalence of anaemia are greater (McGregor, 1984; Brabin, 1983; Bray and Anderson, 1979; Bruce-Chwatt, 1952; Gilles *et al.*, 1969; Cannon, 1958; Archibald, 1956). Mean birth-weights are lower, particularly in first-born children in association with dense placental infections, and low birth-weight is associated with increased risk of perinatal and neonatal mortality. Maternal deaths are rare despite placental parasitaemia prevalence rates of 20% 34%, with rates as high as 74% reported (McGregor, 1984). In Africa, no study has quantified a clear and significant relationship between malaria and foetal wastage (abortions and stillbirths). Congenital malaria infections are rare, probably due to protective antibodies acquired transplacentally (Bruce-Chwatt, 1952; Covell, 1950).

To reduce mortality and morbidity due to malaria, chemoprophylaxis is recommended for pregnant women living in malarious areas (World Health Organization, 1984). In some situations, community health workers may be asked to provide antimalarial chemoprophylaxis to pregnant women as part of malaria control activities. To our knowledge, no information from tropical Africa of the effect of antimalarial chemoprophylaxis to pregnant women provided by volunteer community health workers has been published.

A community-based malaria control programme was initiated in May 1982 in Saradidi, a community in western Kenya near Lake Victoria (Kaseje and Spencer, 1987; Spencer *et al.*, 1987*c*). As part of this programme, chloroquine phosphate chemoprophylaxis for malaria was made available to pregnant women. The drug was provided by volunteer community health workers living in each village. This paper reports the results of investigations done in pregnant women attending antenatal clinics in Saradidi between January 1983 and March 1984 and their infants.

MATERIALS AND METHODS

Areas

Saradidi was divided into three sections, designated areas A, B and C, based on the degree and duration of community organization (Kaseje and Spencer, 1987). These areas were homogeneous with regard to geography, people, economy and malaria transmission. More than 98% of malaria infections were caused by *Plasmodium falciparum* alone or mixed with *P. malariae* and/or *P. ovale* (Spencer *et al.*, 1987*c*).

Chemoprophylaxis

Antimalarial chemoprophylaxis with chloroquine phosphate base 300 mg weekly was made available to pregnant women living in area A. Tablets were provided by the World Health Organization. The drug was given by village health helpers (VHH's) living in each village. VHH's were volunteers chosen and supported by the community (Kaseje *et al.*, 1987*d*). The characteristics of 126 VHH's in Saradidi were as follows: 96·8% were women, 99·2% were married, 75·4% were between 25 and 39 years of age and 80·2% had had at least five years of formal education (only 7% had had none). On her routine visit to the household, the VHH's explained the programme and encouraged pregnant women to take chemoprophylaxis. If the woman agreed, a weekly dose was taken then and a sufficient amount of drug left until the next home visit by the VHH's. In addition to information from the VHH's, pregnant women were informed about chemoprophylaxis at antenatal clinics sponsored by the Saradidi clinic and at community meetings. They could then go to the VHH's and request chemoprophylaxis.

In areas A and B, the VHH's also provided treatment to persons with malaria (Spencer *et al.*, 1987*c*). Chloroquine phosphate base at 10 mg kg^{-1} was given. Thus pregnant women who were not on chemoprophylaxis or those who received it but developed the symptoms of malaria could go to the VHH's and be treated.

Antenatal Clinics

The Saradidi Community Health Programme operated maternal and child health clinics at the programme clinic in area A each week on Tuesday and Friday. Each Wednesday a mobile maternal and child health clinic was conducted at one of four sites in areas B and C. Pregnant women were encouraged to attend these clinics once each month. Each woman was seen by a community health nurse, medical student or physician. Although these clinics did not provide chemoprophylaxis for malaria, all women from area A who attended the clinics were told about the VHH's chemoprophylaxis programme.

Study Design

Between January 1983 and March 1984 every pregnant woman attending an antenatal clinic in Saradidi was entered into the study. The initial visit recorded the age, village, household and personal numbers and whether the woman said she was taking chemoprophylaxis. On each visit (usually monthly) until delivery, a urine sample, a thick blood film and a fingerprick sample for haemoglobin level were collected. Information on parity was collected at the time of delivery. Thick blood films were collected from the infants of these women at the first visit after birth and monthly as long as the child was brought to the clinic.

The study was carried out by male technicians who had been working in Saradidi since August 1980; they lived in the area during the week and spoke Luo, the language of the Saradidi people. Training to standardize techniques was done for two weeks before the study began. Supervision of data collection and record keeping was done monthly. Results are presented here on women seen through March 1984.

The urine was tested for the presence of 4-aminoquinolines using the Dill–Glazko test (Lelijveld and Kortmann, 1970). The thick blood film was stained with Giemsa and examined for malaria parasites. At least 100 fields were examined before a slide was diagnosed as negative. Haemoglobin level was determined immediately using a Spencer haemoglobinometer.*

RESULTS

Study Population

A total of 930 pregnant women were examined at least once: 357 from area A, 373 from area B and 200 from area C. This number is 45·9% of the 2027 live births that were registered in Saradidi between 1 September 1982 and 31 August 1983 (Spencer *et al.*, 1986*d*). Only 104 (29·1%) of the 357 women from area A said they were taking antimalarial chemoprophylaxis. (Women from areas B and C were not offered chemoprophylaxis.) There was no statistically significant difference by age or parity when women taking chemoprophylaxis were compared with those who were not. The number of samples taken from each woman ranged from one to six (mean 2·2 for women taking prophylaxis and 2·1 for the other women). In area A, the proportion of women on chemoprophylaxis significantly ($P<0·0005$) increased with age (Table 1).

Parasitaemia in Pregnant Women

As shown in Table 2, parasitaemia was significantly ($P<0·005$) more frequent in blood samples from women not taking chemoprophylaxis. *Plasmodium falciparum* alone or as a mixed infection with *P. malariae* and/or *P. ovale* was present in 98·3% of positive slides. Among women with two or more samples, the proportion of women with all samples negative for parasites was significantly ($P<0·005$) higher in those taking chemoprophylaxis (Table 3). The prevalence

*The use of brand names is for information only and does not imply endorsement by the Government of Kenya or the U.S. Department of Health and Human Services.

TABLE 1

Proportion of pregnant women from area A taking malaria chemoprophylaxis, by age in Saradidi, Kenya 1983–1984

Age (years)	*No. women*	*% taking chemoprophylaxis*
15–29	271	25·1
30–44	82	43·9
Unknown	4	0
Total	357	29·1

$\chi^2 = 10{\cdot}7$, $df = 1$, $P < 0{\cdot}005$ (excludes those of unknown age).

TABLE 2

Relationship between parasitaemia, urine Dill–Glazko test for 4-aminoquinolines and antimalarial chemoprophylaxis in pregnant women in Saradidi, Kenya 1983–1984

Women on chemoprophylaxis	*No. samples**	*% with parasitaemia*	*No. urine samples**	*% Dill–Glazko test positive*
Yes	265	17·7	255	15·7
No	1700	26·2	1656	8·3

$\chi^2 = 8{\cdot}7$, $df = 1$; $P < 0{\cdot}005$.
$\chi^2 = 14{\cdot}4$, $df = 1$; $P < 0{\cdot}0005$.
*Number of samples, *not* number of pregnant women.

TABLE 3

Relationship of antimalarial chemoprophylaxis and proportion of pregnant women with two or more parasitologic samples where all samples were negative for parasites in Saradidi, Kenya, 1983–1984

	Number of women with two or more parasitologic samples	*% of women with all samples negative*
Chemoprophylaxis	79	69·6
No chemoprophylaxis	516	51·6

$\chi^2 = 10{\cdot}6$, $df = 1$, $P < 0{\cdot}005$.

of parasitaemia by month showed little variation and ranged from 22·7% of samples collected in June 1983 to 32·1% in those taken in December 1983; the differences by month were not statistically significant.

Haemoglobin Levels

Haemoglobin levels in women in all three areas who said they were taking antimalarial chemoprophylaxis were significantly higher than those in women who were not on prophylaxis (Table 4). No significant difference in haemoglobin level by area was found among samples from women not on chemoprophylaxis.

TABLE 4

Relationship between haemoglobin level and antimalarial chemoprophylaxis in pregnant women in Saradidi, Kenya 1983–1984

	Chemoprophylaxis	
Haemoglobin level (g dl^{-1})	*Yes*	*No*
	% Samples	
5·0 to 7·4	0·8	6·0
7·5 to 9·9	40·2	44·3
10·0 to 13·5	59·1	49·7
Total	127	1111

$\chi^2 = 6{\cdot}7$, $df = 2$, $P < 0{\cdot}05$.

The mean haemoglobin level of 127 samples from women taking chemoprophylaxis was 9·95 g dl^{-1} (range 6 to 13·5) compared with 9·62 g dl^{-1} (range 5·0 to 13·0 g dl^{-1}) in 1111 samples from women not on antimalarial chemoprophylaxis (Student's t-test = 2·3483, $df = 482$, $P = 0{\cdot}019$).

Dill–Glazko Tests

Urinary samples for 4-aminoquinolines were significantly ($P < 0{\cdot}0005$) more often positive in women on chemoprophylaxis (Table 2).

Infant Parasitaemia

From May 1983 through March 1984 a total of 1047 blood slides from the 317 infants were examined for malaria parasites; 391 (37·3%) were positive (Table 5). Parasitaemia rates increased rapidly by age; 49·6% of 135 samples from infants four months of age were positive for parasites.

Although samples from infants whose mothers said they were taking weekly chemoprophylaxis with chloroquine had a lower prevalence of parasitaemia (32·6% of 190) when compared with those from infants whose mothers gave no history of antimalarial chemoprophylaxis (38·4% of 857), the difference was not statistically significant.

Although parasitaemia rates by month ranged from 23·8% of samples collected in May 1983 to 46·9% of samples taken in December 1983, the differences were not statistically significant ($P < 0{\cdot}5$).

Parasitaemia in Mothers by Month Prior to Delivery

Among the 314 mothers whose infants were followed, those taking chemoprophylaxis had a significantly lower proportion ($P < 0{\cdot}05$) of thick blood films positive for malaria parasites at zero to two months before delivery but not at three to five months before (Table 6).

TABLE 5

Relationship between age of infant, presence of parasitaemia in infant and chemoprophylaxis status of mother in Saradidi, Kenya 1983–1984

	Mother on chemoprophylaxis					
	Yes		*No*		*All*	
Age of infant (months)	*Number of samples*	*% positive**	*Number of samples*	*% positive**	*Number of samples*	*% positive**
Less than 1	6	0	37	2·7	43	2·3
1	26	7·7	131	13·0	157	12·1
2	24	20·8	146	24·7	170	24·1
3	27	37·0	132	37·9	159	37·7
4	27	44·4	108	50·9	135	49·6
5	26	38·5	95	53·7	121	50·4
6	13	38·5	67	55·2	80	52·5
7	17	41·2	47	53·2	64	50·0
8	9	44·4	38	55·3	47	53·2
9 or more	15	46·7	56	64·3	71	60·6
Total	190	32·6	857	38·4	1047	37·3

*Per cent of thick blood films positive for malaria parasites.

TABLE 6

Parasitaemia in relation to antimalarial chemoprophylaxis by month of sample before delivery in 314 pregnant women whose infants were followed in Saradidi, Kenya 1983–1984

	Chemoprophylaxis			
	Yes		*No*	
Time before delivery (months)	*Number of samples*	*% positive**	*Number of samples*	*% positive**
0–2	115	17·4	447	26·4†
3–5	33	21·2	113	25·7‡
6–9	—	—	8	37·5
Total§	148	18·2	568	26·4

*Per cent thick blood films positive for malaria parasites.
†Comparison of two groups at zero to two months. $\chi^2 = 4{\cdot}01$, $P < 0{\cdot}05$.
‡Comparison of two groups at three to five months. $\chi^2 = 0{\cdot}27$, N.S.
§$\chi^2 = 4{\cdot}21$, $df = 1$, $P < 0{\cdot}05$. Proportion of positive slides in pregnant women on chemoprophylaxis compared with those from women not taking prophylaxis.

DISCUSSION

This is the first report on the efficacy of weekly chloroquine for antimalarial chemoprophylaxis provided to pregnant women by volunteer village health workers. The results demonstrate

that women who said they were taking chemoprophylaxis had statistically significantly fewer blood smears positive for malaria parasites and had higher haemoglobin levels when compared with those not receiving weekly drugs. In addition, women taking chemoprophylaxis were significantly more likely than the other women to have all blood specimens negative for parasitaemia. Although the definition of chemoprophylaxis was based solely on history, pregnant women on chemoprophylaxis also had significantly more urine samples containing 4-aminoquinolines as evidenced by a positive Dill–Glazko test.

Parasitaemia rates in infants were indicative of an intense level of transmission. Infection was present in some infants less than one month of age and almost half of samples from infants four months of age and older were positive for malaria parasites. The relatively linear rate of acquisition of infection observed in the first four to five months of life suggests that in Saradidi passive acquisition of maternal antibodies from the placenta does not influence the development of parasitaemia. These results are similar to those found earlier in Kisumu, Kenya (Fontaine *et al.*, 1978). Parasitaemia rates in the first five to six months of life were similar to those found in Nigeria but in Saradidi samples from older infants (six months and older) had a similar proportion of positivity while in Nigeria parasitaemia rates continued to increase up to 80% or 90% (Bruce-Chwatt, 1952; Gilles *et al.*, 1969; Molineaux and Gramiccia, 1980). The reason for these two different patterns is unknown. Peak transmission is probably less intense in Saradidi and Kisumu than in parts of Nigeria and antimalarial drugs may be more available.

In this study 29·1% of 357 pregnant women from the area where antimalarial chemoprophylaxis was provided by village health workers said they were taking it. This result is both encouraging and disappointing. Another study in the same area demonstrated that more than half of women not on chemoprophylaxis were in fact not aware of the programme (Kaseje *et al.*, 1986*b*). Thus, in Saradidi, village health workers might be effective in providing this service. Volunteers in Papua New Guinea have effectively provided chemoprophylaxis to children (Stace, 1984). In areas where chemoprophylaxis is to be given to pregnant women, this experience in Saradidi suggests that it could be provided as part of primary health care services.

Nonetheless, the coverage in Saradidi was disappointingly low. Given the many responsibilities of the VHH's in Saradidi (Kaseje *et al.*, 1987*d*), it is probable that asking them to provide chemoprophylaxis to pregnant women may have overloaded many of them. The decision to ask volunteer community health workers to provide prophylaxis must be weighed against how much this task will interfere with other responsibilities they are asked to perform. Since from these findings it appeared that more than 40% of pregnant women in Saradidi attended an antenatal clinic at least once, we recommend that chemoprophylaxis might better be provided there than by VHH's in each village. The advantages are obvious. The VHH's could concentrate more on treatment, and chemoprophylaxis provided at the clinic would be part of comprehensive antenatal care which could then be extended to the infant after delivery.

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Malaria chemoprophylaxis to pregnant women provided by community health workers in Saradidi, Kenya. III. Serologic studies

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Parasitaemia and antimalarial antibodies were examined from May 1983 to March 1984 in monthly samples taken from 930 pregnant women attending antenatal clinics in Saradidi, Kenya, and 317 of their infants; 104 women were taking chloroquine phosphate 300 mg base weekly for chemoprophylaxis. Seropositivity rates in pregnant women were uniformly high, and mean enzyme-linked immunosorbent assay (ELISA) absorbance values were not related to presence of parasitaemia or history of chemoprohylaxis. Parasitaemia was present in 26·5% of 1677 slides from pregnant women and there was little variation by month of sample. Mean ELISA absorbance values varied by month of sample. Seropositivity rates in infants were high as measured in both the indirect fluorescent antibody (IFA) test (81·6% of 938) and ELISA at 1:100 (83·8% of 1025) and 1:1000 (34·8% of 1025) serum dilutions. Seropositivity rates decreased slightly after birth but by four months of age rates were again high. Parasitaemia was present in 26·5% of 1677 slides from pregnant women. Paired comparisons were made on maternal samples collected less than two months before parturition and samples from the infants collected within two months after birth. The paired antibody response by IFA or ELISA was not dependent on the presence of detectable parasitaemia in the mother. Infants from mothers with a history of antimalarial chemoprophylaxis had significantly ($P=0·04$) lower IFA titres than other infants. Measuring the absorbance of a 1:100 serum dilution by ELISA appeared to be an excellent method with which to measure longitudinal serologic changes in a population.

A community-based malaria control programme in Saradidi, Kenya (Kaseje and Spencer, 1987; Spencer *et al.*, 1987*c*), provided an opportunity to examine parasitaemia and antimalarial antibodies in pregnant women and to study the acquisition of infection and the inheritance of antibodies by infants and to measure changes in antibody responses during the early months of life. The effect of antimalarial chemoprophylaxis could be determined since some women were taking chloroquine phosphate 300 mg base weekly. Parasitaemia rates and haemoglobin levels in pregnant women have been presented earlier (Spencer *et al.*, 1987*g*). Serologic results are presented here.

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MATERIALS AND METHODS

Background

Saradidi, Kenya, is a rural area in western Kenya near the shores of Lake Victoria (Kaseje and Spencer, 1987). Malaria is hyper- to holo-endemic; *Plasmodium falciparum* is the principal species (Spencer *et al.*, 1987*c*).

Study Population

The study population consisted of 930 pregnant women attending antenatal clinics at the Saradidi clinic (Spencer *et al.*, 1987*g*) and 317 of their infants after birth. Pregnant women were followed monthly. As part of the malaria control programme (Spencer *et al.*, 1987*c*) some women (104) were receiving antimalarial chemoprophylaxis with chloroquine phosphate 300 mg base weekly. Use of chemoprophylaxis was determined by history. Age and parity in the two groups of pregnant women were not significantly different. The number of samples collected from each woman ranged from one to six. After birth infants were also followed monthly up to 12 months of age. Blood for serologic tests and a thick blood film for parasitologic examination were taken by fingerprick.

Parasitology

The procedures used for collecting and reading the blood films have been presented earlier (Spencer *et al.*, 1987*c*).

Serologic Tests

Approximately 75 µl of blood was collected into a heparinized capillary tube and transferred to a 25 × 75 mm piece of RAPACO no. 1024–0·38 filter paper* (Rochester Paper Co., Rochester, MI, U.S.A.). An identification number and the date were written directly on the paper, which was then air-dried and stored frozen until transferred for processing. The blood spots were eluted from the papers into vials containing 1 ml of phosphate-buffered-saline containing 0·05% Tween 20 (PBS/T, pH 7·2); vials were placed on a shaker for a minimum of one hour before being frozen and stored at −20°C. Samples were thawed immediately before they were tested by the enzyme-linked immunosorbent assay (ELISA) or indirect fluorescent antibody (IFA) test.

Enzyme-linked Immunosorbent Assay (ELISA)

Culture-produced *P. falciparum* parasites were used as antigen. Antigen plates were prepared and ELISA carried out as previously reported (Spencer *et al.*, 1979). The effect of the colour change on the absorbance was read on a Titertek Multiskan Reader (Flow Laboratories, McLean, VA) with a 492-nm filter. Samples were examined at dilutions of 1:100 and 1:1000 in PBS/T. An absorbancy 0·3 was considered positive and one greater than 1·0 strongly positive.

Indirect Fluorescent Antibody (IFA) Test

The IFA test was carried out as previously described (Sulzer *et al.*, 1969; World Health Organization, 1974). The blood spot eluates were diluted and tested against *P. falciparum* parasites from *in vitro* culture on thick film antigen slides at dilutions of 1:80, 1:320, 1:1280 and 1:5120 using fluorescent labeled anti-human IgG prepared at the Centers for Disease Control. All readings were made with a Leitz Ortholux incident illumination fluorescence microscope equipped with an HBO 100W mercury lamp, a KP-490 exciter filter and a 590 barrier filter. Those samples not reacting at the 1:80 dilution were arbitrarily assigned a value of 1:20 for the

*Use of brand names is for identification and does not imply endorsement by the Government of Kenya or the US Department of Health and Human Services.

numerical calculations. Those samples with endpoints greater than 1:5120 were considered as 1:5120 for the numerical calculations.

RESULTS

Pregnant Women

At a serum dilution of 1:100, virtually all (96·9%) of the 1677 samples from pregnant women were positive (absorbance $\geqslant$ 0·3) in ELISA and a high proportion (42·4%) were strongly positive (absorbance more than 1·0); the mean absorbance was 0·96 (Table 1). Even at a serum dilution of 1:1000, 59·5% of the samples were positive and 7·1% were highly positive; the mean absorbance was 0·45. The percentage of samples which were positive or highly positive varied for different months (Table 1), being lowest in September and highest during December. The mean absorbance value declined from the December peak to low values during August through October.

Remarkably little variation in parasitaemia was observed during the 12 month study period (Table 1). Little difference was found in mean ELISA absorbance values between samples with and without parasitaemia, or in relation to the use of chemoprophylaxis (Table 2).

Infants

Antibodies to *P. falciparum* as measured by the IFA test were common; 81·6% of 938 samples had a positive reciprocal titre of 80 or more (Table 3). 86·1% of 36 samples from children less than one month of age were serologically positive. Seropositivity rates decreased after one month then increased presumably due to decay of passively acquired maternal antibodies, and 88·2% of 118 samples from infants four months of age were seropositive.

Similar results were observed in ELISA (Table 4). Serum dilutions of 1:100 and 1:1000 gave similar patterns as IFA; there was a drop in seropositivity rates after the first month then a gradual increase. Only a small proportion of samples gave an absorbance greater than 1·0; 84 (8·2%) of the 1025 at a serum dilution of 1:100 and none at a dilution of 1:1000.

No significant differences in the ELISA seropositivity rates were found at either serum dilution when samples from infants whose mothers took chloroquine chemoprophylaxis were compared with those from infants whose mothers were not taking chemoprophylaxis.

Samples were taken sequentially during the course of infant life. Since the children experienced parasitaemia very early in their development a rapid increase in the antibody response was expected. Serologic endpoints (IFA) and absorbance values (ELISA) were determined for paired samples taken during the first and second months of age and subsequent samples taken thereafter from three to eight months after birth. Since not all children were sampled each month, only paired samples were used in the tabulations (Table 5).

The ELISA test indicated an increase in response between the first and second month and a continual increase for up to seven months of age. With the IFA test, changes between the first and second month and between the less than two months and the third and fourth months were minimal. The differences then steadily increased through the eight month samples. Examination of these paired samples gave no evidence of a drop in either the IFA titres or the ELISA absorbance values between the initial and succeeding samples.

Although parasitaemia rates by month ranged from 23·8% of samples collected in May 1983 to 47·3% of samples taken in December 1983 (Table 6), the differences were not statistically significant ($\chi^2 = 14{\cdot}6$, df$= 10$, $P < 0{\cdot}2$).

Relationship Between Maternal and Infant Serologic Responses

Paired comparisons were made of the results from maternal samples collected less than two months before parturition and samples from their infants collected within two months

TABLE 1

Absorbance value distributions in the enzyme-linked immunosorbent assay (ELISA) and presence of malaria parasitaemias by month of sample in pregnant women in Saradidi, Kenya

*Month**	*Total samples*	*Parasitaemias % pos.*	*1:100 serum dilution absorbance (OD)*				*1:1000 serum dilution absorbance (OD)*			
			% < 0·30	*% > 1·00*	*Mean*	S.D.†	*% < 0·30*	*% > 1·00*	*Mean*	S.D.
March	152	28·2	5·3	65·1	1·18	0·51	23·0	21·7	0·67	0·42
April	131	22·9	1·6	48·0	0·98	0·36	31·2	9·1	0·49	0·31
May	157	23·5	0·0	28·0	0·82	0·32	50·9	1·9	0·35	0·24
June	167	22·7	5·4	32·3	0·86	0·40	58·5	7·1	0·37	0·31
July	179	26·2	4·5	25·1	0·79	0·31	55·8	1·1	0·31	0·22
August	169	30·1	3·6	19·5	0·75	0·31	61·5	0·0	0·31	0·23
September	152	23·0	3·3	17·7	0·73	0·27	62·5	0·0	0·28	0·17
October	86	25·5	7·0	17·4	0·73	0·28	62·7	0·0	0·28	0·18
November	142	28·1	4·3	35·2	0·94	0·48	42·9	9·1	0·47	0·35
December	87	32·1	3·5	96·5	1·57	0·36	0·0	34·4	0·93	0·26
January	160	28·7	0·0	75·6	1·19	0·30	8·1	8·7	0·62	0·27
February	95	30·5	0·0	81·0	1·23	0·26	5·2	1·0	0·58	0·18
Totals	1677	26·5	3·1	42·4	0·96		40·5	7·1	0·45	

*March 1983–February 1984.
†Standard deviation.

TABLE 2

Mean ELISA absorbance values of samples from pregnant women with or without Plasmodium falciparum *infections by participation in the chemoprophylaxis programme*

	Maternal chemoprophylaxis(+)			*Maternal chemoprophylaxis(−)*		
	Mean	*s.d.*	*No.*	*Mean*	*s.d.*	*No.*
Parasitaemia*(+)						
ELISA 1:100	0·87	0·40	41	0·98	0·43	405
ELISA 1:1000	0·40	0·26	41	0·49	0·33	405
Parasitaemia(−)						
ELISA 1:100	0·94	0·40	191	0·94	0·42	1040
ELISA 1:1000	0·42	0·32	191	0·45	0·33	1040

*At time serum specimen collected.

TABLE 3

Results of indirect fluorescent antibody (IFA) test for antibodies to Plasmodium falciparum *in infants by age Saradidi, Kenya 1983–1984*

Age (months)	*No. samples examined*	*% positive**
Less than 1	36	86·1
1	120	75·0
2	135	74·1
3	141	75·2
4	118	88·2
5	115	82·6
6	84	88·1
7	69	84·1
8	45	93·3
9 or more	75	96·0
Total	938	81·6

*Reciprocal titre 80 or more.

after birth. Although some samples could have been collected at the extremes (four-month differential), most of the samples were within one month before and after infant birth. It was apparent, based on the mean absorbance values from the ELISA test, that the response of the 1:100 dilution of the blood spot eluates from the mother (mean absorbance 0·91) and that of the infant (mean absorbance 0·41) were markedly different. Mean ELISA values for the positive and negative control samples were 1·52 *v.* 0·08. The 1:1000 dilution endpoints for the infants were too low for a valid comparison. The geometric mean IFA titre was 3·49 in samples from the mothers and 2·30 in those from the infants.

The effect of chloroquine prophylaxis and the presence of parasitaemia in the mother at the time the maternal sample was collected on the paired antibody responses were examined (Table 7). With ELISA, no significant differences were detected between the paired antibody responses in the mothers and infants whether the mother reported taking chloroquine for

TABLE 4

Antibodies to Plasmodium falciparum *in the enzyme-linked immunosorbent assay (ELISA) by age of infant*

		% with absorbance greater than 0·3 at serum dilution	
Age (months)	*No. samples examined*	*1:100*	*1:1000*
Less than 1	41	80·5	34·1
1	139	73·4	18·0
2	158	71·5	19·0
3	165	72·1	25·5
4	127	81·9	34·6
5	116	90·5	44·8
6	84	100	48·8
7	73	100	47·9
8	45	100	60·0
9 or more	74	100	59·5
Total	1025	83·8	34·8

TABLE 5

Changes in mean ELISA absorbance and geometric mean IFA† titre for paired samples from infants taken before two months of age and during succeeding months*

	Mean ELISA absorbance				*Geometric mean IFA*			
Age (months)† between paired samples	*No. samples*	*Initial*	*Secondary*	*Difference §*	*No. samples*	*Initial*	*Secondary*	*Difference‖*
1–2	51	0·41	0·46	+0·05	42	2·29	2·33	+0·04
2–3	89	0·37	0·47	+0·10	81	2·22	2·25	+0·03
2–4	72	0·40	0·56	+0·15	69	2·21	2·24	+0·03
2–5	63	0·34	0·61	+0·27	65	2·13	2·31	+0·18
2–6	55	0·29	0·64	+0·35	52	1·93	2·41	+0·48
2–7	28	0·26	0·83	+0·57	32	1·96	2·52	+0·56
2–8	20	0·23	0·77	+0·54	18	1·73	2·53	+0·80

*Mean absorbance at 1:100 dilution in the enzyme-linked immunosorbent assay.

†Indirect fluorescent antibody.

‡Age in months between paired samples. First sample collected less than two months after birth. Subsequent samples taken from three to eight months after birth.

§Mean difference between mean ELISA absorbance values of paired samples from infants taken less than two months after birth and subsequent samples taken later expressed as absorbance value.

‖Geometric mean difference between IFA titres of paired samples.

prophylaxis or not, nor whether the mother had detectable parasitaemia or not. In the IFA test there was no significant difference in the antibody responses of the mothers. However, samples from infants of mothers taking prophylaxis had significantly lower mean titres when compared with samples from the other infants (2·03 *v.* 2·35, $P=0·04$). No significant difference was found in the antibody responses of mothers or infants with regard to detectable parasitaemias in the mothers.

TABLE 6

Malaria parasitaemia in infants by month of sample Saradidi, Kenya

*Month**	*No. examined*	*% positive*
May	21	23·8
June	55	32·7
July	87	32·1
August	80	40·0
September	94	32·9
October	118	28·8
November	162	35·8
December	131	47·3
January	132	43·1
February	118	38·1
March	36	41·6
Total	1034	37·2

*May 1983–March 1984.

TABLE 7

*Effect of chloroquine prophylaxis or patent parasitaemia on the mother–infant antibody relationship**

		ELISA†			*IFA‡test*		
		No.	*Mother*	*Infant*	*No.*	*Mother*	*Infant*
Chloroquine prophylaxis	Yes	30	0·94§	0·38	27	3·53‖	2·03
	No	157	0·90	0·42	154	3·48	2·35
	P-value¶		0·64	0·45		0·45	0·04
Patent parasitaemia in mother	Yes	43	0·97	0·38	42	3·54	2·25
	No	144	0·89	0·43	139	3·47	2·31
	P-value		0·24	0·27		0·16	0·63

*Paired maternal–infant samples. Maternal samples collected within two months of parturition and infant samples collected less than two months after birth.

†Enzyme-linked immunosorbent assay.

‡Indirect fluorescent antibody test.

§Mean absorbance at 1:100 dilution.

‖Geometric mean titre.

¶Student's *t*-test.

DISCUSSION

It has been shown that children inherit certain malarial antibodies from their mothers and that antibody responses increase in the children with increased malarial experience (McGregor *et al.*, 1965; Collins *et al.*, 1977; Campbell *et al.*, 1980). Previous studies using the IFA test have indicated a 'decay' in the antibody response then a subsequent increase in response which begins with exposure or under the pressure of high intensity transmission; this is

usually evident at approximately six months of age (McGregor *et al.*, 1965; Collins *et al.*, 1977; Campbell *et al.*, 1980). The results in infants suggested high levels of passive antibody acquisition from the mother via the placenta, some decay, then a rapid increase in antibody response.

Parasitologic examinations in this population have indicated that malaria infection is present in some infants under one month of age and that by five to six months of age about 50% of the infants had parasitaemia (Spencer *et al.*, 1987*c*). This intense level of transmission is no doubt responsible for the very early increases in both the IFA and the ELISA responses, with slight evidence of an early decrease in mean antibody responses for the children tested. No evidence was found to indicate that presence of patent parasitaemia in the mother or her participation in the chloroquine prophylaxis programme either markedly increased or decreased the maternal antibody responses. These factors also apparently had only minimal effect on the inheritance of the antibody response in the infants.

The serologic responses of the pregnant women at Saradidi showed a marked seasonal variation as indicated by the mean absorbance values and the high and very high ELISA responses. Thus, at Saradidi, pregnant women were most likely to have increased serologic titres starting in November. These peaked in December, and slowly declined during January through March. The period of lowest level serologic responses was August through October. These seasonal changes were not reflected by the presence or absence of detectable infections with *P. falciparum*.

The use of the two different serologic tests offered a chance to determine the test most applicable in determining maternal–infant antibody response levels and changes in the antibody responses of the infants with increase in age. The results were essentially the same with both tests. The only variation was between the antibody responses of infants born of mothers taking chloroquine for chemoprophylaxis. The ELISA results indicated no significant difference whereas with the IFA test infants of mothers taking prophylaxis had significantly ($P = 0{\cdot}04$) lower geometric mean IFA titres in samples collected before age two months. In addition, the infants appeared to show increases in their ELISA responses at an earlier age than in their IFA responses. ELISA has the advantages of being non-subjective in its reading and uses only one or two dilutions of the samples (very large numbers can be examined in a short time). ELISA appeared to indicate increases in titres at an earlier age, whereas the IFA test was able to indicate a difference in the effect produced by chloroquine prophylaxis. The studies confirm the fact that the two tests may, in fact, be measuring both similar and dissimilar antibodies. In this situation, however, the IFA test appeared to offer few advantages over ELISA. Measurement of the absorbance of a 1:100 serum dilution by ELISA appears sufficient to identify positive responders and seasonal changes. This method could be used to quantitate longitudinal serologic changes in the population.

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Changing response to chloroquine of *Plasmodium falciparum* in Saradidi, Kenya, from 1981 to 1984

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From 1981 through 1984, the response of *Plasmodium falciparum* to chloroquine was monitored in Saradidi, Kenya, as a part of a community-based health programme to provide treatment for malaria in each village. Before 1983, all 71 infections treated with chloroquine were sensitive *in vivo*; parasitaemia cleared by day 3 and remained absent to day 7. In June 1983, 23·1% of 26 infections treated with chloroquine base 10 mg kg^{-1} either recrudesced in seven days (RI resistance, five infections) or decreased but failed to clear (RII resistance, one infection). In September 1983, 16·2% of 68 and in February 1984, 13·2% of 53 infections were resistant *in vivo* after treatment with chloroquine base 10 mg kg^{-1}. A course of chloroquine base 25 mg kg^{-1} over three days remained effective; only two (1·6%) of 129 infections examined were resistant *in vivo*; in both, parasitaemia cleared then recurred (RI). In September 1984, however, nine (10·2%) infections were resistant after treatment with chloroquine base 25 mg kg^{-1}; in four of these parasitaemia decreased but never cleared (RII). Similar results were observed *in vitro*. In the Rieckmann macro *in vitro* test, 63·3% of 30 *P. falciparum* isolates tested were resistant to chloroquine (minimal inhibitory concentration (MIC) $\geq 1{\cdot}25 \times 10^{-6}$ mol l^{-1} blood) in June 1983, as were 61·8% of 34 isolates in the Rieckmann micro test (MIC $\geq 1{\cdot}14 \times 10^{-6}$ mol l^{-1} blood). The effective drug concentrations to chloroquine for 99% inhibition (EC_{50}) increased in the macro *in vitro* test from $0{\cdot}617 \times 10^{-6}$ mol l^{-1} blood in May 1981 to $1{\cdot}917 \times 10^{-6}$ mol l^{-1} in June 1983 and in the micro test from $0{\cdot}929 \times 10^{-6}$ mol l^{-1} blood in May 1982 to $3{\cdot}458 \times 10^{-6}$ mol l^{-1} in September 1984. It was not possible to associate increased drug pressure with the development of resistance since resistance occurred in areas with varying degrees of drug use. The results demonstrate a changing pattern of the response of *P. falciparum* to chloroquine in Saradidi.

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Drug-resistant *Plasmodium falciparum* malaria continues to spread in Africa and other parts of the world (World Health Organization, 1984*b*; Spencer, 1985). Despite numerous published evaluations of drug response patterns in various areas, there have been few longitudinal studies carried out in the same place. Accumulated epidemiological evidence suggests a relationship between drug pressure and the spread of drug resistance but this relationship is not well understood (Peters, 1984; Onori, 1984).

Continued assessment of the response of *Plasmodium falciparum* to chloroquine has been an integral part of community-based malaria control activities in Saradidi, Kenya (Spencer *et al.*, 1987*c*). The primary objectives of this surveillance were to detect early any change in the sensitivity of the parasite to chloroquine and to determine the relationship of resistance to drug use by comparing drug response patterns in the areas where chloroquine was readily available in each village with the area where it was not. Results of the investigations done in 1981 and 1982 prior to beginning drug distribution have been reported (Spencer *et al.*, 1983*b*). In this paper we present findings of the *in vivo* and *in vitro* studies completed during September 1984. The earlier data are presented for comparison. Chloroquine-resistant *P. falciparum,* malaria was first documented in 1982 in Kenyans living in malarious areas in western Kenya (Spencer *et al.*, 1983*a*) and now occurs in as many as 28% of *P. falciparum* infections in Kenyans in some areas (Watkins *et al.*, 1984).

MATERIALS AND METHODS

In vivo Tests

Both modified and standard seven-day WHO *in vivo* tests for the sensitivity of *P. falciparum* to chloroquine were carried out (World Health Organization, 1973). Schoolchildren five to 15 years old from randomly chosen schools were selected if they were infected with *P. falciparum*, if the Dill–Glazko test for 4-aminoquinolines in the urine was negative (Lelijveld and Kortmann, 1970) and if permission was obtained from parents or teachers. The infected children were then weighed and treated with chloroquine phosphate at either 10 mg base kg^{-1} on day 0 (modified test) or 25 mg base kg^{-1} with 10 mg kg^{-1} on days 0 and 1 then 5 mg kg^{-1} on days 2 (standard test). To document drug absorption, a repeat urine test was done on days 1 or 2. A thick blood film was taken and examined for parasites daily until day 7. Asexual parasite counts were expressed per 300 leukocytes. *In vivo* tests were done in May 1981, May 1982, June 1983, September 1983, February 1984 and September 1984. The degree of resistance (RI, RII, RIII) was defined according to the World Health Organization (1973).

In vitro Tests

After informed consent was obtained from parents or teachers, a 5 to 10 ml blood sample (1 to 2 ml was taken if only micro *in vitro* tests were done) was taken from selected children with adequate parasitaemia (25 or more parasites per 300 leukocytes). The blood sample was then put into a heparinized vacutainer tube or defibrinated by swirling in an Erlenmeyer flask with glass beads. Then the sample was immediately placed into a portable refrigerator at 4°C until it was examined in the laboratory. Two *in vitro* tests for sensitivity of *P. falciparum* to chloroquine were used.

Rieckmann macro *in vitro* tests were done as previously described (Rieckmann *et al.*, 1968). One ml aliquots of defibrinated or heparinized parasitized blood were placed in vials supplied by WHO containing 5 mg glucose and chloroquine phosphate to give final concentrations of 0, 0·25, 0·5, 0·75, 1·0, 1·25, 1·5, 2·0 and $3{\cdot}0 \times 10^{-6}$ mol l^{-1} blood. The vials were then incubated at 37° to 38·5°C for 24 to 26 hours. Thick blood films were then made from each vial and the number of schizonts per 300 leukocytes counted. A successful test was one in which 5% or more of the parasites present before incubation developed to schizonts. The minimal inhibitory

concentration (MIC) was the lowest one at which schizont development was inhibited 99% or more of that of the drug-free control. The effective concentrations for 50% (EC_{50}) and 99% (EC_{99}) inhibition were determined at WHO by probit analysis (Grab and Wernsdorfer, unpublished, World Health Organization, Geneva WHO/MAL/83.990). Macro *in vitro* tests were done in May 1981, May 1982 and June 1983.

The Rieckmann micro test was done as previously reported (Rieckmann *et al.*, 1978). 0·1 ml of parasitized blood was mixed with 0·9 ml RPMI medium 1640 supplemented with 25×10^{-3} mol HCO_3 and 25×10^{-3} mol HEPES buffer. Then 50 µl aliquots of the mixture were added to wells of a 96-well microculture plate supplied by WHO and predosed to give final concentrations of chloroquine in the tests of 0, 0·2, 0·4, 0·8, 1·14, 1·6, 3·2 and $6{\cdot}4 \times 10^{-6}$ mol l^{-1} blood. The microculture plate was placed in a candle jar or a gastight box (Bellco Glass Inc., Vineland, New Jersey, U.S.A.)* which was flushed with a mixture of 3% CO_2, 5% O_2 and 92% N_2. The plates were then incubated at 37–38·5°C for 24 to 26 hours. After incubation, the supernatant was removed from each well, a thick film made from the remaining contents, and the number of schizonts per 300 leukocytes counted. A successful test was as in the macro method above. The MIC, EC_{50} and EC_{99} were determined as for the macrotest. Micro *in vitro* tests were done May 1982, June 1983 and September 1984.

Resistance was defined as an MIC greater than $1{\cdot}0 \times 10^{-6}$ mol l^{-1} blood in either *in vitro* test (World Health Organization, 1984). The flatter the regression line and the more the EC_{99} is above $1{\cdot}0 \times 10^{-6}$ mol l^{-1} blood the more resistant the isolate.

Chloroquine Levels

To document that adequate whole blood levels of chloroquine were achieved, we collected 100-µl blood samples by fingerprick on days 1 or 2 and transferred them to a 25 × 75 mm piece of RAPACO No. 1024-0.38 filter paper (Rochester Paper Co., Rochester, Minn., U.S.A.).* Specimens selected were eluted and levels of chloroquine and desethylchloroquine were determined by high-performance liquid chromatography (Patchen *et al.*, 1983). Filter paper specimens were collected in September 1983 on day 1 from all patients.

Areas

Tests were done in the three study areas which had been designated A, B and C as previously described (Spencer *et al.*, 1987*c*). In areas A and B antimalarial treatment with chloroquine phosphate provided by volunteer village health helpers was available free of charge in each village (widespread drug use). Area C served as a control and did not have free chloroquine treatment available in each village. In all three areas, chloroquine phosphate could be purchased at local shops and was also available from Ministry of Health dispensaries (Mburu *et al.*, 1987).

RESULTS

In vivo Tests

Results of the seven-day *in vivo* test are presented in Table 1. Failure of *P. falciparum* infections treated with chloroquine base 10 mg kg^{-1} was not detected until June 1983. From June 1983 to February 1984, the proportion of children with resistant infections did not change significantly. In February 1984 a higher proportion of infections treated with 10 mg base kg^{-1} were resistant in area A (widespread drug use) compared with the control area C; this difference was statistically significant ($P=0{\cdot}03$, Fisher's exact test, two-tailed). The reverse had been true in September 1983 but the difference was not statistically significant ($P=0{\cdot}05$). Before

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September 1984, resistance to treatment with chloroquine base 25 mg kg^{-1} had been seen in only two infected children. In September 1984, only chloroquine 25 mg kg^{-1} base was administered. At seven days, nine (10·2%) of the 88 infected children had resistant patterns, including one child who had only a 58% decrease in parasitaemia at 48 hours and did not clear subsequently (RII-RIII resistance). Because five (5·7%) children had an RII pattern (reduction but not clearance of parasitaemia) follow-up was extended to day 14, at which time an additional 13 (14·8%) children had recrudescent parasitaemia (RI). Therefore, at two weeks, 22 (25%) *P. falciparum* infections were resistant *in vivo*. The proportion of resistant isolates in areas A and B were not significantly different from those in area C (control).

TABLE 1

Sensitivity of Plasmodium falciparum *to chloroquine* in vivo, *in Saradidi, Kenya, 1979–1984*

Date	*Area*	*Dose chloroquine base* (mg kg^{-1})*	*No. infections treated*	*No. (%) resistant*	*No. resistant at level†* RI	RII
May 1981	A and B	10	26	0	—	—
		25	15	0	—	—
May 1982	A and B	10	30	0	—	—
June 1983‡	A and B	10	26	6 (23·1)	5	1
	C		9	0	—	—
September 1983§	A	10	35	3 (8·6)	2	1
	C		33	8 (24·2)	4	4
	A	25	32	1 (3·1)	1	—
	C		34	0	—	—
February 1984‖	A	10	24	6 (25·0)	2	4
	C		29	1 (3·4)	—	1
	A	25	24	1 (4·2)	1	—
	C		24	0	—	—
September 1984	A and B	25	51	5 (9·8)	2	3
	C		37	4 (10·8)	2	2

*Chloroquine base—10 mg kg^{-1} in single dose or 25 mg kg^{-1} given over three days.
†RI = clearance followed with recrudescence by day 7;
RII = decrease in parasitaemia but no clearance.
‡Areas A and B compared with area C, $P = 0{\cdot}14$, Fisher's exact test.
§Area A compared with area C at 10 mg kg^{-1}, $\chi^2 = 3{\cdot}05$, $P > 0{\cdot}05$.
‖Area A compared with area C at 10 mg kg^{-1}, $P = 0{\cdot}03$, Fisher's exact test.

In vitro Tests

In 1981, all isolates in the macro test had an MIC of $1{\cdot}5 \times 10^{-6}$ mol l^{-1} blood or less (Table 2). In contrast, one (8·3%) isolate in 1982 and three (10·7%) isolates in 1983 had an MIC greater than $1{\cdot}5 \times 10^{-6}$ mol l^{-1}. From 1981 to 1983 the proportion of isolates inhibited at every chloroquine concentration decreased. Similar results were found with the Rieckmann micro test (Table 3). By 1984 12 (31·6%) isolates had an MIC greater than $1{\cdot}6 \times 10^{-6}$ mol l^{-1} blood.

Effective chloroquine concentrations in the two *in vitro* tests for 50% (EC_{50}) and 99% (EC_{99}) inhibition of schizont development as determined by probit analysis are shown in Table 4. A

TABLE 2

Response of Plasmodium falciparum *to chloroquine in the Rieckmann macro test in Saradidi, Kenya, 1981–1983*

Concentration chloroquine (10^{-6} mol l^{-1} blood)	*May 1981*		*May 1982*		*June 1983*	
	*No. isolates**	*% inhibited†*	*No. isolates**	*% inhibited†*	*No. isolates**	*% inhibited†*
0·25	17	5·7	14	0	30	0
0·5	16	31·3	14	14·3	29	0
0·75	14	71·4	13	53·8	27	33·3
1·0	17	76·5	13	53·8	30	36·7
1·25	13	92·3	11	90·9	20	60·0
1·5	1	100	14	85·7	29	75·9
2·0	15	100	12	91·7	28	89·3
3·0	12	100	12	91·7	24	91·7

*Not all isolates examined at every concentration.
†Schizont development inhibited ≥99% of drug free controls.

TABLE 3

Rieckmann micro test results for sensitivity of Plasmodium falciparum *to chloroquine in Saradidi, Kenya, 1982–1983*

Concentration (10^{-6} mol l^{-1} blood)	*May 1982 % isolates inhibited at this concentration**	*June 1983 % isolates inhibited at this concentration**	*September 1984 % isolates inhibited at this concentration**
0·2	0	2·9	0·0
0·4	6·3	8·8	2·6
0·8	56·3	38·2	31·6
1·14	75·0	82·4	57·9
1·6	75·0	94·1	68·4
3·2	81·3	94·1	78·9
6·4	87·5	97·1	94·7
No. isolates examined	16	34	38

*Schizont development inhibited ≥99% of drug free controls.

decrease in the sensitivity of *P. falciparum* to chloroquine over time, peaking in 1984, is evidenced by the increasing EC_{50}s and EC_{99}s.

Chloroquine Levels

Filter paper specimens collected on day 1 from ten of 12 children with chloroquine-resistant infections in September 1983 were examined for chloroquine and desethylchloroquine. The mean chloroquine level was 270 ng ml^{-1} (range 147–412 ng ml^{-1}) and the mean desethylchloroquine level was 115 ng ml^{-1} (range 22–218 ng ml^{-1}). These concentrations were within the expected range of normal drug absorption (Patchen *et al.*, 1983).

TABLE 4

Effective drug concentrations for 50% (EC_{50}) and 99% (EC_{99}) inhibition of schizont development in the Rieckmann macro and micro* in vitro *tests for sensitivity of* Plasmodium falciparum *to chloroquine in Saradidi, Kenya, 1981–1983*

Date	EC_{50} (10^{-6} mol l^{-1} blood)		EC_{99} (10^{-6} mol l^{-1} blood)	
	Macro test	*Micro test*	*Macro test*	*Micro test*
May 1981	0·202	—†	0·617	—†
May 1982	0·153	0·309	0·796	0·929
June 1983	0·269	0·395	1·917	1·411
September 1984	—	0·609	—	3·458

*Grab and Wernsdorfer, unpublished. World Health Organization, Geneva, WHO/MAL/83.990.

†Not done.

DISCUSSION

These longitudinal studies demonstrate a changing pattern in the sensitivity of *P. falciparum* to chloroquine in the Saradidi community. Failure of chloroquine treatment at 10 mg base kg^{-1} was first noted in June 1983. These data from *in vivo* and *in vitro* tests demonstrate that changes in the *in vitro* pattern began before drug intervention (Spencer *et al.*, 1983*b*). Of interest is the fact that the probit analysis predicted the *in vivo* response since the EC_{50}s and EC_{99}s were increasing over time in both the macro and micro *in vitro* tests. A similar but less striking trend was noted in the MICs. From June 1983 to September 1984, the proportion of isolates resistant *in vivo* and the degree of resistance *in vivo* (RI to RII as defined by WHO) (World Health Organization, 1973) increased.

It is difficult to ascribe the changing pattern of chloroquine sensitivity to the widespread use of chloroquine in areas A and B. Changes were noted in the *in vitro* response before the beginning of intervention. In June 1983 ($P=0{\cdot}14$, Fisher's exact test, two-tailed) and February 1984 ($P=0{\cdot}03$, Fisher's exact test, two-tailed), the proportion of resistant infections treated with 10 mg kg^{-1} was greater in areas A and B (drug intervention) compared with area C (control). However, in September 1983 ($\chi^2=3{\cdot}05$, $P<0{\cdot}10$) eight of 33 infections were resistant in area C compared with only three of 35 in area A. Significant levels of resistance to chloroquine base at 25 mg kg^{-1} were first noted in September 1984. More rapid progression in the proportion of resistant isolates and in the degree of resistance has been noted along the Kenya coast than in Saradidi (Sixsmith *et al.*, 1983; Watkins *et al.*, 1984).

No striking differences in the proportion of resistant infections were found in areas where chloroquine phosphate was available in each village (areas A and B) when compared with the control (area C). Thus these studies do not definitely implicate drug pressure as the major cause of the development of chloroquine resistance. Chloroquine phosphate was available in shops in area C as well as from a Ministry of Health dispensary and a missionary clinic (Mburu *et al.*, 1987). The lack of observed association with drug use was not due to failure of the people to take antimalarials. From other studies, each person received an average of 1·24 treatments per year (Spencer *et al.*, 1987*e*).

These results emphasize the importance of monitoring the response of *P. falciparum* to antimalarial drugs. Initial indications of drug failure should come from an increase in the proportion of persons who do not respond to treatment in the periphery. In a place like

Saradidi, community health workers should play an important role in the identification and reporting of problems such as drug resistance. Such information will not be accompanied by the results of standard *in vivo* and *in vitro* tests as described here but will usually be simple reports of suspected increased numbers of treatment failures or patients with severe and complicated malaria. These reports need to be investigated and appropriate action taken.

In malarious areas like Saradidi, the decision to change recommendations for initial treatment of malaria should be based not only upon the pressure of drug resistance but also upon the frequency and severity of resistance, its geographical distribution, the epidemiology of malaria, including the level of immunity by age in the population, the severity of the illness, the cost and the toxicity of alternative drugs and the accessibility of a referral system and its ability to cope with severely ill patients and those who have failed to respond to initial antimalarial therapy. Even when resistance is present, clinical symptoms may be ameliorated and mortality or significant morbidity prevented. Thus it is impossible to make uniform recommendations for changing initial treatment based on the occurrence at some previously decided level since each situation will vary according to local conditions.

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Changes in sources of treatment occurring after inception of a community-based malaria control programme in Saradidi, Kenya

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To determine the changes in source of antimalarial treatment and perceptions about malaria after the initiation of a community-based malaria control programme in Saradidi, Kenya, two identical surveys were carried out; one in March 1982 (before the programme began in May 1982) and the other in December 1984. Three areas were involved: areas A and B had antimalarial treatment provided by village health helpers (VHH's) and area C had VHH's who did not provide treatment. Two groups of randomly selected women age 15 to 59 years were interviewed: 45 in survey 1 and 92 in survey 2. A decided change in the source of malaria treatment was observed. In the first survey, 52·9% of the respondents from areas A and B combined purchased antimalarial medicine from shops; other sources were government health facilities, mission clinics, and the Saradidi community clinic. By the second survey, 85·2% of the respondents in areas A and B obtained treatment from the VHH's; no significant change occurred in area C. In both surveys the leading reasons given for people purchasing drugs from shops was that the distance to health facilities was great, that no transport was available and that shops were open when emergencies occurred. The shopkeeper frequently advised which drug to take and the dosage as well as selling the drug. For family illnesses of unknown aetiology most people (82.2% in survey 1 and 97·8%, in survey 2) went to a hospital or clinic. These results demonstrate that the malaria control programme in Saradidi has influenced both the source of antimalarials and the attitudes people have about malaria. In Saradidi, Kenya people chose to obtain antimalarial treatment and advice from community health workers.

A community-based malaria control programme was initiated in Saradidi, Kenya, as part of health development activities (Kaseje and Spencer, 1987; Spencer *et al.*, 1987*c*). Malaria control was concerned with malaria as a disease not an infection. The main objective was to provide easy access to appropriate treatment for persons ill with malaria in order to reduce malaria related mortality and morbidity. Antimalarial treatment was made available in each village from volunteer village health helpers (VHH's) who were chosen and supported by the people of the village in which they lived.

For the malaria control programme to be effective, a basic requirement was that people should in fact seek to obtain treatment in the village from the VHH's when they are ill with malaria. In order to understand where, when and why people in the community obtained treatment for malaria before treatment was made available in the village and what changes in this behaviour occurred after the programme began, two identical surveys were carried out: one in March 1982 (before the programme began in May 1982) and the other in December 1984.

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MATERIALS AND METHODS

Areas

Saradidi, Kenya, is located in western Kenya near Lake Victoria (Kaseje and Spencer, 1987; Spencer *et al.*, 1987*c*). Saradidi was divided into three operational areas based on the length and degree of community organization and development. All three areas had VHH's (area C by survey 2), received mobile health clinics, training and health education and had access to essential health care services. In area A, the VHH's treated people for malaria and provided weekly chloroquine chemoprophylaxis for pregnant women who wished to take it. Area B had a treatment programme only. VHH's in area C did not provide antimalarial treatment or chemoprophylaxis.

Sample Populations

A complete household census had been carried out in the area previously (Spencer *et al.*, 1987*h*). To obtain a representative sample in both surveys, villages and households were randomly selected from the census using a table of random numbers. Area A consisted of 23 villages, area B of 13 and area C of 20. Twelve villages were selected for study in survey 1 (five in area A, four in B, three in C) and 31 in survey 2 (13 in A, seven in B, 11 in C). The chosen households were visited in sequence, and the oldest woman 15 to 59 years of age or older was interviewed in each household. Women of 60 or more were excluded. Three to four women in each village were surveyed. Women rather than men were selected as the source of information because a survey done by medical students in Saradidi in 1979 revealed that it was the women who most often determined and responded to the family's health needs and who made the decisions regarding treatment and care during illness for young children.

Sources of Antimalarials

In Saradidi, at the time of the surveys, antimalarials were available in small local shops, from two Ministry of Health dispensaries (more than 85% of the people lived more than 5 km from these facilities), from the Saradidi Programme Clinic, from the mission hospital and from the VHH's (in areas A and B after May 1982) (Kaseje and Spencer, 1987).

Interviewers

The surveys were conducted by two female Luo-speaking medical students supervised by a social scientist. The interviewers were trained and the questionnaires field tested in the community before beginning. All interviews were done in Luo, the principal language of the community. Survey 1 took three weeks and survey 2, six weeks.

Information

Information on age and education was collected from each person interviewed. Questions regarding malaria included: Do you or any members of your family get malaria? If so, do you get medicine to treat malaria? If not, why not? If yes, where do you most often get medicine for malaria? If you buy medicine in a shop, how do you know which medicine is best for you and how many tablets to take? Why do people go to the shops for malaria medicine? Why do they not always take malaria medicine from the shops? For what diseases do people go to the shops for medicine? When you are in doubt as to the cause of an illness in the family, what do you do? If treatment for malaria were available from VHH's, do you think people would go to them? Do you think people should pay for malaria treatment from the VHH? (Asked of participants in all three areas in the first survey and of those in area C only in the second.) For which illnesses should VHH's have treatment?

RESULTS

Sample Population

In survey 1 (before malaria control began) 45 women were interviewed: 19 women in area A, 15 in area B and 11 in area C. In survey 2, 92 women were interviewed: 40 in area A, 21 in area B and 31 in area C. Age and education of the respondents by survey are presented in Table 1.

Malaria

Only one (2·2%) woman in the first survey and none in the second survey said that malaria never occurred among their family members. Virtually all women said that when people have malaria they take medicine. One respondent in the first survey said that 'medicine does not cure malaria' and one in the second survey stated that her religion forbade the use of medicines.

Source of Medicine

The results for A and B were so similar they were combined. A statistically significant change (χ^2 67·7, $df=2$, $P<0{\cdot}000001$) in where people sought to obtain antimalarial medicine in areas A and B occurred between the first and second surveys (Table 2). By December 1984, 85·2% of the respondents said they were obtaining treatment for malaria from the VHH's in their villages. The initial high proportion of those purchasing malaria medicine from shops had decreased to almost nil. In contrast, there was little change in the source of drug in area C where VHH's did not have chloroquine phosphate ($\chi^2=0{\cdot}83$, N.S.). Interestingly, no respondent in either survey mentioned traditional herbs as treatment for malaria despite the fact that these treatments were available.

Shops in Saradidi are typical rural African shops selling most of the essential commodities used by the community. They stock a wide range of medications. Most medicines are in tablet form, are often white in colour and are not packaged. The seller has no training in dispensing medicines. In theory the shopkeeper only stocks those medicines which are permitted by the government to be sold without a prescription; however, shopkeepers sometimes stock other drugs as well. In rural areas of Kenya, many persons buying medicine are illiterate and thus cannot utilize the information on package inserts.

TABLE 1

Age and education of female participants by survey in Saradidi, Kenya

Age (years)	*Survey 1 (March 1982) (%)*	*Survey 2 (December 1984) (%)*
15–29	46·7	25·0
30–44	28·9	39·1
45–59	24·4	35·9
Total number	45	92
Education in years		
None	44·4	32·6
1–4	13·3	31·5
5 or more	42·2	35·9
	45	92

The responses given for why people buy malaria medicine from shops when they could get the same drug from the mission hospital cheaper or from government dispensaries or VHH's free were varied (Table 3). Other facilities were often long distances away and motorized

TABLE 2
Source of antimalarial treatment by area and survey in Saradidi, Kenya

	Area A and B combined		*Area C*	
Source	*Survey 1**	*Survey 2**	*Survey 1*	*Survey 2*
Shop	52·9†	1·6	45·5	61·3
Village health worker	—	85·2	—	—
Other‡	47·1	13·1	54·5	38·7
Number of respondents	34	61	11	31

*Survey 1 carried out in March 1982; survey 2 carried out in December 1984.
†Percentage of group with this source.
‡Includes Saradidi clinic, mission clinic, and Ministry of Health facilities.

TABLE 3
Reasons why people buy medicine for malaria from shops by area and survey in Saradidi, Kenya

	Area A and B combined		*Area C*	
Reason	*Survey 1**	*Survey 2**	*Survey 1*	*Survey 2*
Other sources too far/ no transport	32·4†	—	45·5	41·9
Necessary in emergencies	17·6	8·2	45·5	48·4
Shop medicine good	14·7	—	—	3·2
Shops are cheap	5·9	—	—	—
Hospital/dispensary has no drugs	11·8	—	9·1	—
Other	11·8	—	—	—
Do not know	5·9	1·6	—	—
Most people do not use	—	90·2	—	6·4
Number of respondents	34	61	11	31

*Survey 1 conducted in March 1982; Survey 2 conducted in December 1984.
†Percentage of group responding.

transport was scarce. Shops were more convenient in emergencies since dispensaries were only open during the day. In addition, Ministry of Health facilities sometimes had no medicine. The Kenya Government has now developed an essential drugs supply and management system intended to solve this problem in the rural areas.

Choice of Drug and Dose

Which drug to buy is determined in a variety of ways (Table 4). The biggest change occurring between surveys 1 and 2 in all three areas was in the proportion of respondents identifying the advice of the VHH as a major factor in their decision. For many people, the shopkeeper was used to prescribe medicines as well as sell them. In contrast to the first survey, few respondents

TABLE 4

Reasons for buying particular drug from shops, by area and survey in Saradidi, Kenya

	Area A and B combined		*Area C*	
Reason	*Survey 1**	*Survey 2**	*Survey 1*	*Survey 2*
Past prescription/ experience	35·3	—	45·5	6·5
Advice of shopkeeper	11·8	21·3	27·3	48·4
Advice of VHH	—	70·5	—	19·4
Radio advertisement	5·9	—	9·1	6·5
Advice of friends	2·9	1·6	—	19·4
'Just guesses'	23·5	—	9·1	—
Other	11·8	—	9·0	—
Never buy from shop	8·8	1·6	—	—
Don't know	—	4·9	—	—
	34	61	11	31

*Survey 1 conducted in March 1982; survey 2 conducted in December 1984.
†Percentage of group responding.

in any area in the second survey stated that the choice of drugs was determined by past prescription or experience.

The shopkeeper also influenced the dose of antimalarial medicine people took. In the first survey, 15 (33·3%) of 45 respondents in the three areas listed this individual as the source for determining the dose of malaria medicine and in the second survey, 17 (41·5%) of 41 respondents said the shopkeeper told them how many pills to take (51 respondents from areas A and B said they never bought treatment for malaria from a shop). The remaining respondents in both surveys listed past experience, radio advertisement, advice of friends or 'guesses' for information on dose.

Illnesses of Unknown Aetiology

For a family illness of unknown aetiology most women (82·2% in survey 1 and 97·8% in survey 2) went to a hospital or clinic and not to the VHH's. Some (8·9% and 1·1%) said that, if unsure, they would suspect malaria as it presents in different ways or said they would buy aspirin from a shop (8·9% and 1·1%).

Village Chloroquine Distribution

In survey 1 (done before the VHH's had chloroquine in areas A and B and before there were VHH's in area C), 42 (93·3%) women said people would go to a VHH for antimalarial treatment if it were available from her. The three women who said they would not go to the VHH stated that such people were not adequately trained (one woman) or that VHH's would give medicine without proper medical examination (two women). In survey 2, 91 (98·9%) of respondents felt that people would go to the VHH's; one person said no because the VHH's are not well trained.

Most of the women interviewed felt people should not pay for medicine from VHH's; 55·6% in survey 1 (4·4% undecided) and 89·1% in survey 2 (3·3% undecided).

Every person in both surveys said VHH's should give treatment for malaria. Other diseases mentioned for which treatment should be provided by the VHH's were diarrhoea/vomiting, colds/cough, aches/pains, measles, intestinal worms and skin problems.

DISCUSSION

These two surveys, done before and 18 months after treatment for malaria became available in villages in Saradidi, demonstrate marked changes in the reported behaviour of people. The results which are consistent with the measured consumption of choloroquine phosphate provided by VHH's suggest a change in behaviour actually occurred (Spencer *et al.*, 1987*e*). In March 1982 the principal source of antimalarials was shops, while in December 1984, 85·2% of the women interviewed from the areas where treatment was provided said they obtained treatment from the VHH's. The initial high proportion utilizing shops had decreased to almost nil. In the control area where the VHH's had no chloroquine, more than half continued to buy medicine from the shops. People patronized shops because they were much closer than other facilities and in emergency situations other health facilities were often closed. The VHH's lived in the villages and were available for emergencies.

In areas of Saradidi where alternative sources of treatment for malaria were not available, the rural shops played an important role. For many people the shopkeeper prescribed medicine as well as sold it. The shopkeeper also influenced the dose of medicine taken since patients frequently asked his advice when purchasing drugs. These are important facts to consider when examining patterns of utilization of antimalarial drugs in similar areas. In Saradidi, the VHH's became an important source for prescribing which antimalarial to buy. Traditional herbs were not mentioned as a source of antimalarial treatment. Since the interviewers were medical students, it cannot be excluded that this information was withheld.

An important finding in both surveys was that most people preferred to go to health facilities for illness of unknown aetiology rather than buy medicine from shops or obtain treatment from VHH's. Other studies in Saradidi have indicated that people prefer to go to health facilities for serious illnesses rather than receive treatment from the VHH (Kaseje *et al.*, 1987*e*). These results suggest that providing antimalarial treatment in each village may not significantly decrease mortality or morbidity rates if persons with serious illnesses do not avail themselves of local treatment but delay treatment by travelling long distances to pre-existing health facilities as before if a significant proportion of serious illnesses is due to malaria.

The malaria control programme in Saradidi has clearly influenced both the source of antimalarials and the attitudes people have about malaria and its treatment. People will obtain treatment and advice from community health workers. Some would even be willing to pay for this treatment, although most would prefer that treatment be free. In Saradidi, the shops are utilized, but alternative sources of treatment are preferred.

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Usage of community-based chloroquine treatment for malaria in Saradidi, Kenya

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A survey was done in June 1983 in Saradidi, Kenya, one year after the inception of a community-based malaria control programme to determine if people were obtaining malaria treatment from volunteer village health helpers (VHH's) chosen by the community. Ten of 36 villages were randomly chosen. From these ten villages, 100 households were randomly selected and 222 people ten years of age or more were interviewed: 113 (50·9%) had a history of malaria in the previous two weeks and 82 (72·6% of 113) had taken medicine for malaria in that period. Of these 82, 51·2% obtained drug from the VHH, 28% purchased it from a shop, 12·2% from a health facility, 4·9% from family members and 3·7% from a private practitioner or a shop outside Saradidi. Reasons given for not obtaining treatment from the VHH's among the 40 people who went elsewhere for treatment included: the VHH was not at home when needed (35%); the VHH had no drugs (22·5%); the patient was too sick for the VHH to treat (10%); had drugs already in the home (10%); 'not registered' with VHH (10%); VHH 'no good' (7·5%); and more 'convenient' to go elsewhere (5%). Similar results found on questioning the mother were obtained for 103 children under nine years old in these households; 67 (65·0%) children had a history of malaria in the previous two weeks and 59 (88·1%) of these 67 children had received anti-malarial treatment. The VHH was the principal source of treatment (50·8% of 59), followed by health facilities (20·3%) and shops (18·6%). Again, the major reasons for not obtaining treatment from the VHH was that the VHH was not at home (23·3% of 30), the VHH had no drug (13·3%), or the patient was too sick (20%). It is clear that the community-based programme was the main source of anti-malarial treatment in Saradidi. Drug consumption was high in both adults and children, perhaps because the survey was done during the season of peak malaria transmission. The main reasons for failure to obtain treatment from the VHH were logistical or organizational.

A community health programme began in Saradidi, Kenya, in 1979 (Kaseje and Spencer, 1987). Residents considered malaria to be their major health problem second only to lack of water and were enthusiastic to initiate a malaria control programme. In May 1982, a community-based malaria control programme was initiated in each village (Spencer *et al.*, 1987*c*). Treatment of malaria was provided in each village at no charge by volunteer community health workers called village health helpers (VHH's) who were selected and supported by community residents. Previous surveys done in the area (Mburu *et al.*, 1987) had identified the major sources of medicine for malaria to be shops, Ministry of Health facilities (two dispensaries) and a missionary hospital.

Since patterns of utilization of treatment in the village would determine the effect on health, it was important to know if people were in fact obtaining treatment from the VHH's or were continuing to use alternative sources. This paper presents results of a survey on utilization

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of treatment done in June 1983, one year after treatment for malaria became available in each village and at a time when malaria transmission was at its peak (Spencer *et al.*, 1987*c*).

METHODS

A questionnaire was developed to determine the proportion of persons with malaria during the previous two weeks who obtained treatment from the VHH's, the usage of alternative sources of chloroquine and the reasons people failed to obtain treatment in their village from the community-based programme. The interviews were conducted by two female fourth-year Luo-speaking medical students. The interviewers were trained and the questionnaire was pretested in the community. Results of field-testing were analysed and discussed with the interviewers and community members. The survey began after the questionnaire was modified and was completed in four weeks.

Villages and households in the chosen villages were randomly selected from the census records using a table of random numbers; four additional households close to the one selected were also visited. All persons aged ten years and over were interviewed. Households were revisited on at least three different occasions to find persons not available at the first visit.

Information collected included village, household and personal identification numbers, age and sex. The following questions were then asked: (1) Have you taken medicine for malaria during the previous two weeks? (2) If yes, where did you get the medicine? (3) For persons who did not receive treatment from the VHH, why did you not go to the VHH for medicine for malaria? The same three questions were asked of mothers regarding their children under ten years of age. The total number of children under ten years living in the household was recorded.

RESULTS

Ten of the 36 villages with treatment provided by VHH's were selected and 100 households visited. A total of 222 persons ten years of age and older were interviewed (Table 1); 113 (50·9%) gave a history of malaria in the previous two weeks and 82 (36·9%) had taken medicine for malaria. Most, 133 (59·9%), of those interviewed were women, but no statistically significant difference ($P < 0{\cdot}05$) by age or sex in the proportion of people with a history of malaria or who had received treatment was found.

The majority (82 or 72·6%) of the 113 individuals who thought they had malaria took medicine (Table 1). The differences in the proportions receiving treatment by age were not statistically significant. More than half sought and received treatment from the VHH (Table 2). The other two major sources were shops and health facilities. A few obtained treatment from a family member or already had chloroquine at home.

The most frequent reasons for not getting medicine from the VHH were that the VHH was not at home or had no drugs (Table 3). A total of 64 (79·3%) patients obtained or first tried to obtain chloroquine from the VHH (41 obtained from VHH; for 14 VHH not there; for nine VHH had no drugs). In four (10%) instances, the patient was felt to be too sick for the VHH to treat; all these patients obtained antimalarials from a health facility usually the Saradidi clinic. Four persons said they did not get medicine from the VHH because they were not registered with the VHH. This reason was difficult to understand since there was no requirement for registration before a VHH could treat a patient. Three individuals thought the VHH was 'no good', did not have adequate training and one said that it was more convenient to obtain chloroquine from a shop that was near to them when they became ill.

Similar results were found regarding treatment of children (Table 1). In these households, there were reported to be 103 children less than ten years of age whose mother was also interviewed; 67 (65·0%) were reported to have had malaria in the previous two weeks; 59

TABLE 1

Selected characteristics of persons interviewed about antimalarial treatment in Saradidi, Kenya, 1983

Age (years)	*No. interviewed*	*History of malaria* No. (%)*	*History of taking medicine for malaria* No. (%)*	*Proportion of those with malaria taking medicine*
0–4†	54	42 (77·8)	39 (72·2)	92·9 (39/42)
5–9†	49	25 (51·0)	20 (40·8)	80·0 (20/25)
10–14	59	30 (50·8)	19 (32·2)	63·3 (19/30)
15–29	59	25 (42·4)	22 (37·3)	88·0 (22/25)
30–44	42	25 (59·5)	18 (42·9)	72·0 (18/25)
⩾45	62	33 (53·2)	23 (37·1)	69·7 (23/33)
	325	180 (55·4)	141 (43·4)	78·3 (141/180)

*In the previous two weeks.
†Information obtained from mother.

TABLE 2

Source of antimalarial drugs for 82 persons receiving treatment in the two weeks before survey in Saradidi, Kenya, 1983*

Source	*Percentage*
Village health helper	51·2
Shop	28·0
Health facility†	12·2
Family member‡	4·9
Other§	3·7

*Ten years of age or more.
†Health centre, hospital, dispensary or Saradidi clinic.
‡Includes drugs already in home.
§Private practitioner = 1; shops outside Saradidi area = 2.

(88·1%) of these 67 received antimalarial treatment. The highest proportion of any age group treated were in children of zero to four years (72·4% of 54) (Table 1). The VHH was the largest source of treatment for children (30 of 56; 50·8%) followed by health facilities (20·3%) and shops (18·6%). Three (51%) children were given a drug already present at home, and for three children the source of antimalarial treatment was unknown.

Major reasons given for not obtaining treatment for children from the VHH were that she was not at home or had no drug (Table 4). As with adults, the four children who were considered too sick for the VHH to treat were all taken to health facilities, usually the Saradidi clinic. Thus, a total of 41 (69·5) of 59 children considered to have malaria went first to the VHH for antimalarial treatment (30 who received from VHH; for seven VHH not at home; for four VHH had no drugs).

TABLE 3

Reasons that 40 persons (over ten years of age) failed to obtain chloroquine for treatment of malaria from the village health helper (VHH) in Saradidi, Kenya, 1983

Reason	*Percentage*
VHH not there	35·0
VHH had no drugs	22·5
Patient too sick	10·0
Drugs already available in home	10·0
'Not registered' with VHH	10·0
VHH 'no good'	7·5
More 'convenient' to obtain elsewhere	5·0

TABLE 4

Reasons that 30 children (under nine years of age) did not obtain antimalarial treatment from the village health helper (VHH) in Saradidi, Kenya, 1983

Reason	*Percentage of children*
VHH not at home	23·3
VHH had no drug	13·3
Treated with drug already at home	20·0
Treated in school survey	13·3
Child 'too sick' for VHH	13·3
Too far from VHH when became ill	3·3
Unknown	13·3

In all 42 (18·9%) of 222 persons aged ten years or more and 30 (29·1%) of 103 children (nine years or less) had received antimalarial treatment from the VHH in the previous two weeks.

DISCUSSION

From these results, it is clear that the community-based programme of malaria treatment with chloroquine provided by the VHH was the main source of antimalarial treatment in Saradidi. More than two-thirds of adults and children (106 of 141; 75·2%) considered to have malaria first went to the VHH for treatment. Frequent reasons given for failure to obtain chloroquine from the VHH was that the VHH was not home or that she/he had no drugs. Since 96·8% of VHH's are women who have the same household responsibilities as other women in Saradidi, such as fetching water and firewood for the family, often from long distances (Kaseje *et al.*, 1987*d*), it is not surprising that they are sometimes not at home. Lack of drugs is difficult to understand since the Saradidi centre maintained reserves to supply the VHH's, however, some VHH's lived as much as 20 km from the clinic.

An important reason for failure to use the VHH was the perception that the patient was too sick to be taken to the VHH. All of these individuals were taken to health facilities such as health centres or hospitals. This fact may be important in determining how effective this programme can be in reducing mortality rates due to malaria if the sickest patients continue to be treated as before. The dispensaries, hospitals and health centres these patients are taken to may on occasion not have antimalarials available. For most people in the Saradidi community the nearest health facility is more than 5 km away and transport is not readily available even for very sick patients. A baseline survey done in 1982 (Mburu *et al.*, 1987) indicated small local shops to be the main source of antimalarial treatment; these shops stock various brands of chloroquine phosphate. Chloroquine phosphate is available in the area since a number of patients received the drug from family members or already had antimalarials in their home.

This survey indicates that the principal reasons for failing to obtain treatment from the VHH's were mainly logistical or organizational. Thus, if the VHH was able to be available and have drugs all the time, then most members of the community, with the exception of those who are considered to be too sick at the time they seek treatment, or who already have chloroquine in their own homes, would use the community source of chloroquine. The VHH's seem to be well accepted by the village since only three of the 22 persons interviewed in these ten villages gave mistrust of these workers as a reason for not going to the VHH.

Drug consumption during this period was high. A possible reason is that the survey was done in June 1983, a time of peak malaria transmission. Although the use of questionnaires can be fraught with difficulties in obtaining reliable information, the results presented here correlate well with those from records kept by the VHH's of consumption of chloroquine phosphate (Spencer *et al.*, 1987*e*) and with surveys of sources of malaria treatment done in Saradidi in 1982 and 1984 (Mburu *et al.*, 1987). These results suggest that volunteer community health workers such as the VHH's in Saradidi can be effective in supplying antimalarial treatment.

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Consumption of chloroquine phosphate provided for treatment of malaria by volunteer village health workers in Saradidi, Kenya

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A community-based malaria control programme in Saradidi, Kenya provided chloroquine treatment for malaria in each village beginning in May 1982. Malaria was holoendemic in Saradidi. Treatment was provided by volunteer community health workers chosen and supported by the village. Consumption of the drug and characteristics of persons treated were recorded. Between 1 September 1982 to 31 August 1983, 40 649 treatments with chloroquine were given to village residents. The treatment rate per person in the mid-year population was 1·24. However, at least 41·8% of the mid-year population of 32 650 did not receive a single treatment. Multiple treatments were given to 50·5% of persons treated at least once and 13·4% of 13 879 persons treated at least once received five or more treatments during the year. Consumption patterns were not random: they were higher in females, in persons above 30 years of age and in the area with greater community organization and community participation. There is need to ascertain the reasons why so large a proportion of the population never received a single treatment in this highly malarious area and why adults who should not have had a high frequency of clinical malaria were treated so often. Nonetheless, the results demonstrate that volunteer community health workers can effectively provide treatment for malaria.

Knowledge of the consumption of antimalarial drugs is necessary in estimating drug requirements and is useful in determining utilization of treatment services. There is little information from Africa on consumption of chloroquine given by community health workers for treatment of malaria.

As part of self-help development, a community-based malaria control programme was initiated in Saradidi, Kenya (Spencer *et al.*, 1987*c*). The principal objective was to reduce death and disease due to malaria by making antimalarial treatment available in each village. The records maintained of the characteristics of persons treated provide important information on patterns of consumption under these conditions.

MATERIALS AND METHODS

Background

As previously discussed (Kaseje and Spencer, 1987), Saradidi is a rural community in western Kenya near the shores of Lake Victoria. The community included all persons living in Saradidi. The people of Saradidi divided themselves into three operational areas (A, B and C) based on the degree of community organization. These areas were then subdivided into 56

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villages based on geography, kinship ties, clan groupings and religious affiliations. The community development programme began in area A in 1979 and this was the most organized area. At the time of census, the total population of area A was 16 560, of area B 11 052 and of area C 15 182 (Spencer *et al.*, 1987*h*).

Malaria Control

A community-based malaria control programme (Spencer *et al.*, 1987*c*) was initiated in area A (23 villages) and area B (13 villages).

Chloroquine phosphate for treatment of malaria was provided in each village by village health helpers (VHH's) who were chosen and supported by the people living in the village (Kaseje *et al.*, 1987*d*). The dosage of chloroquine phosphate was 10 mg base kg^{-1} given in a single dose. The number of pills or teaspoons of syrup (for small children) given was based on age and designed to ensure at least 10 mg base kg^{-1} was taken (e.g. adults were given five tablets each of 150 mg base). The dosage chosen was based on results of *in vivo* and *in vitro* drug sensitivity studies carried out in Saradidi prior to initiating malaria control activities (Spencer *et al.*, 1983*b*). Any person wishing treatment for malaria went to the home of the VHH. The antimalarial drug was taken in the presence of the VHH; none could be carried home. Exceptions to this rule were made for acutely ill individuals; treatment for these persons could be given to a family member to deliver to the patient.

For each treatment given the VHH recorded the date, name, age, and sex of the patient, whether the patient lived in the village, the household and personal numbers, the village of residence if not the village where treatment was obtained, the number of pills or teaspoons of syrup given, whether the patient had requested previous treatment and, if so, the date. The printed record books were each numbered. Each page also had information identifying the VHH, the village and the area. Each page had a unique page number (e.g. one book began with the number 101, another with 201, etc).

The malaria control programme began in May 1982. The one-year period 1 September 1982 to 31 August 1983 was selected for analysis. The mid-year population was based on continuous registration of vital events as previously described (Spencer *et al.*, 1987*d*, 1987*h*).

RESULTS

Treatment Rates per Person

A total of 40 649 treatments with chloroquine were given to 32 650 village residents during the study year (Table 1). The treatment rate per person was 1·36 in area A, 1·06 in area B and 1·24 for both.

The lowest rate of antimalarial treatments was in persons five to 29 years old and the highest rate in persons 45 to 59 years of age (Table 1).

Females had significantly higher treatment rates than males in both areas (Table 2). However, the major differences occurred in the age group 15 to 59 years (Fig. 1). Prior to age 15 years treatment rates were similar in males and females and after age 60 the rate was higher in males.

Proportion of Mid-year Population Treated Once

The exact proportion could not be determined. This was because 3508 (12·9%) chloroquine treatments in area A and 1633 (12·2%) treatments in area B were given to people for whom the identification number was not accurately recorded by the VHH's. Either the number was not known, was not recorded or was incomplete. It could not be determined, therefore, if the treatments without identification had been given to people who received no other treatments during the year or who had in fact been treated at another time. Although treatment rates were

TABLE 1

Mid-year population, number and percent of treatments given for malaria and average number of treatments per mid-year population by age and area in Saradidi, Kenya, 1 September 1982 to 31 August 1983*

Age (years)	Area A			Area B			Both areas		
	Mid-year population	No. (%)† treatments	Treatment rate per person	Mid-year population	No. treatments (%)	Treatment rate per person	Mid-year population	No. treatments (%)	Treatment rate per person
<1	759	1201 (4·4)	1·58	503	634 (4·7)	1·26	1242	1835 (4·5)	1·45
1–4	2985	4914 (18·1)	1·65	1772	2480 (18·5)	1·49	4757	7394 (18·2)	1·55
5–14	5953	5876 (21·6)	0·99	3591	2590 (19·3)	0·72	9544	8466 (20·8)	0·89
15–29	5031	5368 (19·7)	1·07	3215	2672 (19·9)	0·83	8246	8040 (19·8)	0·98
30–44	2326	4206 (15·5)	1·81	1598	2053 (15·3)	1·28	3924	6259 (15·4)	1·60
45–59	1545	3339 (12·3)	2·16	1036	1806 (13·4)	1·74	2581	5145 (12·7)	1·99
≥60	1363	2137 (7·9)	1·57	973	1178 (8·8)	1·21	2336	3315 (8·2)	1·42
Unknown	—	180 (0·7)	—	—	15 (0·1)	—	—	195 (0·5)	—
Total	19 962	27 221	1·36	12 678	13 428	1·06	32 650	40 649	1·24

*Treatments to people who lived in the village; non-residents excluded.
†Percent of total treatments in this age group.

TABLE 2

Mid-year population, number of malaria treatments given and treatment rate per person by sex and area in Saradidi, Kenya, 1 September 1982 to 31 August 1983

	Area A		*Area B*		*Both areas*	
	Males	*Females*	*Males*	*Females*	*Males*	*Females*
Mid-year population	9233	10 658	6046	6610	15 279	17 268
Number of treatments given	11 457	15 557	5771	7488	17 228	23 045
Treatment rate per person	1·24	1·46	0·95	1·13	1·13	1·33

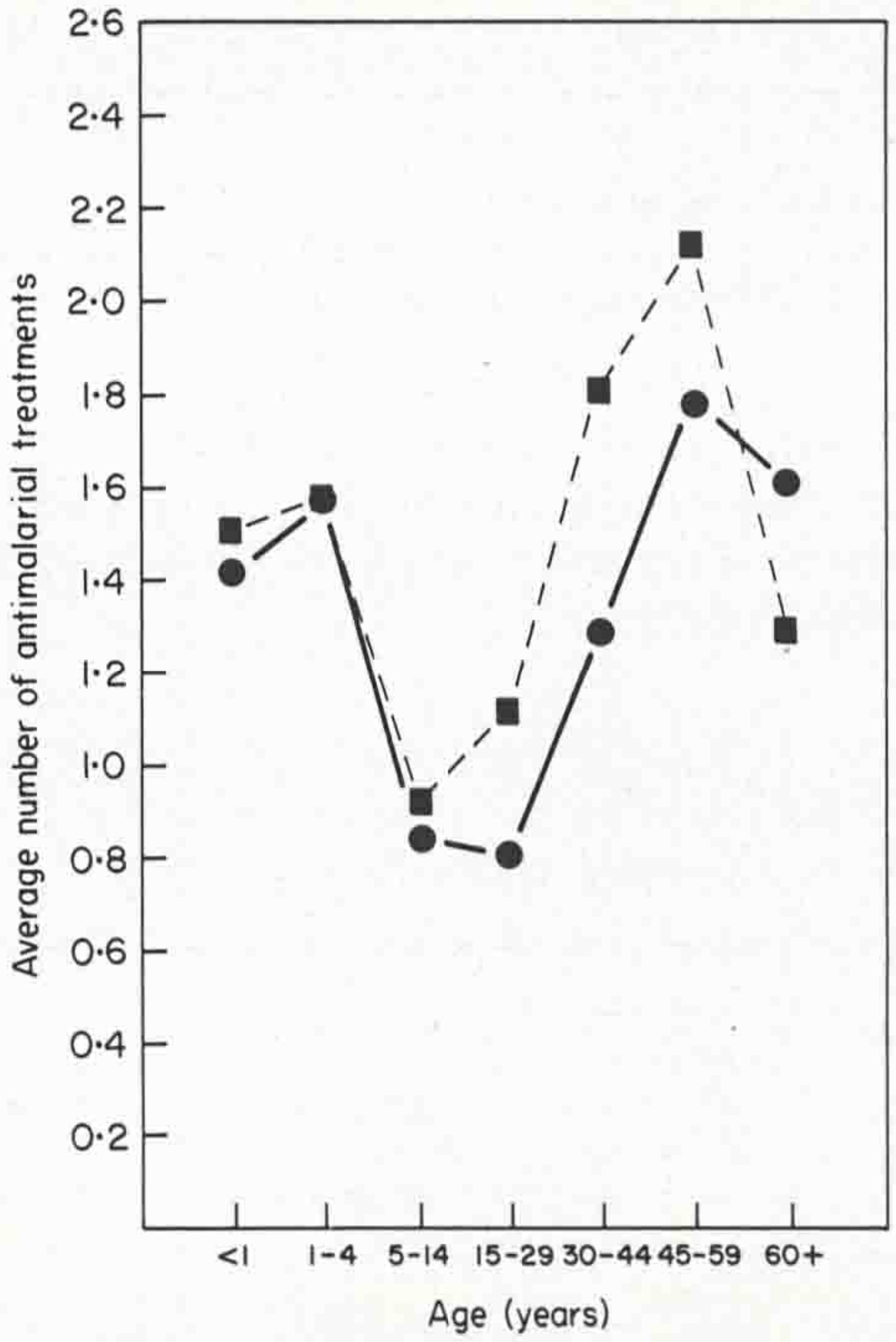

Fig. 1. Average number of antimalarial treatments by age and sex in Saradidi, Kenya, 1 September 1982 to 31 August 1983. ■– – –■, Females; ●————●, Males.

high in area A when compared with area B, age and sex consumption patterns were identical in the two areas. Thus the combined results are presented.

Depending on whether treatments without identification numbers were included, the proportion of the total mid-year population treated at least once was between 42·4% and 58·2% (Table 3). Thus *at least* 41·8% of persons living in Saradidi never received a single malaria treatment from the VHH's during the year. The age groups with the highest proportion of the mid-year population treated at least once were children less than five years and adults 30 to 59 years.

TABLE 3

Proportion of mid-year population treated for malaria at least once by age in Saradidi, Kenya, 1 September 1982 to 31 August 1983*

Age (years)	*Mid-year population*	*No. persons treated at least once ID recorded* †	*% of mid-year population treated at least once ID recorded*	*No. persons treated at least once, all*‡	*% of mid-year population treated at least once, all*
<1	1262	683	(50·2)	970	(76·9)
1–4	4757	2558	(53·8)	3668	(77·1)
5–14	9544	3340	(35·0)	4448	(46·6)
15·29	8246	2941	(35·7)	4112	(49·9)
30–44	3924	1832	(46·7)	2498	(63·7)
45–59	2581	1564	(60·6)	2031	(78·7)
≥60	2336	986	(42·2)	1268	(57·3)
Total	32 650	13 854	(42·4)	18 995	(58·2)

*Areas A and B combined.

†Includes only persons with registered identification numbers.

‡Persons with known and unknown identification numbers included. Each treatment without an accurate identification number was considered to be a separate person.

Antimalarial treatment rates per persons in those treated at least once were 2·92 if only persons with accurately recorded identification numbers were included and 2·13 if all persons treated were included (Table 4). Treatment rates were significantly higher in persons 30 years and older compared with those younger.

TABLE 4

Antimalarial treatment rates per person by age in persons treated at least once in Saradidi, Kenya, 1 September 1982 to 31 August 1983*

Age (years)	*No. treatments given*	*No. persons treated at least once ID recorded* †	*Treatment rate per person ID no. known*	*No. persons treated at least once, all*‡	*Treatment rate per person, all*
<1	1835	633	2·90	970	1·89
1–4	7394	2558	2·99	3668	2·02
5–14	8466	3340	2·53	4448	1·90
15–29	8040	2941	2·73	4112	1·96
30–44	6259	1832	3·42	2498	2·51
45–59	5145	1564	3·29	2031	2·53
≥60	3315	986	3·36	1268	2·61
Total	40 454	13 854	2·92	18 995	2·13

*Areas A and B combined.

†Includes only persons with registered identification numbers.

‡Persons with known and unknown identification numbers included. Each treatment without an accurate identification number was considered to be a separate person.

TABLE 5

Number of antimalarial treatments per person in Saradidi, Kenya, 1 September 1982 to 31 August 1983

Number of treatments	*Percent*
1	49·5
2	20·0
3	10·9
4	6·3
5 to 9	10·6
10 or more	2·8
Number of persons treated at least once	13 879†

*Areas A and B combined. Only persons with complete identification numbers included.

†Totals include persons of unknown age and sex.

TABLE 6

Antimalarial treatments per person by age in Saradidi, Kenya, 1 September 1982 to 31 August 1983*

	Number of times treated						
Age (years)	*1*	*2*	*3*	*4*	*5 to 9*	*10 or more*	*Number of persons treated at least once in age group*
<1	55·3†	20·2	8·7	4·7	9·5	1·6	633
1–14	52·7	20·8	10·1	5·2	8·8	2·4	5898
15–29	51·9	20·3	10·6	6·5	9·1	1·6	2941
≥30	42·6	18·6	12·4	7·8	14·2	4·4	4382

*Areas A and B combined. Persons with absent identification numbers excluded. Analysis based on recorded identification numbers.

†Percent of age group treated this many times.

TABLE 7

Antimalarial treatments given to non-residents by age in Saradidi, Kenya, 1 September 1982 to 31 August 1983

Age (years)	*Percent of treatments to persons of this age*
<1	5·1
1–14	33·0
15–29	22·7
≥30	38·5
Unknown	0·7
Total number of treatments	1927

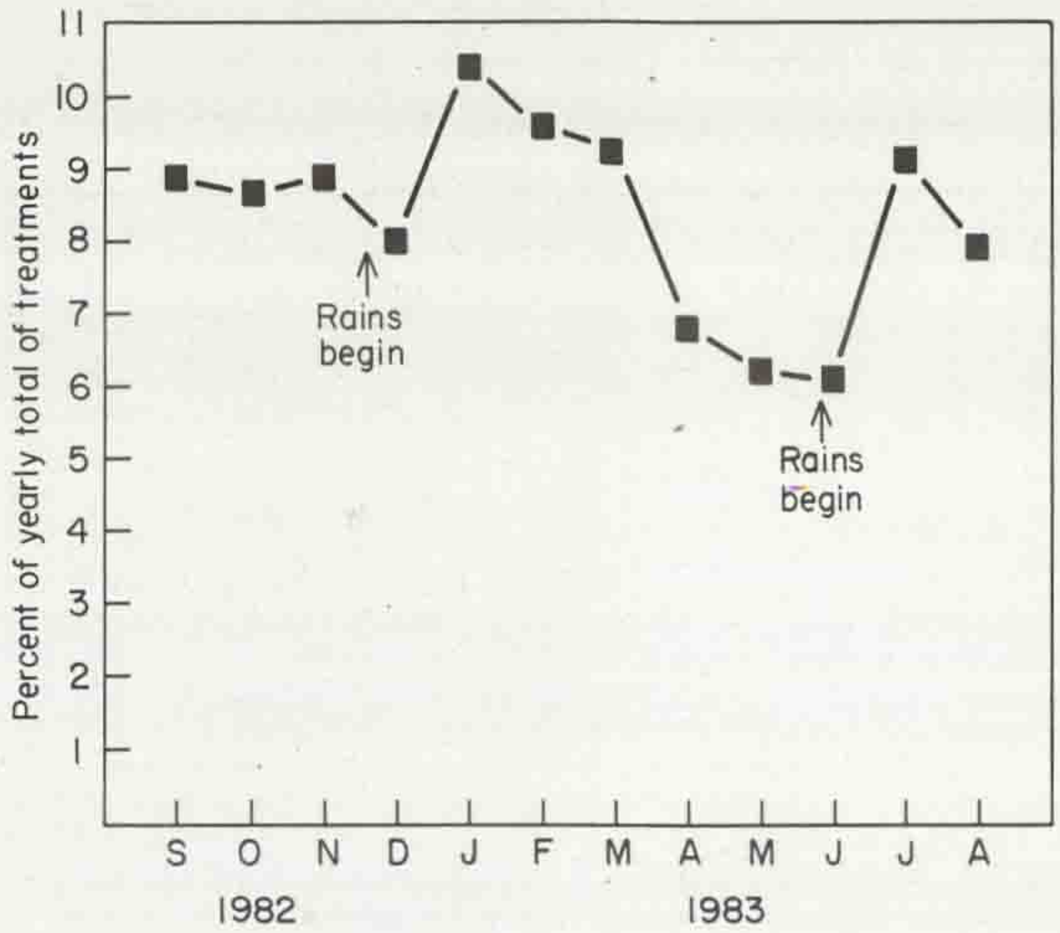

Fig. 2. Antimalarial treatment by month in Saradidi, Kenya, 1 September 1982 to 31 August 1983.

Multiple Treatments

More than half (50·5%) of persons with recorded identification numbers who were treated at least once received multiple treatments during the year from VHH's; 13·4% received five or more treatments (Table 5). One adult male was treated with chloroquine 33 times during the year. Multiple treatments were statistically significantly ($\chi^2 = 222{\cdot}7$, $df = 1$, $P < 0{\cdot}000001$) more frequent in persons 30 years of age and over when compared with persons under 30 (Table 6). The proportion of males (49·4% of 5994) and females (51·3% of 7818) with multiple treatments was similar.

Treatments Given to Non-residents

Few treatments were given to persons who did not live in the village (Table 7).

Consumption of Chloroquine Syrup

During the study year 8028 (18·9%) of all treatments (including non-residents) were given chloroquine syrup and not tablets.

Seasonal Consumption Patterns

The proportion of treatments varied by month (Fig. 2). The lowest monthly percent of treatments occurred in April to June 1983. In 1983, the rainy season in Saradidi did not begin until May.

DISCUSSION

To our knowledge, this is the first report from Africa on consumption patterns of antimalarials provided by volunteer health workers chosen and supported by the community. The results suggest the VHH's were effective in providing antimalarial treatment in Saradidi, Kenya. More than 42 000 treatments with chloroquine were given during the study year. The treatment rate per person in the mid-year population was 1·24. Treatment rates were higher in the area (area A) with the longer period of community participation, the greater degree of community organization, and the most active programme (Kaseje and Spencer, 1987).

Not everyone participated in the programme, however. At least 41·8% of village residents never received a single dose of chloroquine from the VHH's. There are several possible explanations for this observation. These individuals may have obtained antimalarial treatment elsewhere. As previously shown in Saradidi (Kaseje *et al.*, 1987*e*), some people did not receive antimalarial therapy from the VHH's because the VHH was not at home when the patient went for treatment, the VHH was out of drugs or the patient was considered to be too sick to be taken to the VHH. Chloroquine phosphate was also available in Saradidi from shops and from other health services, such as the mission hospital and government dispensaries (Mburu *et al.*, 1987). The possibility that portions of the community did not have access to the VHH because of social or cultural differences cannot be excluded.

It is also possible that persons not receiving treatment from the VHH's during the study year in fact had no attacks of clinical malaria and did not require therapy. Even in holoendemic malarious areas like Saradidi, exposure to malaria can vary (Molineaux and Gramiccia, 1980). However, it is difficult to explain the large proportion of non-users by assuming different exposure rates since transmission rates are so high in this area (Spencer *et al.*, 1987*c*). The most likely explanation for the high proportion of non-users is that they obtained treatment from another source.

There is little information available to permit estimation of the expected incidence of clinical attacks of malaria in this population. In other malarious areas of tropical Africa with similar epidemiological patterns of malaria transmission, children under five who are continuously exposed to infection without any protection have high rates of symptomatic attacks while attack rates of clinical malaria in adults are much lower (Molineaux and Gramiccia, 1980). The observed consumption patterns in Saradidi differed from those expected. Persons 30 years of age and older had higher treatment rates than young children. Females 15 to 59 were more often treated than males of the same ages. More than half of the persons treated at least once received multiple treatments; 13·4% received five or more treatments during the year. Mothers may have requested treatment for themselves whenever they brought their children under five years of age to the VHH thus adding to the number of treatments given to adult females. The reasons for excess use of treatment by other adults is unclear.

These findings suggest that, for planning purposes, it can be expected that under similar circumstance in tropical Africa with holoendemic malaria and easy access to free treatment the yearly consumption of chloroquine from community health workers will consist of one to two treatments per year per person; chloroquine syrup should constitute almost 20% of the total estimated requirements. In Saradidi, few antimalarial treatments were given to persons not living in the village. In other places, however, use of community health services by non-residents could prove substantial.

There is need to investigate why so large a proportion of the population did not obtain treatment from the VHH's. Similarly, the reason some population groups, such as adults, overused treatment facilities under these conditions also needs to be ascertained. Nevertheless, in Saradidi, volunteer community health workers were effective in providing antimalarial treatment.

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Epidemiology of chloroquine-associated pruritus in Saradidi, Kenya

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The association of pruritus and ingestion of chloroquine phosphate in Saradidi, Kenya, was determined by randomly giving 437 children (less than 18 years) and 182 adults either 10 mg base kg^{-1} of regular chloroquine, 10 mg base kg^{-1} of enteric-coated chloroquine, 10 mg base kg^{-1} of amodiaquine, or one 300 mg tablet of enteric-coated ferrous sulphate. Before treatment, a blood smear was taken. Paired urine samples were tested for 4-aminoquinolines to exclude prior drug ingestion, to document drug absorption, and to exclude chloroquine or amodiaquine intake in persons who received iron. The following day, the incidence of itching was ascertained.

More adults (20·3%) reported itching than did children (12·8%) ($P < 0·05$); no significant difference between males and females was noted. A history of itching 24 hours after treatment was not significantly more common in persons with malaria parasitaemia. Pruritus was more frequent in those receiving regular chloroquine (21·5% of 186) and enteric-coated chloroquine (17·8% of 118) than after amodiaquine (11·6% of 173) or iron (8·5% of 142) ($P < 0·005$). Amodiaquine which is a 4-aminoquinoline like chloroquine did not appear to cause significant pruritus in this population. These results demonstrate that chloroquine-associated pruritus is experienced frequently in Saradidi. This side effect of malaria treatment could influence usage of chloroquine phosphate provided by village health workers.

Pruritus associated with ingestion of chloroquine for chemotherapy or chemoprophylaxis has been reported in Africans and non-Africans (Berliner *et al.*, 1948; Ekpechi and Okoro, 1964; Olatunde, 1977; Olatunde and Obih, 1981; Spencer *et al.*, 1983*a*; Osifo, 1984). When chloroquine phosphate was made available in May 1982 in Saradidi, Kenya, in each village as part of a community-based malaria control programme (Spencer *et al.*, 1987*c*), reports of chloroquine-induced pruritus began to appear. Because of the concern that this side effect would influence drug usage, a study was undertaken to determine the prevalence and some of the epidemiologic features of chloroquine-induced pruritus in Saradidi.

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MATERIALS AND METHODS

Two investigations were carried out, one in schoolchildren (January 1983) and the other in adults (March 1984). The methods were the same in both studies.

Subjects were informed that they would receive treatment for presumptive malaria and should return for examination the next day. Consent was obtained from the adult patients or from parents or teachers of the children. A thick blood film for malaria parasites was taken, and a urine sample was examined for 4-aminoquinolines by the Dill–Glazko test (Lelijveld and Kortmann, 1970). If this test was negative, patients were weighed and then given either 10 mg base kg^{-1} of regular chloroquine phosphate (white tablet of 150 mg base), 10 mg base kg^{-1} of enteric-coated chloroquine phosphate (red tablet of 300 mg base), 10 mg base kg^{-1} of amodiaquine (yellow tablet of 200 mg base), or 300 mg of enteric-coated ferrous sulphate (green tablet). Since enteric-coated chloroquine is not available in Kenya, the participants in the study did not know what these pills contained. Enteric-coated ferrous sulphate is not available in rural Kenya, although it can be purchased in urban areas.

That same day, the blood films were stained with Giemsa and examined for malaria parasites. On the following day, a repeat Dill–Glazko test was done on a urine sample from each individual. Then each person was asked three questions in the following order: (1) Have you had any problems since treatment yesterday? (2) If yes, what? (3) Have you had itching? (The last question was asked only if itching was not mentioned in the answer to the second question). The interviewers were members of a field team who had been working in the area for three to four years and who were well known to the study population. Interviews were conducted in Luo, the local language, and all subjects were interviewed separately. Interviewers had no knowledge of parasite results or which drug the person had received. Itching was considered to be present if the person mentioned it in response to the second question or if they replied affirmatively to the third question. Persons who had received iron and who had a blood film showing malaria parasites were treated with chloroquine. Persons who had a positive Dill–Glazko test before treatment or those who received iron but had a positive Dill–Glazko on followup were excluded from analysis, as were all persons without a urine sample at 24 hours.

For the study in children, every pupil in a randomly selected school was examined. In the adult study, persons were asked to come to places where a community meeting or mobile health clinic was being conducted. The three sites selected for the adults were each at least 5 km from the other.

RESULTS

There were 426 children in the school study and 193 persons in the adult study. Eleven persons under 18 years of age enrolled in the adult study; for purposes of analysis these 11 were considered to be children, giving final totals of 437 children (less than 18 years) and 182 adults (18 or more years).

Pruritus was reported most frequently by children and adults who received regular chloroquine (Table). Those who received enteric-coated chloroquine had the second highest frequency of pruritus. The differences among treatment groups in adults ($P<0{\cdot}05$) and in adults and children combined ($P<0{\cdot}005$) were statistically significant. Adults reported more itching than children in all treatment groups; the total difference was statistically significant ($P<0{\cdot}05$). Twelve of 37 adults and 19 of 56 children gave a spontaneous history of itching (responding to the question 'have you had any problems since treatment yesterday?') The rest gave a history of itching only after being asked directly.

When the findings in children and adults are combined, itching was significantly less frequent in those who received iron or amodiaquine than in those who received chloroquine

TABLE

Itching by type of drug in schoolchildren and adults in Saradidi, Kenya*

	Schoolchildren		*Adults*		*Both*	
Drug†	No.	% itching	No.	% itching	No.	% itching
Iron (I)	102	7·8	40	10·0	142	8·5‡
Amodiaquine (AD)	126	10·3	47	14·9	173	11·6‡
Enteric-coated chloroquine (ECH)	65	13·8	53	22·6	118	17·8‡
Regular chloroquine (CH)	144	18·1§	42	33·3‖	186	21·5‡
	437	12·8	182	20·3	619	15·0
	$\chi^2=6{\cdot}56$, $df=3$ $P<0{\cdot}1$		$\chi^2=8{\cdot}05$, $df=3$ $P<0{\cdot}05$		$\chi^2=13{\cdot}3$, $df=3$ $P<0{\cdot}005$	

*History of itching by either direct or indirect questioning.
†See text for dosages.
‡AD compared with CH, $\chi^2=5{\cdot}67$, $df=1$ $P<0{\cdot}05$
AD compared with ECH, $\chi^2=1{\cdot}76$, $df=1$ NS*
ECH compared with CH, $\chi^2=0{\cdot}4$, $df=1$ NS
I compared with AD, $\chi^2=0{\cdot}5$, $df=1$ NS
I compared with ECH, $\chi^2=4{\cdot}2$, $df=1$ $P<0{\cdot}05$
I compared with CH, $\chi^2=19{\cdot}8$, $df=1$ $P<0{\cdot}01$
§Adults compared with children, $\chi^2=5{\cdot}68$, $df=1$ $P<0{\cdot}05$.
‖Not significant $P>0{\cdot}05$.

in either form (Table). The observed difference between the regular and enteric-coated chloroquine treatment groups was not statistically significant.

No significant difference in the occurrence of itching was found when males were compared with females. Similarly, the presence or absence of parasitaemia did not affect the development of itching. In those patients receiving either regular chloroquine or enteric-coated chloroquine, 24 (18·3%) of 131 with parasitemia complained of pruritus, compared with 37 (21·4%) of 173 without parasitaemia ($\chi^2=0{\cdot}3$, not significant).

DISCUSSION

Chloroquine-associated pruritus was experienced frequently by the population in Saradidi. Its occurrence in 20·1% of 304 persons receiving regular chloroquine or enteric-coated chloroquine at 10 mg base kg^{-1} was similar to the rate of 8% to 28% reported from Nigeria (Olatunde, 1977; Olatunde and Obih, 1981). In a previous study (Osifo, 1984), the maximum intensity of pruritus occurred 25 ± 12 hours after ingesting chloroquine. Therefore, the true rate may have been underestimated in this study, since all persons were interviewed 24 hours after treatment. Itching was significantly more frequent in those who received chloroquine in either form than in those who received amodiaquine or ferrous sulphate. No significant difference in the rate of itching was found between recipients of the latter two drugs; thus amodiaquine, which is a 4-aminoquinoline similar to chloroquine, was not demonstrated to be a cause of itching. The fact that 8·5% of 142 persons receiving ferrous sulphate had itching suggests that some people expect to have itching when taking medicine that they believe is for the treatment of malaria. One can estimate that the rate of itching ascribable to chloroquine is about 12% in this population.

Pruritus occurred less frequently in children than adults in all treatment groups. Males and females had similar rates. The presence of malaria infection did not affect chloroquine-associated pruritus, since itching did not occur significantly more frequently in persons with parasitaemia than in those without.

These findings cause concern about the use of available chloroquine in a malarious area such as Saradidi. Patients experiencing chloroquine-associated pruritus are often unwilling to take the drug again and are thus at increased risk of complications from malaria. If mothers who experience chloroquine-associated pruritus are unwilling to give the drug to their children, malaria mortality and morbidity rates may not decline in a segment of the population in Saradidi, in spite of the availability of chloroquine. *Plasmodium falciparum* malaria resistant to chloroquine at a dose of 10 mg base kg^{-1} has been documented in Saradidi (Spencer *et al.*, 1987*a*). If the dose is increased to 25 mg base kg^{-1} given over three days, the appearance of pruritus within 24 hours, as occurred in this study, could discourage people from taking the full course of treatment.

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Symptoms associated with common diseases in Saradidi, Kenya

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A community-based malaria control programme was initiated in Saradidi, Kenya. One factor determining the utilization of treatment would be the symptoms felt to be diagnostic of malaria. The 12 most common diseases and 29 most common symptoms were identified by community members. Thirty-six randomly selected women were interviewed to determine association of the common diseases and symptoms; nine women were aged 15 to 29 years, nine women were 30 to 44 years, nine were 45 to 59 years and nine were 60 years or more. Women 60 years and older recognized a higher proportion of the diseases ($P<0{\cdot}0005$) when compared with the other women of other ages. More than 90% of the women associated headache, fever, vomiting, joint pain, loss of appetite, tiredness and death with malaria. Measles and influenza were distinguished from malaria by rash and mouth ulcer for measles and by 'runny nose' and 'sneezing' for influenza. Analysis by average linkage hierarchical clusters revealed that malaria, influenza and measles were distinguished readily. The results suggest that if people in Saradidi do not obtain treatment from community health workers, it is not because they do not recognize the clinical symptoms of malaria.

Few countries in tropical Africa have an adequately developed health infrastructure or organized antimalarial services. In such areas, the control of malaria should initially be directed towards management of fewer cases with antimalarial drugs in an effort to reduce disease and deaths due to malaria by making prompt diagnosis and appropriate treatment more accessible. In many programmes, antimalarial drugs will be provided by community health workers to people who come to them for treatment. Increasing accessibility to malaria treatment would have little impact on malaria-specific mortality and morbidity if people do not recognize when they have malaria and go for treatment. There have been few studies in Africa on the symptoms associated with malaria, yet local definitions of disease are one characteristic of paramount importance in determining utilization of treatment facilities.

A community-based health development programme was initiated in 1979 by the people of Saradidi, Kenya (Kaseje and Spencer, 1987). The community considered malaria to be a priority public health problem and a community-based malaria control programme began in May 1982 (Spencer *et al.*, 1987*c*). The purpose was to reduce mortality and morbidity due to malaria. Chloroquine phosphate was made available in each village. Treatment for malaria was given by volunteer village health helpers (VHH's) chosen and supported by their village (Kaseje *et al.*, 1987*d*). People who felt they had malaria would go to the VHH for treatment.

This paper reports the results of a study carried out in March 1981 prior to the control programme, to determine the symptoms perceived to be associated with common diseases in Saradidi and to see how malaria was distinguished from other common diseases by symptom.

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METHODS

Background

As presented earlier (Kaseje and Spencer, 1987), Saradidi is a rural area in western Kenya near the shores of Lake Victoria. Virtually all the population belongs to the Luo tribe. Most people are subsistence farmers; less than 10% of adults have salaried jobs. Before the health development programme, the majority of the population lived more than 5 km from any health facility. A complete census had been carried out prior to the survey (Spencer *et al.*, 1987*h*).

Symptoms and Diseases

A list (Table 1) of common diseases and symptoms was elicited as follows: Villages and the Saradidi programme centre were visited and people at random were asked to name diseases and symptoms (in Luo, the local language) they considered to be common in Saradidi. Lists were merged and a final list generated which consisted of those diseases and symptoms recognized as 'common' by a majority of people queried. This final list was then field tested in order to remove any ambiguous terms. One problem encountered was that occasionally a symptom was synonymous for a particular disease.

TABLE 1
Common diseases and symptoms in Saradidi, Kenya

*Diseases**	*Symptoms**	
Malaria	Headache	Runny nose
Measles	Fever	Chest pain
Influenza	Vomiting	Sore throat
Gastroenteritis	Joint pain	Diarrhoea
Cholera	Loss of appetite	Pus in eyes
Chickenpox	Death	Big spleen
Tuberculosis	Tiredness	Ulcers in mouth
Whooping cough	Madness	Wheezing
Worms	Chronic cough	Coughing blood
Tetanus	Sneezing	Constipation
Ear infection	Difficulty breathing	Rash
Schistosomiasis	Red eyes	Bloody diarrhoea
	Weight loss	Pus from ears
	Stomach pain	Blood in urine
	Stiff body	

*Translation from Luo.

Study Population

Thirty-six women were interviewed. Women were chosen because they were most often in the household and because they are responsible for medical care for themselves and for children under five years (Kaseje, personal communication).

Nine of the 36 villages where a census had been carried out were selected using a table of random numbers. Households were then chosen randomly and one woman in each household was identified. Four women from each village were interviewed; one from each of the age groups 15–29 years, 30–44 years, 45–59 years and 60 or more years. Households were visited a total of three times before an alternative to the selected women was interviewed.

TABLE 2
Proportion of 36 women who knew a particular disease in Saradidi, Kenya

Disease	*Proportion of women*
Malaria	100
Measles	100
Influenza	100
Ear infection	86·1
Worms	86·1
Gastroenteritis	75·0
Whooping cough	72·2
Tuberculosis	63·9
Chickenpox	58·3
Cholera	55·6
Schistosomiasis	50·0
Tetanus	22·2

The woman was asked whether she knew the disease. If she said yes, she was asked the symptoms one by one and if a particular symptom was caused by that disease or not. Responses were recorded yes, no and unknown.

Interviews

The study was carried out by two male Luo-speaking technologists. They had been working in the area for more than two years and were well known to the people. One had seven and the other ten years of formal education.

Interviews were carried out in Luo at the home of the respondent. Before beginning the survey, each interviewer gave the questionnaire to five women in the presence of one of the principal investigators. Problems encountered were discussed and a standard approach developed.

Analysis

Approximate English translations of the Luo terms for the common symptoms and diseases are presented. In an effort to group 'like' diseases based on the constellation of symptoms perceived associated, an average linkage hierarchical cluster analysis was carried out using the Statistical Package for the Social Science (SPSS) Programme (D'Andrade *et al.*, 1972; Nie *et al.*, 1975; Young, 1978). The aim of this analysis was to allocate sets of symptoms to groups so that symptoms within a group are similar to one another while symptoms in different groups are dissimilar. Like diseases were based on symptom responses according to the number of clusters specified. For example, given six clusters, all diseases were assigned to one of the six. Clusters were permitted to overlap so that symptoms could belong simultaneously to multiple clusters.

RESULTS

Study Population

Twenty-five (69·4%) of the women interviewed were those randomly selected; seven (19·5%) were first alternates, three (8·3%) were second alternates and one (2·8%) was third alternate.

Symptoms and Diseases

Twelve common diseases and 29 common symptoms were identified (Table 1).

TABLE 3

Proportion of women associating common symptoms with common diseases in Saradidi, Kenya, 1982

	Malaria	*Measles*	*Influenza*	*Gastroenteritis*	*Cholera*	*Chickenpox*	*Tuberculosis*	*Whooping cough*	*Worms*	*Tetanus*	*Ear infection*	*Schistosomiasis*
Headache	100·0	97·1*	100·0	70·4	80·0	90·5	50·0*	69·2	61·3	75·0	80·6	44·4
Fever	100·0	100·0	97·2	77·8	65·0	100·0	45·5	61·5	67·7	87·5	48·4	33·3
Vomiting	100·0	77·8	25·0	96·3	100·0	42·9	60·9	84·6	74·2	25·0	3·2	27·8
Joint pain	97·2	94·1*	75·0	77·8	80·0	90·5	59·1*	48·0*	48·4	75·0	48·4	38·9
Loss of appetite	97·2	97·2	65·7*	88·9	90·0	81·0	63·6*	84·6	64·5	25·0	32·3	33·3
Death	97·2	97·2	38·9	88·9	90·0	90·5	90·9*	88·5	77·4	75·0	38·7	94·4
Tiredness	91·7	100·0	52·8	88·9	90·0	95·2	87·0	88·5	90·3	75·0	38·7	76·5*
Madness	77·8	5·9*	5·6	3·7	0·0	4·8	4·3	7·7	3·2	12·5	19·4	0·0
Chronic cough	66·7	91·7	83·3	33·3	25·0	57·1	100·0	100·0	22·6	25·0	16·1	11·1
Sneezing	60·0*	58·3	97·2	22·2	15·0	42·9	47·8	57·7	6·5	37·5	16·1	11·1
Difficulty breathing	58·3	88·9	55·6	11·1	20·0	66·7	95·7	80·8	16·1	50·0	6·5	5·6
Red eyes	58·3	88·9	88·9	18·5	31·6	81·0	54·5*	64·0*	10·0*	37·5	22·6	11·1
Weight loss	52·8	72·2	30·6	85·2	65·0	66·7	78·3	84·6	87·1	75·0	35·5	66·7
Stomach pain	52·8	83·3	5·6	81·5	85·0	57·1	13·0	26·9	96·8	57·1*	6·5	77·8
Stiff body	47·2	27·8	16·7	11·5*	42·1*	33·3	40·9*	84·0*	16·1	87·5	12·9	11·1
Runny nose	41·7	83·3	97·2	18·5	15·8*	76·2	34·8	34·6	3·3*	50·0	16·1	5·6
Chest pain	38·9	63·9	47·2	14·8	21·1*	50·0*	100·0	96·2	16·1	37·5	6·5	11·1
Sore throat	38·9	77·8	69·4	14·8	30·0	42·9	63·6*	80·8	3·2	50·0	19·4	5·6
Diarrhoea	36·1	86·1	5·6	100·0	95·0	28·6	4·3	11·5	51·6	25·0	3·2	17·6*
Pus in eyes	33·3	86·1	66·7	18·5	15·0	81·0	39·1	38·5	12·9	50·0	16·1	11·1
Big spleen	31·4*	2·8	0·0	7·4	5·0	0·0	0·0	0·0	30·0*	0·0	0·0	5·6
Ulcers in mouth	31·4*	91·7	13·9	11·1	5·3*	66·7	4·3	3·8	6·5	0·0	3·2	0·0
Wheezing	16·7	47·2	22·2	11·1	10·5*	14·3	87·0	92·3	6·5	12·5	6·5	0·0
Coughing blood	13·9	30·6	11·1	11·1	25·0	4·8	91·3	61·5	0·0	0·0	3·2	5·6
Constipation	13·9	29·4*	2·8	48·1	22·2*	23·8	4·3	11·5	100·0	25·0	3·3*	41·2*
Rash	8·3	97·2	2·8	7·4	15·8*	61·9	0·0	3·8	3·2	12·5	3·2	0·0
Bloody diarrhoea	5·6	36·1	2·8	59·3	45·0	9·5	4·5*	7·7	19·4	12·5	3·3*	38·9*
Pus from ears	5·7*	8·3	11·1	0·0	10·0	4·8	8·7	15·4	0·0	0·0	96·8	0·0
Blood in urine	2·9*	2·9*	0·0	7·4	10·0	4·8	4·3	0·0	13·3*	0·0	0·0	88·9
Average	50·9	66·3	41·1	40·9	41·5	50·7	46·1	51·4	34·8	37·7	20·9	26·7
Number of women who knew diseases	36	36	36	27	20	21	23	26	31	8	31	18

*One or two women did not know if this symptom was associated or not.

TABLE 4

Distance from average for each symptom of proportion of women associating common symptoms with common diseases in Saradidi, Kenya 1981*

	Malaria	*Measles*	*Influenza*	*Gastroenteritis*	*Cholera*	*Chickenpox*	*Tuberculosis*	*Whooping cough*	*Worms*	*Tetanus*	*Ear infection*	*Schistosomiasis*	*Absolute average*
Headache	23·5	20·6	23·5	− 6·1	3·5	14·0	−26·5	− 7·3	−15·2	− 1·5	4·1	−32·1	14·8
Fever	26·3	26·3	23·5	4·1	− 8·7	26·3	−28·2	−12·2	− 6·0	13·8	−25·3	−40·4	20·1
Vomiting	40·2	18·0	−34·8	36·5	40·2	−16·9	1·1	24·8	14·4	−34·8	−56·6	−32·0	29·2
Joint pain	27·8	24·7	5·6	8·4	11·6	21·1	−10·3	−21·4	−21·0	5·6	−21·0	−30·5	17·4
Loss of appetite	29·4	29·4	− 3·9	20·3	21·4	12·4	− 5·0	16·0	− 4·1	−43·6	−36·3	−35·3	21·4
Death	16·5	16·5	−41·8	8·2	9·3	9·8	10·2	7·8	− 3·3	− 5·7	−42·0	13·7	15·4
Tiredness	10·4	18·7	−28·5	7·6	8·7	13·9	5·7	7·2	9·0	− 6·3	−42·6	− 4·8	13·6
Madness	65·7	−6·1	− 6·5	− 8·3	−12·0	− 7·3	− 7·7	− 4·3	− 8·8	0·5	7·3	−12·0	12·3
Chronic cough	14·0	39·0	30·7	−19·3	−27·7	4·5	47·3	47·3	−30·1	−27·7	−36·5	−41·6	30·5
Sneezing	19·0	19·0	57·9	−17·1	−24·3	3·6	8·5	18·4	−32·8	− 1·8	−23·2	−28·2	21·1
Difficulty breathing	12·1	42·6	9·3	−35·1	−26·3	20·4	49·4	34·5	−30·1	3·7	−39·8	−40·7	28·7
Red eyes	11·0	42·6	42·6	−28·8	−15·7	33·7	7·2	16·7	−37·3	− 9·8	−24·7	−35·2	25·4
Weight loss	−13·8	5·6	−36·1	18·6	− 1·6	0·0	11·6	18·0	20·5	8·4	−31·1	0·0	13·8
Stomach pain	− 0·8	29·7	−48·0	28·1	31·4	3·5	−40·6	−26·7	43·2	3·5	−47·1	24·2	27·2
Stiff body	11·3	−8·1	−19·2	−24·4	7·8	− 2·6	5·0	44·1	−19·8	51·6	−23·0	−24·8	20·1
Runny nose	1·9	43·5	57·4	−21·3	−24·0	36·4	− 5·0	− 5·2	−36·5	10·2	−23·7	−34·2	24·9
Chest pain	− 3·0	22·0	5·3	−27·1	−20·8	8·1	58·1	54·3	−25·8	− 4·4	−35·4	−30·8	24·6
Sore throat	− 2·4	36·5	28·1	−26·5	−11·3	1·6	22·3	39·5	−38·1	8·7	−21·9	−35·7	22·7
Diarrhoea	− 2·6	47·4	−33·1	61·3	56·3	−10·1	−34·3	−27·2	12·9	−13·7	−35·5	−21·1	29·6
Pus in eyes	− 5·7	47·1	27·6	−20·5	−24·0	41·9	0·1	− 0·6	−26·1	11·0	−22·9	−27·9	21·3
Big spleen	24·6	−4·0	− 6·8	0·6	− 1·8	− 6·8	− 6·8	− 6·8	23·2	− 6·8	− 6·8	− 1·2	8·0
Ulcers in mouth	11·6	71·9	− 5·9	− 8·7	−14·5	46·9	−15·5	−16·0	−13·3	−19·8	−16·6	−19·8	21·7
Wheezing	−10·6	20·1	− 5·1	−16·2	−16·8	−13·0	59·7	65·0	−20·8	−14·8	−20·8	−27·3	24·2
Coughing blood	− 7·6	9·1	−10·4	−10·4	3·5	−16·7	69·8	40·0	−21·5	−21·5	−18·3	−15·9	20·4
Constipation	−12·9	2·6	−24·0	21·3	− 4·6	− 3·0	−22·5	−15·3	73·2	− 1·8	−23·5	14·4	18·3
Rash	− 9·8	79·1	−15·3	−10·7	− 2·3	43·8	−18·1	−14·3	−14·9	− 5·6	−14·9	−18·1	20·6
Bloody diarrhoea	−14·8	15·8	−17·6	38·9	24·6	−10·8	−16·0	−12·7	− 1·0	− 7·9	−17·1	18·5	16·3
Pus from ears	− 7·8	−5·1	− 2·3	−13·4	− 3·4	− 8·6	− 4·7	2·0	−13·4	−13·4	83·4	−13·4	14·2
Blood in urine	− 8·4	−8·4	−11·3	− 3·9	− 1·3	− 6·5	− 7·0	−11·3	2·0	−11·3	−11·3	77·6	13·4
Absolute average	15·4	26·2	22·8	18·6	15·8	15·3	20·8	21·3	21·3	12·7	28·0	25·9	20·3

*This table derived from Table 3. The average proportions for each symptom were determined; i.e. the sum of the proportions of women who associated the symptom with each disease divided by 12. The distance from the average was then determined.

TABLE 5

Disease by cluster for grouping of six clusters in Saradidi, Kenya 1981

Cluster	*Disease*
1	Tuberculosis, whooping cough
2	Cholera, gastroenteritis, worms
3	Tetanus, schistosomiasis, ear infection
4	Malaria
5	Influenza
6	Measles

Diseases Known

Measles, malaria and influenza were known by all 36 women (Table 2). Tetanus was recognized by only eight women.

Women 60 years and older knew a higher proportion of the diseases. Of a possible 108 positive responses (nine women × 12 diseases), women 60 years of age and more had 92 (85·2%), those 45 to 59 years had 77 (71·3%), those 30 to 44 years had 63 (63·0%) and those 15 to 29 had 76 (70·4%). These differences were statistically significant ($\chi^2 = 13{\cdot}95$, $df = 3$, $P < 0{\cdot}0005$).

Associations of Symptoms With Diseases

The associations of symptoms with diseases were very similar among the different age groups of women and so the results were combined. More than 90% of women associated headache, fever, vomiting, joint pain, loss of appetite, tiredness, and death with malaria (Table 3). Madness was associated with malaria by 77·8%. Many symptoms associated with malaria were also associated with measles and influenza. Major distinguishing symptoms as shown by distance from the average (DFA) were rash and ulcers in the mouth for measles (DFA = +79·1 and +71·9 respectively) and 'runny nose' and sneezing (DFA = +57·4 and +57·9) for influenza (Table 4). Conversely, difficulty breathing (DFA = −35·1) was seldom mentioned as a symptom associated with gastroenteritis. A high positive DFA denotes a strong perceived association of symptoms with disease while a high negative DFA suggests weak association.

Cluster Analysis

Malaria and measles were distinct at any grouping level with three or more clusters and malaria, measles and influenza were distinctly perceived when four or more clusters were formed. Tuberculosis and whooping cough were the most closely associated. As an example, the diseases by cluster for grouping of six clusters are shown in Table 5.

DISCUSSION

Based on symptoms, the women interviewed clearly distinguished malaria from measles and influenza. The constellation of symptoms associated with malaria were those expected. The symptoms associated with diseases other than malaria were also reasonable based on known clinical manifestations. Diseases could be separated based on perceived symptoms. The results suggest that if people in Saradidi do not obtain treatment from community health workers, it is not because they do not recognize the clinical symptoms of malaria.

Cluster analysis has been used successfully in examining the properties defining disease states (D'Andrade *et al.*, 1972; Young, 1978; Welles, 1983, 1984). The present study examined

only the association of symptoms and diseases. The respondents were asked to respond positively or negatively to a given association and were not to name specific symptoms caused by a given disease. A great variety of properties may serve as distinctive features in defining disease states (D'Andrade *et al.*, 1972). These include type of agent, body location, symptom types and order of appearance, duration of illness, degree of disability and others. Different cultures deal with, think about, and integrate disease into their wider system of beliefs, values and behaviour in different ways. Thus, while these results present associated symptoms they give little insight into disease concepts and other factors in Saradidi that will cause a patients decision to seek treatment, to take some other action or to do nothing. Similarly attitudes and beliefs regarding available health services (including traditional medicine) will also influence drug use and behaviour. These factors need to be considered in evaluating community-based health development programmes.

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Community-based distribution of family planning services in Saradidi, Kenya

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Community-based distribution (CBD) of family planning services was initiated in 1980 in Saradidi, Kenya, as part of a community development effort. Family planning information and services in each village were provided by volunteer health helpers (VHH's) chosen and supported by the people in each village. The initial examination and supply of commodities was provided at a community clinic. Less than 1% of women 15 to 49 years of age used a family planning method before CBD was initiated. In 1983, 31 (17·3%) of 179 randomly selected currently married women and 26 (52·0%) of 50 currently married VHH's reported having used a family planning method; 38 (66·7%) were still using a method at the time of the survey. Family planning use increased with age and education. Women who used family planning had higher parity, were less likely to want more children and had had a longer time since the last delivery. From 1980 to 1983, 732 persons (including 121 men) were seen at the Saradidi clinic requesting family planning services; 17·2% were referred from the VHH's. About one-third of clients referred from VHH's to the clinic for examination and commodities actually came. Allowing VHH's to carry out the initial examination and provide the first supply of commodities to the acceptors might have significantly increased the rate of family planning use. The findings demonstrate an increased use of family planning services in Saradidi following the inception of CBD.

Primary health care has been defined as '... essential health care based on practical, scientifically sound and socially acceptable methods and technology made universally accessible to individuals and families in the community through their full participation and at a cost that the community and country can afford to maintain at every stage of their development in the spirit of self-reliance and self-determination' (World Health Organization and United Nations Children's Fund, 1978).

One approach being increasingly tried to make health services universally available with full community participation at an acceptable cost is community-based distribution (CBD). CBD programmes have four essential features (Kols and Wawer, 1982): 1. Supplies and services are delivered by community residents who are not health professionals. 2. Health services are provided in each community or even in each household; clinic attendance is not required. 3. Community health workers operate relatively autonomously with no direct day-to-day supervision. 4. Many diagnostic, screening and record-keeping procedures are omitted because they are not practical for community health workers. CBD programmes increase access to health services because they bring the services closer to the community, services are provided free or for minimal charge, services are provided by people known to the community and thus are often more acceptable and this approach decreases bureaucratic problems such as long waits, lengthy forms and limited hours of operation.

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Family planning is one primary health care service that can be delivered effectively through CBD; more than 70 family planning CBD programmes have been developed worldwide (Kols and Wawer, 1982; Foreit *et al.*, 1978). However, the need continues for examining and documenting the effectiveness of such programmes.

CBD family planning was initiated in 1980 in Saradidi, Kenya, as part of a community health development effort (Kaseje and Spencer, 1987). In this study we evaluate the effectiveness of the programme and analyse the factors influencing use of community-based family planning services.

MATERIALS AND METHODS

Background

Saradidi is located in Siaya district in western Kenya near Lake Victoria. In 1979 in Siaya district the crude birth rate was 50 per 1000 population, the total fertility rate for women 15 to 49 years was 7·1 and the district was one of the most densely populated in Kenya (250 persons per km^2) (Central Bureau of Statistics, 1980, 1981; Sindiga, 1985). A survey done in Saradidi in 1979 by University of Nairobi medical students revealed that less than 1% of women 15 to 49 years of age were using any family planning method. This low rate was confirmed in discussions held with community health workers from each village.

A community-based health development programme began in Saradidi, Kenya, in 1979 (Kaseje and Spencer, 1987). The community consisted of all persons living in Saradidi. Family planning was considered to be one of the interventions which could help to reduce some of the socio-economic and health problems prevalent in the area associated with lack of adequate birth-spacing. This decision was reached during a community leaders' workshop held in August 1980. At that time the major problems experienced in the villages were identified in discussion groups. Suggestions from these groups were discussed in plenary and assigned priority. Large, poorly-spaced families were among the top ten priority problems listed.

Approach

Family planning in the community can be provided through one of three systems or a combination of these (Kols and Wawer, 1982; Foreit *et al.*, 1978):

1. A depot holder system in which family planning information and commodities are available within the community but the prospective users have to go somewhere (e.g. centre, clinic, etc.) for them.
2. An active distribution system where the information and commodities are distributed by family planning workers to users and potential users in their homes.
3. A commercial distribution system where the services and commodities are provided through local shops and users have to buy the commodities at the shops.

The community-based distribution system in Saradidi was a combination of (1) and (2).

Low utilization of family planning services can be explained by lack of knowledge by the target group about these services or by the fact that services are unavailable, inaccessible, unacceptable to the people, or too expensive. The family planning programme in Saradidi attempted to address all these possible reasons for low utilization.

Programme

The Saradidi Rural Health Programme provided family planning information and services in each village. Family planning information was brought to every household by the village health helpers (VHH's). These were volunteers chosen and supported by the village (Kaseje *et al.*, 1987*d*). One of their responsibilities was to make regular visits to each household in the village. During home visits they would encourage all potential users to accept and use family planning methods. Those who accepted had to go to the Saradidi Rural Health Programme

Centre or one of its mobile clinics, where they received a physical examination and were assisted in choosing an appropriate family planning method. The acceptor would get her first supply of commodities (pills, condoms, foam tablets, creams or jellies) from the clinic but received additional supplies in the village from the VHH. Those who required intrauterine devices (IUD's) had these inserted at the clinic and were examined there at least once every year. Between appointments, these women were visited by the VHH or went to the clinic whenever they had any problems.

Using non-formal participatory education methods described elsewhere (Kaseje *et al.*, 1987*f*), the VHH's were trained concerning the effectiveness, advantages and disadvantages of the different contraceptive methods. Possible side effects of various methods and when to refer clients to the Saradidi clinic were also discussed. The VHH's training contained sessions on communication and education methods including how to inform people about family planning methods and how to help them choose the most appropriate one in each instance. The services at the clinic were provided by a community health nurse trained in family planning. She was assisted by a family health field educator who helped supervise the VHH's, kept records and wrote reports. In 1980, the programme was initiated in 23 villages.

Survey

In 1983, a sample of women were surveyed to elicit knowledge, attitudes and behaviour was regarding family planning and the community-based delivery through the VHH's. Twelve of the 23 participating villages were randomly selected. Then two index households were randomly selected using the census list. The index households and nine nearest households were visited. All currently married women 15 to 49 years of age present were interviewed. Each household was revisited twice more to find currently married women 15 to 49 years not present on the initial visit. Interviews were conducted in Luo, the residents' language, by two female social scientists after they were trained, and the questionnaire was pretested. Information collected included age, sex, marital status, education, knowledge of contraceptive methods, practice of birth control and source of family planning supplies. Questions were also asked about parity, number of children dead, date of last delivery, whether still breastfeeding, desired family size, number of additional children wanted and history of attendance at antenatal clinics. In addition to community members, currently married VHH's were also randomly selected and interviewed.

Information Acceptors

Acceptor forms were completed in duplicate by the VHH, with one copy given to the prospective acceptor to take to the clinic and the other remaining with the VHH. The clinic copy was taken with the acceptor to the clinic and the VHH's copy was handed in with her monthly reports. Thus, the proportion of referrals from the VHH that came to the clinic could be determined. Clinic records also contained census characteristics such as age, sex, education and village as well as the family planning methods used.

RESULTS

Survey

Study Population. A total of 229 currently married women were interviewed; 179 were community members and 50 were VHH's. At the time of the survey there were 126 VHH's in Saradidi. As a group, the VHH's were older and more educated than the other women (Table 1). Most of the women (88·8% of community members and 94·0% of VHH's) were housewives and subsistence farmers. In Saradidi women are mainly responsible for growing food for the family. Only 5·6% of community members and 6·0% of VHH's were self-employed (e.g. shopkeepers). No VHH held a salaried job. The remaining community members either held salaried jobs (2·8%) or occupation was not recorded (2·8%).

TABLE 1

Family planning use in currently married women by age, education and group in Saradidi, Kenya, 1983

	Community members		*Village health helpers*	
	No. in group	*% ever using a family planning method*	*No. in group*	*% ever using a family planning method*
AGE (YEARS)				
Less than 20	25	(4·0)	—	—
20 to 29	93	(16·1)	19	(63·2)
30 or more*	60	(23·3)	31	(45·2)
Not stated	1	(100)	—	—
	179	(17·3)	50	(52·0)
EDUCATION (YEARS)				
None	51	(11·8)	—	—
1 to 4	111	(19·8)	41	(51·2)
More than 4	14	(14·3)	9	(55·6)
Not stated	3	(33·3)	1	(0)
	179	(17·3)	50	(52·0)

*Seven women were 40 to 49 years.

Parity and Number of Dead Children. Parity was high, since 63 (35·2%) community members and 22 (44·0%) VHH's had given birth to six or more children (Table 2). Few women had no children. The proportion of women with parity more than 0 reporting at least one child having died was high; 89 (52·2%) community members and 32 (66·7%) VHH's (Table 3). The observed differences between community members and VHH's were probably due to the fact that the VHH's as a group were older.

TABLE 2

Family planning use in currently married women by parity in Saradidi, Kenya, 1983

	Community members		*Village health helpers*	
Parity	*No. in group*	*% ever using a family planning method*	*No. in group*	*% ever using a family planning method*
0	9	(0)	2	(0)
1 to 3	72	(11·1)	14	(28·6)
4 to 5	33	(18·2)	12	(50·0)
6 or more	63	(27·0)	22	(72·7)
Not stated	2	(0)	—	
	179	(17·3)	50	(52·0)

Last Delivery. In 98 (57·6%) community members and 12 (25·0%) VHH's the last delivery had occurred in the previous 12 months (Table 4).

Antenatal Clinic Attendance. Family planning information and supplies were provided at antenatal clinics sponsored by the Saradidi programme, a missionary hospital or the Ministry of Health. One Hundred and sixty-seven (98·2%) community members and 46 (95·8%) VHH's reported they attended a clinic at least once during their pregnancy.

TABLE 3

Number of dead children among currently married women in Saradidi, Kenya, 1983*

No. of dead children	*Percent community members*	*Percent village health helpers*
0	48·8	33·3
1	25·9	27·1
2	14·1	10·4
3 or more	9·4	22·9
Unknown	1·8	6·3
No. of women	170	48

*Excludes nine community members and two VHH's with parity of 0.

TABLE 4

Time since last delivery and proportion of currently married women ever using a family planning method in Saradidi, Kenya, 1983

	Community members		*Village health helpers*	
Time since last delivery	*No. in group*	*% ever using a family planning method*	*No. in group*	*% ever using a family planning method*
Less than 12 months	98	16·3	12	50·0
One year or more	71	21·1	36	55·6
Unknown	1	0	—	
	170	18·2	48	54·2

Knowledge of Family Planning. Only 39 (21·8%) community members and two (4·0%) VHH's said they knew no method of family planning. Methods mentioned included pills, condoms, foam, jellies, creams, diaphragm, IUD, sterilization, abstinence, rhythm method, douche, breast-feeding and traditional herbs. Each respondent mentioned an average of 2·04 methods. The pill was the best known method, followed by the condom, IUD and rhythm method.

Practice of Birth Control. A significantly higher proportion of VHH's than community members reported ever using a birth control method; 26 (52·0%) of 50 VHH's compared with only 31 (17·3%) of 179 community members ($\chi^2 = 92{\cdot}4$, $P < 0{\cdot}000001$). Of those 57 women who had ever used a birth control method, 38 (66·7%) were still using one (20 VHH's and 18 community members) (Table 5). The differences observed between VHH's and community members in the proportion currently using a family planning method was also statistically significant ($\chi^2 = 30{\cdot}3$, $P < 0{\cdot}000001$). Reasons given for stopping family planning use included the woman wanted to have another baby, the birth control method caused side effects and 'I got pregnant'! Refusal of the husband to allow family planning practice or difficulty in obtaining supplies were also mentioned.

Characteristics of Family Planning Users. The proportion of community members who had ever used a family planning method increased by age from 4·0% of those less than 20 years to 23·3% of those 30 years of age and older (Table 1).

Although women with no formal education were less likely to have ever used a family planning method, the proportion of those who had ever used a method did not continue to increase with increasing years of education (Table 1).

Increasing parity (Table 2) and longer time since last delivery (Table 4) were also associated with increased likelihood of ever using a family planning method in both community members and VHH's. Women who desired additional children were less likely to be currently using a family planning method or to have ever practiced family planning (Table 5). However, only 15·8% of 38 women who said that they did not want more children were currently using a family planning method.

Of the 38 women currently using family planning 26·3% had been using the method for less than one year, 31·6% between one and two years and 15·8% for more than two years (26·3% had used the method for an unknown period). Only one (2·7%) woman currently using a method had received her current supplies from the VHH; 24 (63·2%) women had received supplies from the Saradidi Programme Clinic or mobile health clinics and 13 (34·2%) from other sources including government clinics and shops.

FAMILY PLANNING USERS REGISTERED AT THE SARADIDI PROGRAMME CLINIC

From 1980 to 1983, 732 family planning acceptors were registered at the clinic.

Characteristics of Acceptors

Most acceptors were female, were 20 to 29 years and had less than primary education (Table 6). Family size ranged from 0 to 15.

Forms

Only 126 (17·2%) of 732 acceptors brought forms from the VHHs. The percentage varied from village to village. Some VHHs escorted their clients to the clinic to ensure they arrived. Between 26% and 38% of clients referred from the VHHs came to the clinic.

Acceptors by Method

The Saradidi programme made available all family planning methods offered elsewhere except for sterilization and injectable contraceptives. However, most acceptors used either pills, foam or condoms. The pill was the most common: 421 (68·9%) of 611 women selected it. Condoms were used by both men and women; 16% of all condom acceptors were females who gave them to their partners. Foam was largely used as a starter method for breast-feeding women or undecided women while they waited for a time to begin taking the pill. Foam was also preferred by women whose sexual partners were away for an extended duration.

DISCUSSION

The results show an increase in the use of family planning services since 1978, when less than 1% of women 15 to 49 years used any contraceptive method. In the 1983 survey, 18 (10·1%) of 179 married women aged 15 to 49 were currently using a family planning method as were 40% of the married VHH's. The 611 women acceptors 15 to 49 years of age seen at the clinic represented 10·1% of the census population of women 15 to 49 years in areas A and B (Spencer *et al.*, 1987*h*).

TABLE 5

Currently married women in Saradidi, Kenya, 1983 who have ever used any family planning method by number of additional children desired

No. additional children desired	*Community members*			*Village health helpers*		
	No. in group	*% ever used a family planning method*	*% currently using a family planning method*	*No. in group*	*% ever used a family planning method*	*% currently using a family planning method*
None	38	26·3	15·8	15	66·7	60·0
1 or 2	76	19·7	11·8	16	56·3	43·8
3 or more	37	10·8	5·4	14	35·7	28·6
Unknown	28	7·1	3·6	5	40·0	0
	179	17·3	10·1	50	52·0	40·0

TABLE 6

Characteristics of 732 family planning acceptors registered at programme clinics in Saradidi, Kenya, 1980–1984

Characteristics	*Percentage*
SEX	
Female	83·5
Male	16·5
Age (years)	
less than 20	13·7
20 to 29	53·6
30 to 39	25·3
40 to 49	5·1
50 or more	0·8
Unknown	1·6
EDUCATION (YEARS)	
None	13·9
Less than primary	57·1
Primary or more	16·8
Not stated	12·2

This increase has not been achieved in neighbouring areas where usage of family planning is still less than 1% as determined in a family planning and nutrition survey done in 1984 in the same district in South Sakwa and West Wyoma locations. Modern contraceptive use in Kenya is considered to be almost negligible despite an estimated population growth rate of 4% and crude birth rate of 53 per 1000 population (Central Bureau of Statistics, 1980; London *et al.*, 1985). Despite the gains in Saradidi, there is need to follow the family planning acceptors to see how many continue to use contraceptive methods and the reasons for drop-out.

Some important characteristics of women who were currently using a family planning method or who had ever used one were noted. Higher proportions of women who had ever used a method were observed among older women, those with some formal education, those with higher parity, those with a longer interval since last delivery and most importantly those women who desired no additional children. Similar associations have been found in Kenya before and in most other countries with a prevalence of family planning use less than 50% (Sindiga, 1985; London *et al.*, 1985).

Most of the acceptors were women who already had large families. These results suggest that decreasing the desired number of children could significantly increase the use of family planning practices. Only four out of every 100 Kenyan women between 15 and 50 years desire fewer than six children (Sindiga, 1985). Social and cultural factors are often the most important influences leading to cessation of family planning practices.

The VHH's differed significantly in family planning practices when compared with other currently married women. The reason for the high rates of family planning use among the VHH's is unclear. One possibility is that the intensive training the VHH's received which included information about family planning may have influenced their decision to use a family planning method (Kaseje *et al.*, 1987*f*). The VHH's were also volunteers who were highly motivated towards improving health practices. The high rates of family planning use observed among the VHH's suggest that there is great interest in family planning in Saradidi.

The CBD system at Saradidi recruited 121 male acceptors. This was considered important, since family planning in Kenya is usually considered to be the duty of women only. It has been repeatedly emphasized that the participation of men is crucial to any successful fertility

programme (Sindiga, 1985). Disproportionate attention to women's attitudes and socio-economic characteristics may lead to conclusions of doubtful validity. Family planning programmes need to investigate fertility perceptions and behaviour at the household level using valid household probability samples. Only by understanding the factors affecting decisions on fertility can relevant objectives and policies be set.

It is clear from these results that the majority of family planning acceptors at the clinic were not referred from the VHH's, although the VHH's did provide information to some. Many of those referred from VHH's did not appear at the clinic, perhaps due to problems of distance, convenience and privacy. The rate of use of family planning methods in the Saradidi community might be significantly increased simply by allowing the VHH's to carry out the initial examination and provide the first supply of commodities to the acceptors. This is a policy decision that would need to be made by the Ministry of Health. The VHH's could be allowed to give the first supply of all non-clinical methods including birth control pills if they were trained to be aware of major contraindications. While this approach may not be appropriate for all VHH's, it could reduce distance as an obstacle to family planning use.

CBD of family planning has been used successfully in other areas of tropical Africa such as Zimbabwe (Kols and Wawer, 1982; Foreit *et al.*, 1978). In South-East Asia (Thailand, Philippines, Malaysia and Indonesia) the strategy is well developed. As shown in Saradidi and elsewhere, family planning can be delivered safely, effectively and inexpensively through community-based services.

All CBD programmes decrease the distance from services; reduce the cost to the user; minimize waiting time and forms required; increase hours of operation and therefore increase the access to the services; and make services available in a form more socially and culturally acceptable to the users. The programmes may vary in the number of supplies and services offered, in whether a fee is charged, in the means of delivery (e.g., by community health workers or other groups visiting households or as a depot of supplies), in whether these programmes include other health services or a research component as well, and in whether the programme is government or private.

In Saradidi, the VHH's provided treatment for malaria and other services as well as family planning. The community determined family planning to be a priority. Availability of family planning services in each village therefore increased utilization. It is likely that the number of acceptors would have markedly increased if the clients did not have to be referred to the clinic for their initial supply of commodities. People did not pay for these services in Saradidi.

Of the three systems of CBD (depot holder, active distribution and commercial distribution systems), the best strategy will be based on the programme and local situation. The rural areas may initially need the depot holder that has active family planning information, education and communication but eventually providers will require reimbursement if these services are to continue. For urban and periurban communities the commercial distribution supported by health education may be the most appropriate system.

Community-based distribution of family planning services should be successful where family planning is a recognized community health priority as in Saradidi. As shown here, this type of programme can increase the number of acceptors. Family planning supplies and services are safer than pregnancy and can be provided by volunteer community health workers with minimal training. This experience in Saradidi emphasizes the need for better understanding of attitudes and behaviour regarding fertility and contraception in order to increase the success of family planning programmes.

CBD at Saradidi has been successful. It remains to be shown that the community can support the system supplying commodities by contributing money to pay for the services.

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