

**Zeitschrift:** Acta Tropica  
**Herausgeber:** Schweizerisches Tropeninstitut (Basel)  
**Band:** 44 (1987)  
**Heft:** 2: A longitudinal study in a rural Tanzanian community 1982-1984

**Artikel:** Longitudinal study on the health status of children in Kikwawila village, Tanzania : study area and design  
**Autor:** Tanner, M. / Degrémont, A. / Savigny, D. de  
**DOI:** <https://doi.org/10.5169/seals-313827>

#### **Nutzungsbedingungen**

Die ETH-Bibliothek ist die Anbieterin der digitalisierten Zeitschriften auf E-Periodica. Sie besitzt keine Urheberrechte an den Zeitschriften und ist nicht verantwortlich für deren Inhalte. Die Rechte liegen in der Regel bei den Herausgebern beziehungsweise den externen Rechteinhabern. Das Veröffentlichen von Bildern in Print- und Online-Publikationen sowie auf Social Media-Kanälen oder Webseiten ist nur mit vorheriger Genehmigung der Rechteinhaber erlaubt. [Mehr erfahren](#)

#### **Conditions d'utilisation**

L'ETH Library est le fournisseur des revues numérisées. Elle ne détient aucun droit d'auteur sur les revues et n'est pas responsable de leur contenu. En règle générale, les droits sont détenus par les éditeurs ou les détenteurs de droits externes. La reproduction d'images dans des publications imprimées ou en ligne ainsi que sur des canaux de médias sociaux ou des sites web n'est autorisée qu'avec l'accord préalable des détenteurs des droits. [En savoir plus](#)

#### **Terms of use**

The ETH Library is the provider of the digitised journals. It does not own any copyrights to the journals and is not responsible for their content. The rights usually lie with the publishers or the external rights holders. Publishing images in print and online publications, as well as on social media channels or websites, is only permitted with the prior consent of the rights holders. [Find out more](#)

**Download PDF:** 12.01.2026

**ETH-Bibliothek Zürich, E-Periodica, <https://www.e-periodica.ch>**

<sup>1</sup> Swiss Tropical Institute Field Laboratory, Ifakara, Tanzania

<sup>2</sup> Swiss Tropical Institute Basel, Switzerland

<sup>3</sup> District Health Office, Kilombero District, Tanzania

## Longitudinal study on the health status of children in Kikwawila village, Tanzania: study area and design

M. TANNER<sup>1,2</sup>, A. DEGRÉMONT<sup>2</sup>, D. DE SAVIGNY<sup>1</sup>, T. A. FREYVOGEL<sup>2</sup>,  
CH. MAYOMBANA<sup>1</sup>, S. TAYARI<sup>3</sup>

### Summary

The paper describes the study area and the project design of a longitudinal study on the health status of children undertaken in Kikwawila village in southeastern Tanzania from 1982 to 1984. This rural village is situated in the Kilombero river plain (270 m above sea level) and extends over 50 km<sup>2</sup>. A census in 1982 (repeated in 1984) revealed that 1152 (1406) people lived in 260 (299) households of the nucleated roadside settlements of the sectors Kikwawila and Kapolo. The vital statistics showed an infant mortality rate estimate of 198/1000 which was far above the regional (140‰) and the national (137‰) averages. Over 30 tribes were recorded but 6 tribes formed 84% of the population. The population was predominantly muslim (75%). Most adult inhabitants (90%) were subsistence farmers cultivating an average of 3.7 acres per household. Rice, maize and cassava were the main crops of the area.

At the beginning of the study, the village had no village health post, dispensary or health centre and it lacked an adequate and safe water supply. A great proportion of the population (67%) had to rely on water from unprotected hand dug wells and from rivers for domestic purposes. Only half of the households had a simple pit latrine. Even when latrines were present, they collapsed after heavy rains due to loose, unconsolidated soils, termites and the high water table. These difficulties affected the sustained success of sanitation campaigns.

The study area represented a typical settlement of the Kilombero valley and was, with regard to most demographic, ethnic, agricultural and health characteristics, considered a suitable pilot area. A primary health care programme based on village health workers was implemented in parallel with complementary community based studies on the causes, interrelations and

---

Correspondence: Dr. Marcel Tanner, Swiss Tropical Institute, Socinstrasse 57, CH-4051 Basel, Switzerland

control measures of the major health problems faced by the community, and possible control measures.

**Key words:** rural community; health status; Tanzania; primary health care; applied research.

## Introduction

The longitudinal study on the health status of a rural community focused on the interactions between nutritional and immunological factors, parasitic infections and the environment. The investigations reported in this volume were undertaken in Kikwawila village (Morogoro Region, Kilombero District) in Tanzania from 1982 to 1984. The village is situated in the Kilombero river plain about 14 km northeast of the district capital Ifakara (Fig. 1), 320 km inland from the coast and approximately 270 meters above sea level.

The Kilombero river plain extends over 250 km from southwest to northeast lying between the chain of the Iringa mountains on its northwestern border and the Mahenge mountains on its southeastern border. A grassland vegetation (flood grassland) is predominant in the river plain which is flooded every year. The embankment of the plain shows "miombo", *Brachystegia* woodland, which gradually proceeds to moist primary forests on the mountain-slopes.

The alluvial soils of the plain and the alluvial fans of the Kilombero tributaries are considered suitable for agricultural development and the river is rich in fish (FAO, 1961). A large proportion of the population – with its various cultural (tribal) background practices – is engaged in either subsistence farming and/or in fishing. Rice, maize and cassava are the main food crops of the area. The demographic and agricultural features of the Kilombero riverplain as well as its potential for development have been extensively described (FAO, 1961; Jätzold and Baum, 1968).

Administratively, Kikwawila village is within the Kibaoni Ward and part of the Ifakara division of the Kilombero District (Fig. 1, Table 1). The village extends over about 50 square km, from the foot of the Udekwa mountains in the north to the Kilombero riverplain in the south (Fig. 2).

The estimated population of 2430 (census 1978; BOS, 1978) lives in four sectors: Kapolo, Kikwawila, Lower and Upper Kilama (Fig. 2). Kapolo and Kikwawila are situated along the trunk road Ifakara – Mikumi – Morogoro. The village area is crossed by the Tazara (Tanzania–Zambia) railway; there is a station, Ifakara, 3 km west of the village.

The area of the village was already populated at the beginning of this century, but Kikwawila village was registered only in 1977 (Mzee Namkina, great-grand-son of the founder of the settlement and village chairman up to 1982, personal communication). Consequently, a village government with a

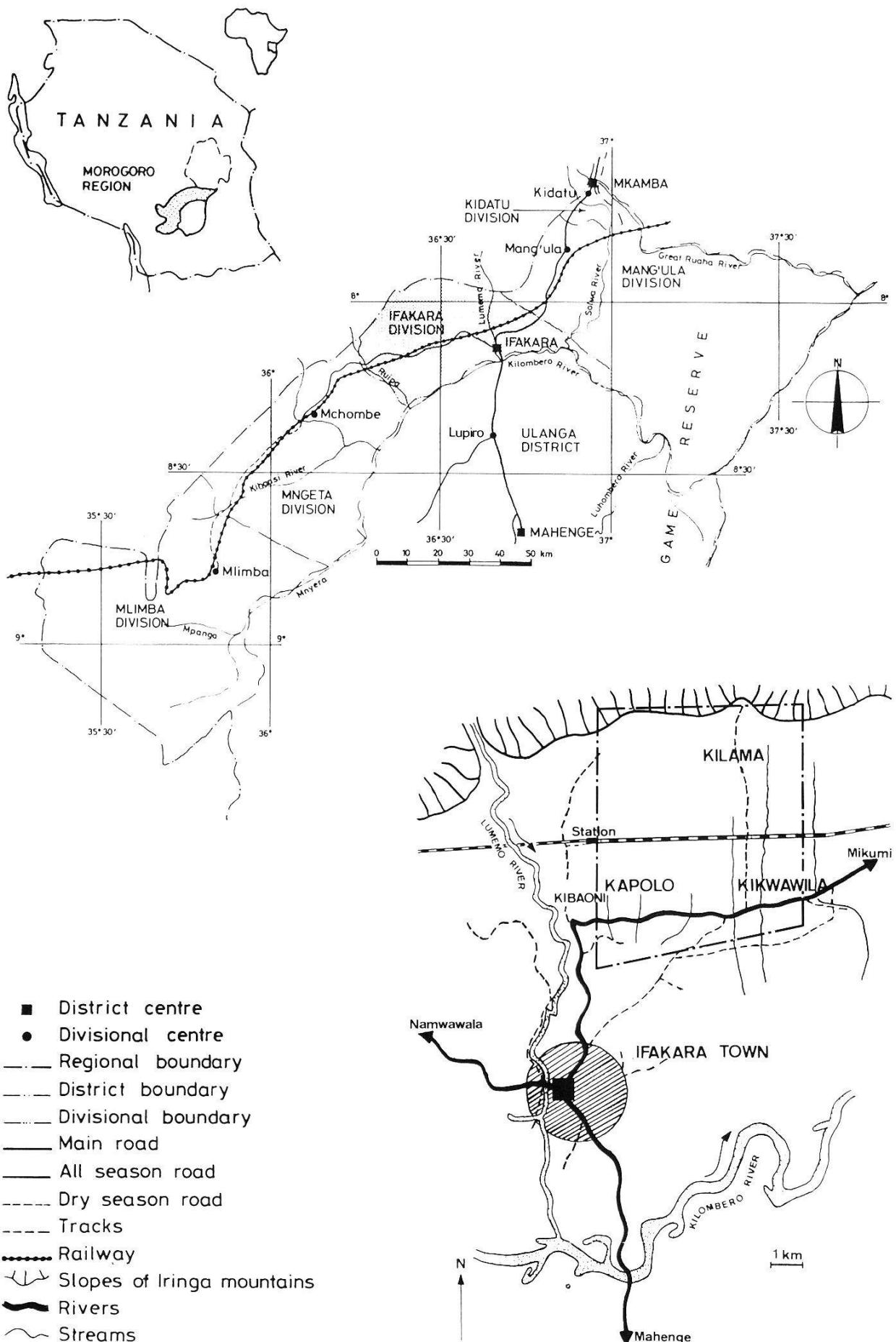


Fig. 1. Maps of the study area. A. Tanzania-Morogoro region with the Kilombero District (shaded area). B. Kilombero District with Ifakara division (shaded area). C. Part of the Ifakara division showing Kikwawila village (frame, enlarged in Fig. 2) (produced after Zumstein, 1983 and UNICEF, 1985b).

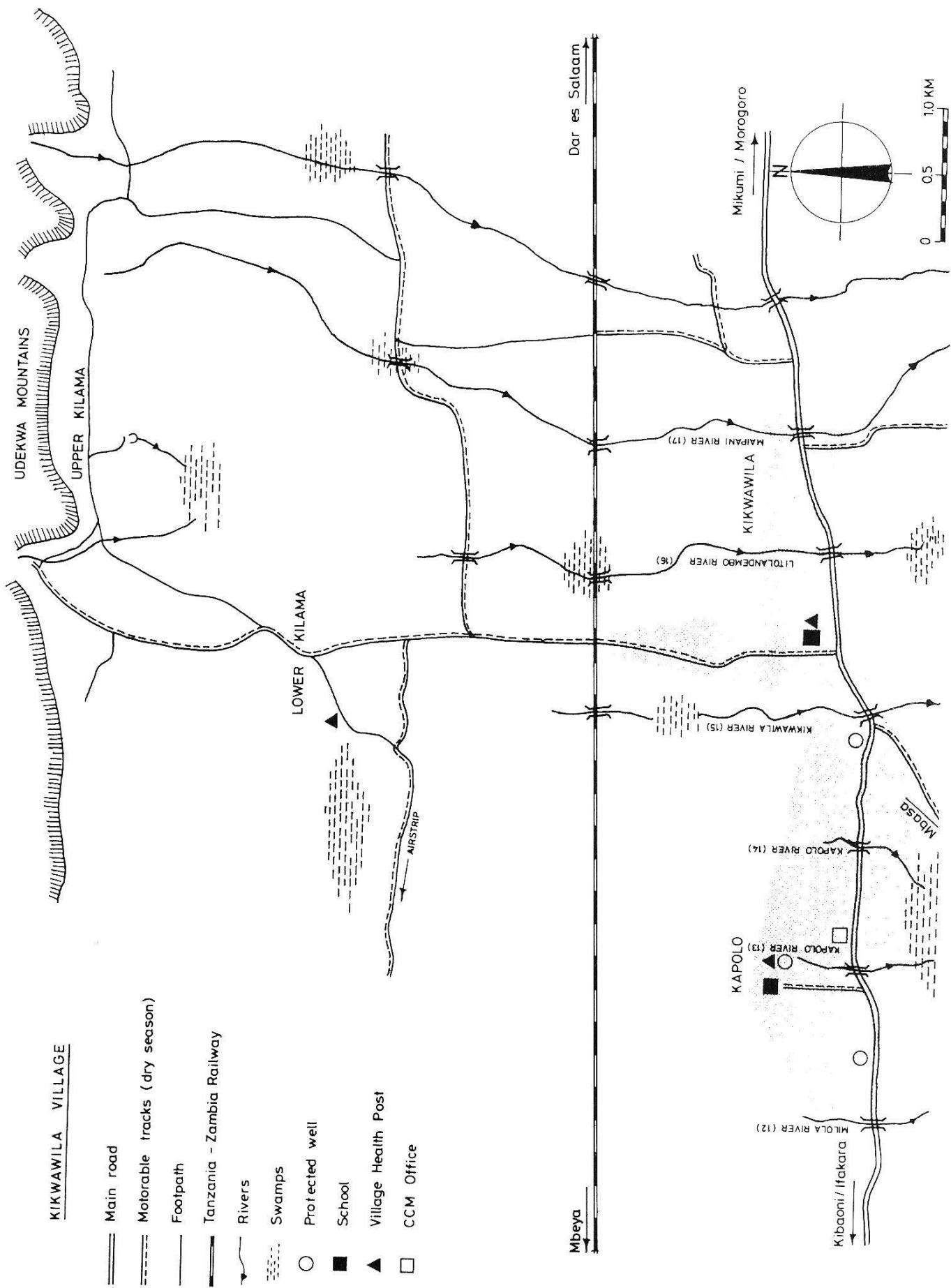


Fig. 2. Sketch map of Kikawawila village with the four sectors of which the nucleated settlements of Kapolo and Kikawawila (shaded) formed the study community.

Table 1. Kilombero District and Ifakara division<sup>a</sup>

	Area km <sup>2</sup>	Population	
		1978	per km <sup>2</sup>
Kilombero District .....	14 918	132 510	9
Ifakara division .....	~1 730	52 800 (32 000) <sup>b</sup>	31 (12) <sup>c</sup>
Kikwawila village .....	~50	2 400	48

<sup>a</sup> Based on BOS (1978) and UNICEF (1985b)

<sup>b</sup> Population estimated to live in Ifakara town area

<sup>c</sup> Population/km<sup>2</sup> excluding the town area

chairman, secretary and various committees was gradually formed. The key persons at the grassroots level are the “(ma)-balozi”, ten cell leaders. They are responsible for a small number (theoretically 10) of households. Fig. 2 also shows the position of the two primary schools in the Kikwawila and Kapolo sector, the party office, the 3 shallow wells constructed in 1982 and 1984 respectively (as part of the southern Morogoro region rural water supply programme) and the village health posts. A higher level of infrastructure in Kapolo is evident.

The Ifakara division experiences two seasons; the rainy season from November to May and the dry season from June to October (Freyvogel, 1960). A short period of rains is usually seen in November/December, followed by a dry spell in January/February before the heavy rains occur from March to April. The rain data collected at Ifakara during the study period are depicted in Fig. 4. They compare well with the comprehensive data collected earlier (Freyvogel, 1960).

The village of Kikwawila was selected for our longitudinal studies on community health problems as it showed a settlement of which most features are also found in many other rural communities of the Kilombero riverplain: such as soil, climate, demographic and agricultural structure (Jätzold and Baum, 1968). In addition, the village covers a large area (see above) and thus represents a “cross-section” of the Kilombero valley. At the initiation of the study in 1981, there were no health care facilities in the village (i.e. no dispensary, health centre or village health post) and health problems (nutritional disorders, parasitic infections) were numerous as indicated by a pilot survey among school children (Tanner et al., 1982). Medical care was generally provided at the dispensary of Kibaoni (cf. Fig. 1) and at the St. Francis Designated District Hospital in Ifakara. Only a mobile mother child health (MCH) service was run by a team of St. Francis Hospital in the Kikwawila and Lower Kilama sector nearly every month. Table 2 summarizes the diseases most often reported in the Kilombero District in 1983 (DHO, 1984).

The present paper describes the study population of the Kapolo and Kikwawila sectors and the environmental background as assessed by two censuses in 1982 and 1984. In addition, the design of the longitudinal study on the health status of children is outlined.

## 1. Results of censuses 1982 and 1984

A comprehensive census which included questions about sanitation, water supply and the cultivated acreage was undertaken by the project team among all the households of the four sectors of the village, Kikwawila, Kapolo, Lower and Upper Kilama. The census was launched in 1982 before any surveys and health interventions (cf. Fig. 5). The census using the same forms as in 1982 was repeated at the end of the first study period in 1984. Moreover, a map of the village was drawn.

As the health research project reported in this volume focused on the Kikwawila (1982: 137 households, 1984: 141) and Kapolo (123 vs 158) sectors

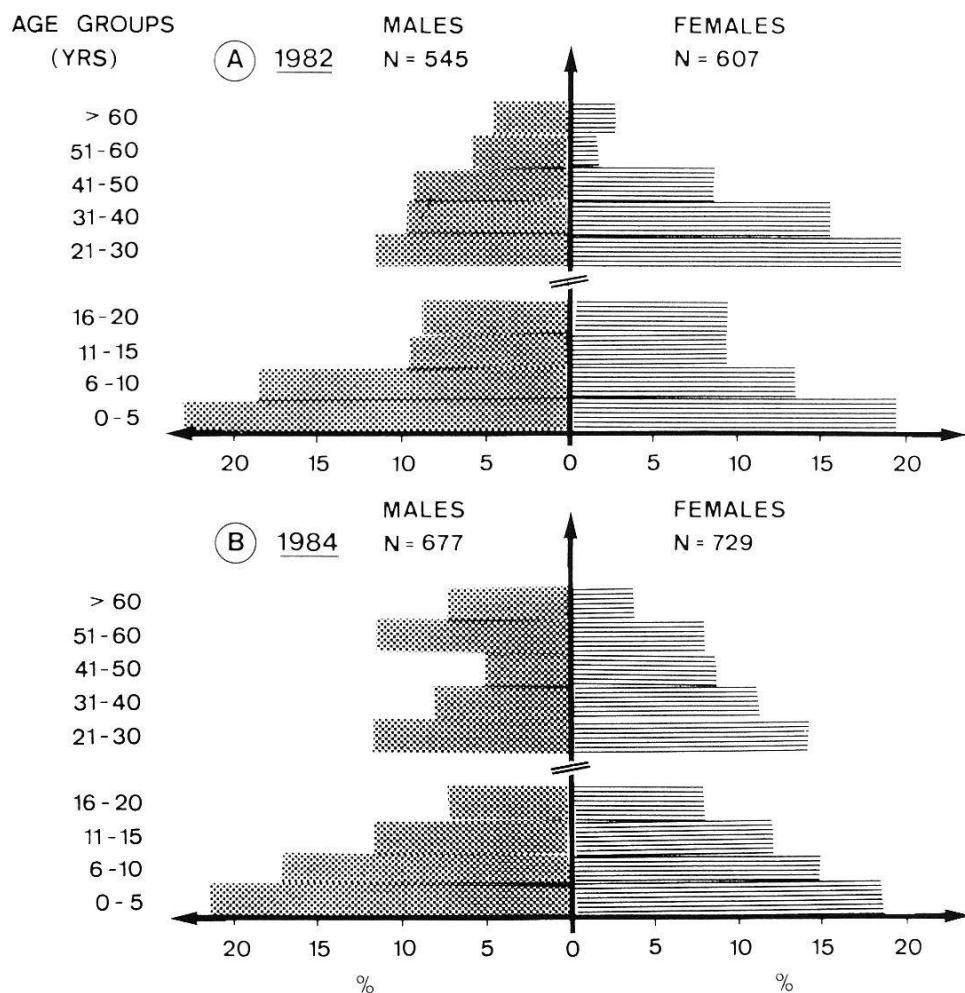


Fig. 3. Age and sex distribution among the population of the Kapolo and Kikwawila sectors according to the results of the censuses 1982 and 1984.

Table 2. Most reported diseases in the Kilombero District in 1983; based on statistics of the District Health Office (DHO, 1984)

Disease	Number of cases recorded <sup>a</sup>	%
Malaria .....	50 553	78
Schistosomiasis .....	2 876	4
Amoebiasis .....	2 024	3
Scabies .....	1 864	3
Diarrheal diseases .....	1 745	3
Measles .....	1 618	2
Hookworms .....	953	1
Other intestinal helminths .....	917	1
Tuberculosis .....	681	1
Venereal diseases .....	662	1
Leprosy .....	603	1
Malnutrition .....	574	1
Tetanus .....	48	
Filariasis .....	36	
Whooping-cough .....	12	

<sup>a</sup> at all levels of the health care delivery system, i.e. hospitals, health centres, dispensaries

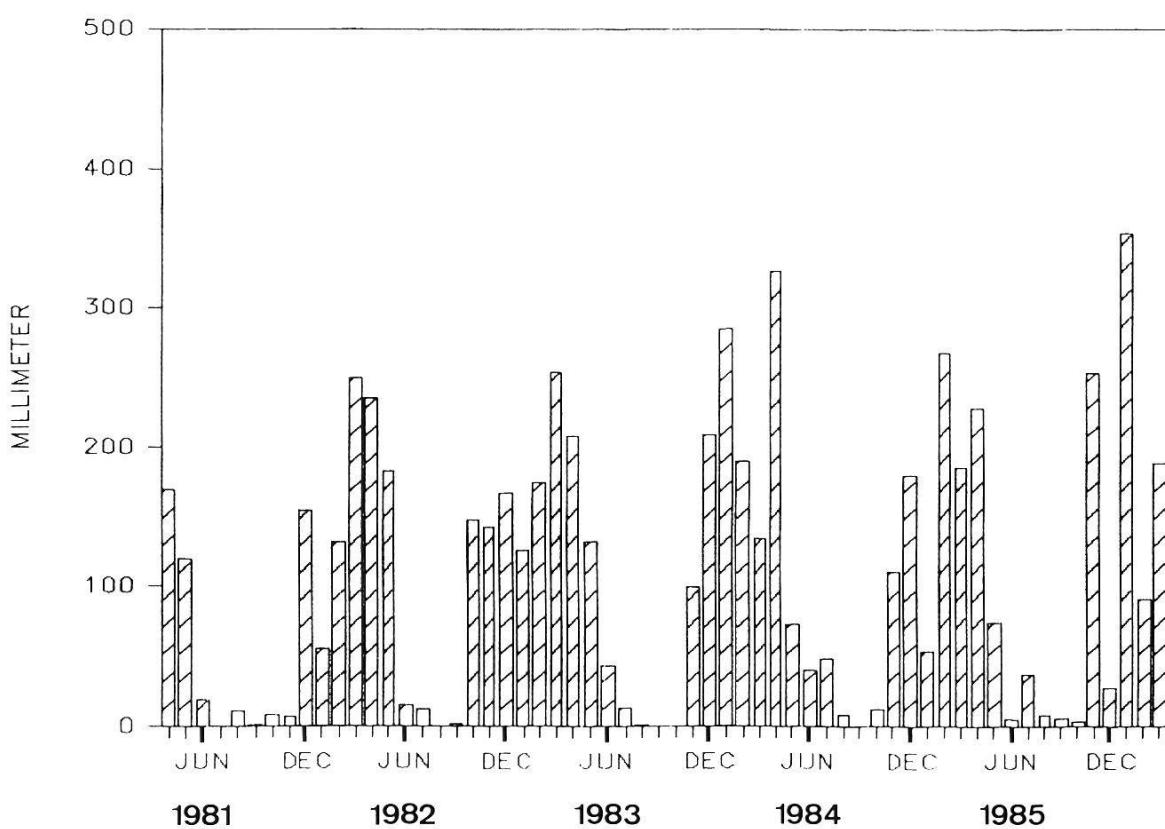
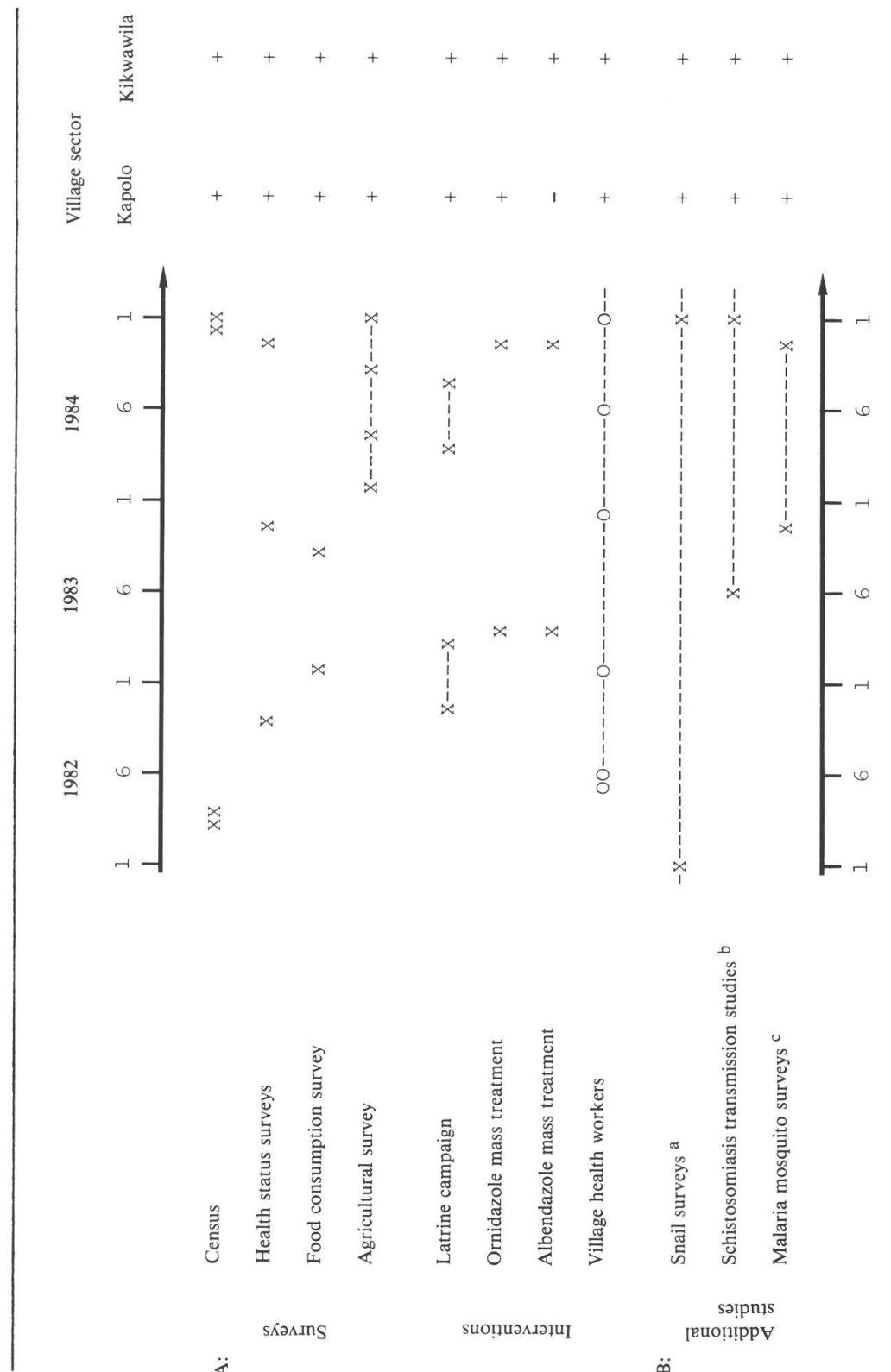


Fig. 4. Rainfall data collected in Ifakara town from 1981 to 1985.



a cf. Marti et al. (1985)

- ct. Marti et al. (1983)

b cf. Suter et al. (

c cf. Biro (1987)

x = Period of survey/intervention  
o = Training and upgrading course

0 = 1-dimensional and higher-dimensional continua

Fig. 5. Kilombero Health Research Programme: time table of surveys and interventions in the Kapolo and Kikawila sectors of Kikawila village, a rural community in southeastern Tanzania, from 1982 to 1984.

only (Fig. 2); the results of the census are given for these sectors. The data from Kikwawila and Kapolo are usually presented together; a separate analysis only follows when features of the two sectors differed significantly.

The two sectors (Kapolo and Kikwawila) represented the core structure of the village and formed the nucleated settlement along the trunk road (Fig. 2). In contrast, many households of the two Kilama sectors, not studied in this paper, were temporary and very scattered (cf. Zehnder et al., 1987).

### *Demography*

Fig. 3 shows the age and sex profile of the population of the Kikwawila and Kapolo sectors in 1982 and 1984. As the age of adults was only established by interviews or estimates, age classes of ten years were made. Age classes of five years seemed appropriate for children and adolescents as MCH (mother child health) cards were often available for children under five or as the parents could give reliable information. In 1982, 1152 people lived in 260 households (mean 4.4 per household) compared to 1406 people in 299 households (4.7) in 1984. There was a lower proportion of young adult males (21–40 yrs) when compared to females of the same age. On the other hand, there were clearly more old males (>50 yrs) than females in the village. A vital statistics survey for 1984 and the records of the village health workers revealed a crude birth rate of 54/1000, a crude death rate of 17/1000 resulting in a natural increase rate of 37/1000. The infant mortality rate was at 198/1000 (STIFL/DHO, 1985).

Table 3 shows the proportions of the six most frequent tribes in the Kikwawila and Kapolo sectors. It is important to note that 31 different tribes were recorded in 1982 and 33 in 1984. This ethnic heterogeneity may be explained by the fact that firstly, Kikwawila became an official village following the Tanzania-wide process of villagisation in 1974 and secondly the village is close to the district capital and a railway station.

In 1982 and in 1984, 75% of the population stated to be Muslims, 23% Christians and 2% animists.

Table 3. Proportion of the six most frequent tribes in the Kikwawila and Kapolo sectors in 1982<sup>a</sup>

Tribe	Proportion % (n = 1152)
Ngoni .....	24
Ndwewe .....	15
Ngindo .....	13
Ndamba .....	12
Pogoro .....	10
Mbunga .....	10
25 others .....	16

<sup>a</sup> data from census among 260 household; the results of the census 1984 (299 households) gave the same proportions.

Most adult inhabitants (90%) were subsistence farmers. The remaining 10% (mainly men) were teachers, craftsmen or workers in public services at the district headquarter in Kibaoni (Fig. 1). In 1982, 231 out of 260 households cultivated fields of  $\geq 0.5$  acres (mean 3.7 acre per household). All households cultivated rice. Maize and/or cassava were found in half of the households. The village has had a community rice field of approx. 40 acres on a co-operative basis since 1984. The agricultural situation was comprehensively assessed in 1984 (Zehnder et al., 1986). It is described later in this volume (Zehnder et al., 1987) as well as a study on food consumption patterns during the lean (February) and the post-harvest season (August) of 1983 (Tanner and Lukmanji, 1987, this volume).

#### *Houses, water supply and sanitation*

Table 4 shows the proportion of the four different house types found in the Kikwawila and Kapolo sectors. All the houses were rectangular; most of them (84%) had mud walls and were covered with grass ("manyasi") or palm leaf mats ("makuti"). The walls were often reinforced by a wood or bamboo wattle. The walls of one house were entirely built of reeds ("matete") and covered with grass (not mentioned in Table 4). Mud walls predominated. Bricks when used were made from local clay and subsequently burned. Adobe walls were only occasionally found. Gabled roofs were predominant. Larger houses sometimes had hipped roofs.

The members of the households were asked where they usually drew water for drinking and cooking. The results revealed significant differences between the two village sectors (Table 5). People from the Kapolo sector chiefly frequented the nearby protected wells (Fig. 2) while the population of the Kikwawila sector had to rely on hand dug wells and river water. A detailed study on the human water contact activities in the Kikwawila and Kapolo sectors with special regard to the transmission of schistosomiasis has recently been compiled (cf. Fig. 6, Lwihula 1985).

Table 4. Types of houses in the Kikwawila and Kapolo sectors; data from census 1982

Wall	Roof	Number	%
Mud	grass or palm leaves .....	220	83.3
Mud	corrugated iron sheets .....	31	11.7
Bricks	corrugated iron sheets .....	12	4.6
Bricks	grass .....	1	0.4
		Total	264 <sup>a</sup>
			100

<sup>a</sup> more than 260 houses surveyed, as a few of the 260 households had more than one house, forming a family hamlet

During both censuses (1982 and 1984) the latrine situation was assessed. In addition, a sanitation survey was undertaken at the end of each campaign to promote latrine construction in the village. The latrines were conventional pit latrines with a mud/wattle superstructure and a thatched roof. No additional structures such as ventilation pipes or draped pieces of sacking soaked in motor oil were installed to prevent flies. Some villagers dumped used motor oil into the pit to prevent flies and smell. Table 6 summarizes the assessment of the latrine situation during the period of study. Latrine campaigns promoted by the project and undertaken by the staff of the District Health Office occurred just before the latrine surveys of March 1983 and November 1984 (cf. Fig. 5). The campaigns resulted in a slight increase of the proportion of good latrines (good = latrine completed with elevated slab, walls and roof) used by household members (cf. Table 6). There was a significant decrease of the proportion of households without a latrine following the campaign. Only 6% of the households

Table 5. Main sources of water for domestic purposes; answers obtained from 299 households during census 1984

Village sector	N	Source, % frequented		
		Protected well <sup>a</sup>	Hand dug well	River
Kapolo . . . . .	158	55	45	-
Kikwawila . . . . .	141	13	82	5

<sup>a</sup> shallow wells built by District Water Engineer as part of the southern Morogoro region rural water supply programme; two along trunk road in 1982, one at Kapolo school in 1984 (cf. Fig. 2)

$\chi^2 = 62.41$  (df = 2), P < 0.001

Table 6. Proportion of households with latrines in the Kikwawila and Kapolo sectors during the survey period 1982–1984

Pit latrine	Condition	March 1982	March 1983	January 1984	November 1984
Present . . . . .	good <sup>a</sup>	57%	66%	52%	69%
Present . . . . .	bad/under repair <sup>b</sup>	NA	16%	25%	NA
None . . . . .	-	43%	18%	24%	31%
Number of households . . . . .		260	272	292	299

<sup>a</sup> good condition (= latrine completed with elevated slab, walls and roof) and used by household members

<sup>b</sup> broken down and hardly used

NA = not assessed. These data (1982, November 1984) came from the census where the latrines were not inspected.

(17/299) were found without a latrine in all surveys. Twelve of the 32 (38%) newly built houses from March 1982 to February 1984 had good latrines. Pit latrines were added to new constructions only after completion of the house, i.e. if funds were still available.

The rainy season led to the destruction of many latrines. The assessment showed that 27% (71/260) of the households lost their latrines in the period 1982/83. On the other hand, many households which were without a latrine in 1982 built a new one during the campaign (1982/83: 31/260, 12%). Some households had a pit latrine in permanent state of construction simply to show and to impress people during latrine surveys after the campaign. These results and Table 6 show that there was a great variation in the latrine situation even within the two years of the study. This may reflect social and cultural factors of acceptance of latrines by the population (Lwihula, 1985) as well as the problems of maintenance and difficulties in constructing long-lasting pits (loose, unconsolidated soils, termites and temporary high water table in the rainy season).

## 2. Design of longitudinal study

The present project was undertaken to

- conduct repeated cross-sectional studies among children of a rural community and to investigate how interactions between nutrition, parasitic infections, immunity and environmental factors govern their health status, and
- evaluate various health interventions such as primary health care (PHC) implementation, selective population chemotherapy, health education, sanitation and schistosomiasis transmission control.

These goals required that the study should be conducted over several years. Furthermore, it was essential to combine the research component with the PHC component in order to achieve community involvement and participation. Fig. 5 summarizes the arrangement of the study, the sequence of the surveys undertaken and the health interventions initiated between January 1982 and December 1984. The present volume focuses on part A. Part B of Fig. 5 lists the studies on the transmission dynamics of urinary schistosomiasis in Kikwawila village before and after transmission control measures. These results are presented elsewhere (Zumstein, 1983; Marti et al., 1985; Suter, 1986; Suter et al., 1986; Lwihula, 1985). The results from the first anopheline surveys in Kikwawila village are reported by Biro (1987).

Fig. 5 (Part A) shows that the *census* was the first activity in Kikwawila village after the district and village governments had agreed to the study and the population had been informed during the monthly meetings of the villagers. The *surveys on the community health status* (Tanner et al., 1987, this volume) were followed by control measures. These were launched only after joint discussions with the village leaders, i.e. chairman, secretary, elders, teachers, "balozi" (ten cell leaders). A description of the *PHC component*, the activities of

Table 7. Number of children (1 month to 15 years) examined during the surveys on the community health status

Children seen	Number	Proportion of first survey	Census <sup>a</sup>
1982 .....	565	–	536
1983 .....	552	–	ND
1984 .....	588	–	673
1982 and 1983 .....	297	53%	–
1982 and 1984 .....	224	40%	–
1983 and 1984 .....	221	40%	–
1982, 1983 and 1984 .....	170	30%	–

<sup>a</sup> number of children (1 month to 15 years) as revealed by the census 1982 and 1984 (cf. Fig. 3) are added for comparison.

village health workers, is found below, while the *latrine campaign* followed by *mass treatments* against giardiasis and hookworm are outlined in Tanner et al. (1987, this volume).

Table 7 summarizes the number of children (1 month to 15 years) examined each year during the cross-sectional surveys on the community health status. The number of children of the same age established by the census are added for comparison and allow estimates of the compliance rate. The number of children seen during the survey 1982 is larger than the number in the census data, as children also came from the scattered houses around the core settlements of the Kikwawila and Kapolo sectors (Fig. 2).

As all the children were identified by their name, age, sex, household and "balozi", they could be followed during the period of study. Table 7 shows that 40–53% of the children were seen twice and 170 children (30%) could be examined over three consecutive years. Most data presented in the following papers of this volume focus on this cohort of 170 children. The age and sex structure of the different groups of children studied is presented in the following paper (Tanner et al., 1987).

### 3. The primary health care (PHC) component

The objectives of the longitudinal study suggested that the research component should be linked to the health care system at community level. In order to understand the role of the PHC component of the project and its relation to control measures and health status surveys (Fig. 5, part A), the major elements of the PHC programme emphasising village health workers (VHW) are briefly outlined. A comprehensive description and first evaluation of the programme is found elsewhere (STIFL/DHO, 1985).

As mentioned above, the village was without health care facilities, i.e. without a village health post, a dispensary or a health centre, at the beginning of the study (pilot survey 1981; Tanner et al., 1982). A mobile MCH clinic of the district hospital made monthly visits to the Kikawila and Lower Kilama sectors of Kikawila village. After discussions with the village leaders and the District Authorities, the joint PHC project between the District Health Office and the Swiss Tropical Institute Field Laboratory was launched. The initial aim was to introduce VHW in the large village of Kikawila and the village of Namawala (36 km W of Ifakara). The introduction of VHW followed the Tanzanian National Guidelines on PHC (Ministry of Health, 1983). The VHW were selected by the community but supervised by and responsible to the district health services. The selection criteria for VHW were permanent residence in the village/village sector, interest in health work and the community, and preferably one male and one female should be selected per village/village sector. The village selected three VHW in May 1982. After an initial training of 14 days at the dispensary in Kibaoni (see Fig. 1), they started their work in the Kapolo, Kikawila and Lower Kilama sectors in June 1982. The village selected three additional VHW in December 1982. Despite the emphasis on the selection criteria during the meetings with the villagers, only males were selected. Only when two VHW dropped out (June 1984 and November 1984) were women subsequently selected to replace them. All VHW were literate but had no previous health care training.

The training and up-grading of VHW differed from the national guidelines inasmuch as the initial training lasted only 14 days and took place at district level (guidelines and national pilot projects: 3 to 4 months at regional level and no regular up-grading courses). Up-grading courses were held every 3 to 4 months for 5 to 10 days (timetable see Fig. 5). The initial VHW training and the up-grading courses covered the topics that enabled the VHW to cope with the following activities:

- registration of patients attending the health post (name, age, sex, complaint, diagnosis, treatment);
- management of common diseases/conditions; wounds, fever/malaria, abdominal pain, diarrhoea, cough, chest pains, headaches;
- identification of malnutrition and participation in the monthly mobile MCH clinics (weighing of children together with the MCH staff);
- home visits for the promotion of MCH activities, identification of risk families (nutritional and social problems), detection of chronic cough (TB), education on health problems and sanitation;
- referral of patients to the dispensary at Kibaoni or to the district hospital;
- registration of birth and death in their village/village sector and recording of monthly statistics on attendances and treatments (incl. drug distribution).

VHW were supposed to work half-time and to alternate preventive activities in their sectors and curative activities at their village health post (a room in

the premises of the schools of Kapolo and Kikwawila, the house of a balozi in Lower Kilama). The project provided the funds for the assignment of the VHW to the village. VHW received a monthly allowance of TSH 250.- (US \$ 13.- at 1985 rates; now the national guidelines propose TSH 300.-). It was agreed that the payment of this allowance would be progressively handed over from the project to the village and that by mid-1985 the village would entirely pay it from its own development budget.

Contacts with traditional healers and traditional birth attendants who live in Kikwawila village were not formally planned, but were established by the VHW showing that competition between them and the VHW does not seem to be important. Traditional healers deal mostly with health problems other than those a VHW was trained to handle, e.g. with psycho-somatic problems, fertility, hernia.

Drugs and the basic equipment for the village health post were provided by the district pharmacy. The Tanzanian essential drug program does not yet cover village health posts. The village health posts were supervised once or twice per month by a medical assistant or a medical doctor of the project.

An average of 20 patients was seen at a village health post every day. The monthly frequencies of the various diseases/conditions seen by the VHW as well as the drugs prescribed are presented in a detailed report (STIFL/DHO, 1985) and are also summarized and discussed in a paper of this volume (Degrémont et al., 1987). The estimated recurrent cost (excluding training, supervisory visits) was TSH 2.3 (US \$ 0.12, 1985 rates) per patient and attendance (mean: 600 attendances/month and village health post), i.e. the costs per village per capita will amount to TSH 9.- (US \$ 0.5).

Besides their routine work VHW were involved in the longitudinal study of the health status of children in Kapolo and Kikwawila sectors. Their involvement included:

- information of the population about planned surveys;
- participation in the census;
- distribution of stool containers the day before the surveys and motivation of the population to participate in the surveys;
- participation in the annual health status surveys (cf. Fig. 5), i.e. identification of children and adults attending the surveys (names to ensure follow-up, household, estimation of age), health information and education of people waiting for the examinations;
- feedback to the population, distribution of forms with survey results;
- participation in the latrine campaign (cf. Fig. 5) through health education and construction of prototypes at their homes;
- motivation of the population to participate in mass treatments against giardiasis and hookworm (cf. Fig. 5).

The evaluation of the first three years revealed that the VHW were very popular, mainly because of their curative activities. It is suggested that close

supervision, diagnostic and treatment guidelines adapted to the local conditions, the referral system and the regular drug supply have contributed to this achievement. VHW seem well motivated which is reflected in the low drop-out rates, their regular work and the continuation of their work even when the village failed to pay regularly its contribution to the allowance. While the curative activities are well performed and seem to meet the needs of the population, the preventive activities still need to be improved. VHW made few home visits and did not yet become involved in regular health education programmes and in planning of village development activities (water, sanitation). The village had great difficulty in paying regularly the allowances of their VHW after the project gradually decreased its contribution to the village. Finally, the supervision of the VHW is not yet integrated into the routine activities of the staff of the District Health Office (cf. STIFL/DHO, 1985).

In summary, the VHW were well accepted by the population and the initial phase of this PHC component should provide a sound basis for future consolidation of the curative tasks of VHW and for an expansion of their preventive activities. VHW have also significantly contributed to the smooth implementation of the various research activities (see Fig. 5, parts A and B); mainly the annual cross-sectional health status surveys and the schistosomiasis control activities where the population became involved and started to participate in control measures (Tanner et al., 1986; Suter, 1986).

## Conclusions

The study area, Kikwawila village, represents a typical rural roadside settlement of the Kilombero valley, characterized by cultural heterogeneity, subsistence farming, traditional housing conditions and a lack of adequate sanitation and water supply. The climate and the soil conditions are comparable to those in other areas in the Kilombero valley (Freyvogel, 1960; FAO, 1961; Jätzold and Baum, 1968).

The age and sex structure of the population has the features of a typical rural settlement in Tanzania (ILO, 1982). Young adult males are underrepresented as they frequently work in urban areas or are engaged in activities outside the village (fishing). Females seem to die earlier than men; a higher proportion of old males ( $>50$  yrs) were recorded. Migration of the population was considered important but could not be quantified; the scattered settlements of Lower and Upper Kilama showed 10–15% new or abandoned houses. Only one third of all children (1 month–15 yrs) of Kikwawila/Kapolo could be followed over 3 consecutive years (Table 7); due to migration of the population, temporary absence from the village and possibly due to deaths. The infant mortality rate as established by a vital statistics survey in 1984 was striking (STIFL/DHO, 1985); 198/1000 was far above the regional average of 140/1000 and the most recent national estimate of 137/1000 (UNICEF, 1985a, b). Infant

mortality rates vary substantially between regions in Tanzania (range 76–161/1000; BOS, 1978; UNICEF, 1985a). The communicable diseases and the nutritional problems endemic in Kikwawila village (Tanner et al., 1982, 1987; Tanner and Lukmanji, 1987) are of major importance in the whole Kilombero District (DHO, 1984; UNICEF, 1985a, b) and the Morogoro Region (UNICEF, 1985a).

At the beginning of the study the village had few safe water sources and the population had to rely on water from the river or hand dug wells for domestic purposes; this is the situation in two thirds of rural Tanzanian communities (ILO, 1982). A similar situation applies for the safe disposal of excreta. Not more than two thirds of the population had access to, and seemed to use, simple pit latrines. According to recent reports (ILO, 1982), this agrees quite well with the average figures established for Tanzania in 1977.

Consideration of all these features showed that Kikwawila was a suitable pilot area for applied research on health problems of the Kilombero district. In addition, at the time of the initiation of the study the village had no village health post, dispensary or health centre. Only a mobile MCH team of the district hospital visited two of the four village sectors nearly every month.

The project was launched after the first census, and PHC emphasising village health workers was implemented following Tanzania national guidelines and priorities (Tanzania Ministry of Health, 1983). Longitudinal community-based studies reported below (cf. also Fig. 5) were intended to elucidate the causes and interrelations of the major health problems faced by the community and to lead to applicable control measures against them. The PHC component and the research component aimed to stimulate each other and identify methods and measures likely to ensure community participation (Lwihula, 1985; Tanner et al., 1986). The overall goal was to develop a strategy for health care that could be applied to other rural communities with similar features.

Biro S.: Investigations on the bionomics of anopheline vectors in the Ifakara Area, Kilombero District, Morogoro Region, Tanzania. Ph. D. Thesis, University of Basel 1987.

BOS (Bureau of Statistics), Ministry of Finance & Planning: 1978 population census, preliminary report. Dar es Salaam 1978 (n/d).

Degrémont A. A., Lwihula G. K., Mayombana Ch., Burnier E., de Savigny D., Tanner M.: Longitudinal study on the health status of children in a rural Tanzanian community: comparison of community-based clinical examinations, the diseases seen at village health posts and the perception of health problems by the population. *Acta trop.* (Basel) 44, 175–190 (1987).

DHO (District Health Office): Health situation Kilombero District. Report by District Medical Officer MED, A. I./84 (1984) (n/d).

FAO: The Rufiji Basin Tanganyika. FAO expanded technical assistance program. No. 1269, Rome 1961.

Freyvogel T. A.: Einige meteorologische Daten aus Südtanganyika. *Acta trop.* (Basel) 17, 365–374 (1960).

ILO (International Labour Office): Basic needs in danger, a basic needs oriented development strategy for Tanzania, 416 p. ILO, Addis Ababa 1982.

Jätzold R., Baum E.: The Kilombero valley, characteristic features of the economic geography of a semihumid East African flood plain and its margins. München (Weltforum Verlag), London (C. Hurst & Co.), New York (Humanities Press Inc.) 1968.

Lwihula G. K.: Human behaviour factors associated with transmission and control of *Schistosoma haematobium* in Ifakara area, Morogoro, Tanzania. 311 p. Ph. D. Thesis, University of London 1985.

Marti H. P., Tanner M., Degrémont A. A., Freyvogel T. A.: Studies on the ecology of *Bulinus globosus*, the intermediate host of *Schistosoma haematobium* in the Ifakara area, Tanzania. *Acta trop.* (Basel) 42, 171–187 (1985).

Suter R.: The plant molluscicide *Swartzia madagascariensis* and its application in transmission control measures against *Schistosoma haematobium*; experience from Kikwawila (Kilombero District, Tanzania). Ph. D. Thesis, University of Basel 1986.

Suter R., Tanner M., Borel Ch., Hostettmann K., Freyvogel T. A.: Laboratory and field trials on the feasibility and applicability of the plant molluscicide *Swartzia madagascariensis*. *Acta trop.* (Basel) 43, 69–83 (1986).

Swiss Tropical Institute and Kilombero District Health Office: Collaborative primary health care project in Kilombero District, Tanzania. Working Document STIFL/DHO 1 (1985).

Tanner M., Lukmanji Z.: Food consumption patterns in a rural Tanzanian community (Kikwawila village, Kilombero District, Morogoro Region) during lean and post-harvest season. *Acta trop.* 44, 229–244 (1987).

Tanner M., Marti H. P., Branderhorst E.: Prevalence of parasitic infections among rural Tanzanian school children in relation to their nutritional status. *Mol. biochem. Parasit. Suppl.* 283–284 (1982).

Tanner M., Lwihula G. K., Burnier E., de Savigny D., Degrémont A.: Community participation within a primary health care programme. *Trop. Med. Parasit.* 37, 164–167 (1986).

Tanner M., Burnier E., Mayombana Ch., Betschart B., de Savigny D., Marti H. P., Suter R., Aellen M., Lüdin E., Degrémont A. A.: Longitudinal study on the health status of children in a rural Tanzanian community: parasitoses and nutrition following control measures against intestinal parasites. *Acta trop.* 44, 137–174 (1987).

Tanzania Ministry of Health: Guidelines for the implementation of the primary health care programme in Tanzania. Ministry of Health, Dar es Salaam 1983.

UNICEF: Analysis of the situation of children and women. 483 p. UNICEF, Dar es Salaam 1985a.

UNICEF: Programme for child survival and development in Morogoro Region 1987–1991. UNICEF, Dar es Salaam 1985b.

Zehnder A., Tanner M., Suter H., Jeje B., Freyvogel T. A.: Agricultural survey in a rural Tanzanian Community (Kikwawila village, Kilombero District, Morogoro Region). TFNC report No. 1005, 110 p. (1986).

Zehnder A., Jeje B., Tanner M., Freyvogel T. A.: Agricultural production in Kikwawila village, southeastern Tanzania. *Acta trop.* (Basel) 44, 245–260 (1987).

Zumstein A.: A study of some factors influencing the epidemiology of urinary schistosomiasis at Ifakara (Kilombero District, Morogoro Region, Tanzania). *Acta trop.* (Basel) 40, 187–204 (1983).