

Monitoring of community health status : experience from a case study in Tanzania

Autor(en): **Tanner, M. / Savigny, D. de**

Objekttyp: **Article**

Zeitschrift: **Acta Tropica**

Band (Jahr): **44 (1987)**

Heft 2: **A longitudinal study in a rural Tanzanian community 1982-1984**

PDF erstellt am: **25.05.2024**

Persistenter Link: <https://doi.org/10.5169/seals-313834>

Nutzungsbedingungen

Die ETH-Bibliothek ist Anbieterin der digitalisierten Zeitschriften. Sie besitzt keine Urheberrechte an den Inhalten der Zeitschriften. Die Rechte liegen in der Regel bei den Herausgebern.

Die auf der Plattform e-periodica veröffentlichten Dokumente stehen für nicht-kommerzielle Zwecke in Lehre und Forschung sowie für die private Nutzung frei zur Verfügung. Einzelne Dateien oder Ausdrucke aus diesem Angebot können zusammen mit diesen Nutzungsbedingungen und den korrekten Herkunftsbezeichnungen weitergegeben werden.

Das Veröffentlichen von Bildern in Print- und Online-Publikationen ist nur mit vorheriger Genehmigung der Rechteinhaber erlaubt. Die systematische Speicherung von Teilen des elektronischen Angebots auf anderen Servern bedarf ebenfalls des schriftlichen Einverständnisses der Rechteinhaber.

Haftungsausschluss

Alle Angaben erfolgen ohne Gewähr für Vollständigkeit oder Richtigkeit. Es wird keine Haftung übernommen für Schäden durch die Verwendung von Informationen aus diesem Online-Angebot oder durch das Fehlen von Informationen. Dies gilt auch für Inhalte Dritter, die über dieses Angebot zugänglich sind.

Swiss Tropical Institute, Basel, Switzerland
Swiss Tropical Institute Field Laboratory, Box 53, Ifakara, Tanzania

Monitoring of community health status: experience from a case study in Tanzania

M. TANNER, D. DE SAVIGNY

Summary

The experience from the first four years of a longitudinal study on interrelations between nutrition, parasitic infections, immunity and environmental factors in a rural community, Kikwawila village (southeastern Tanzania) is reviewed. Two elements supported the implementation of the project. Firstly, the multidisciplinary approach with surveys across a range of biomedical and agricultural science disciplines has enabled the elucidation of part of the complexity of the mutually reinforcing, changing interrelations which can affect child health. Secondly, the primary health care component based on village health workers which paralleled the research project has facilitated the longitudinal character of the study and has triggered some community participation. The studies also indicated that the indigenous perceptions of disease, signs and symptoms may be used as an integrative tool to monitor health care programmes. Already during an initial stage of a project, the indigenous health perspectives could become indicators for community participation and could help to determine the strategy of applied research and control measures within primary health care.

Key words: Tanzania; primary health care; biomedical research; rural community; multidisciplinary approach.

Introduction

The Swiss Tropical Institute has had contacts with Ifakara for 37 years, and the field laboratory has existed since 1957. It was only after the intensive training commitment at the Medical Assistant Training Centre (MATC) was

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

handed over in 1978 to the Tanzanian Authorities that a major reorientation in research could occur. The St. Francis Designated District Hospital was in charge of curative services, the MATC formed the training component and the District Health Office was supervising the whole health care system in the District with particular reference to preventive services. The Swiss Tropical Institute in collaboration with the National Institute for Medical Research understands its role as a centre that can provide applied and operational research data to strengthen both the curative and the preventive health services of the District. Locally, the collaboration was established between the District Health Office, St. Francis Hospital, MATC and the Swiss Tropical Institute Field Laboratory. It was also hoped that the results of studies in the Ifakara area could be extended to other areas in Tanzania.

The reports presented in this volume are part of the ongoing Kilombero Health Research Programme and represent the experience gained during the initial phase of four years of a longitudinal study on interactions between nutritional status, parasitic infections, immune status and environmental factors in a large rural Tanzanian community, Kikwawila village. In attempting to review briefly the achievements and problems of this initial phase, one has to recall the description of the study area and the study design and the initial objectives (Tanner et al., 1987a). The latter can be summarized as follows: The project intended to (i) conduct repeated cross-sectional studies among children and to investigate how interactions between nutrition, parasitic infection, immunity and environmental factors govern their health status, and (ii) evaluate various health interventions such as primary health care (PHC) implementation, selective population chemotherapy, health education, sanitation and schistosomiasis transmission control. The design and the objectives of the project suggested two major prerequisites: 1. A multidisciplinary approach and 2. a primary health care component.

1. Multidisciplinary approach

It became evident that longitudinal surveys across a range of biomedical, agricultural and social science disciplines were required to understand the various levels of the mutually reinforcing relationship between nutrition, infection and immunity (Fig. 1). Food production and food consumption as well as attitudes to health, health problems and disease had to be investigated besides the monitoring of the health status of children through clinical, parasitological, serological and nutritional data. All the previous papers of this volume have attempted to approach these different elements, which are schematically shown in Fig. 1 within a community representative of those in the Kilombero river plain. However, the social and economic element of the circle(s) of interrelations have so far been touched only superficially. Only the investigations of the human behaviour and social factors influencing schistoso-

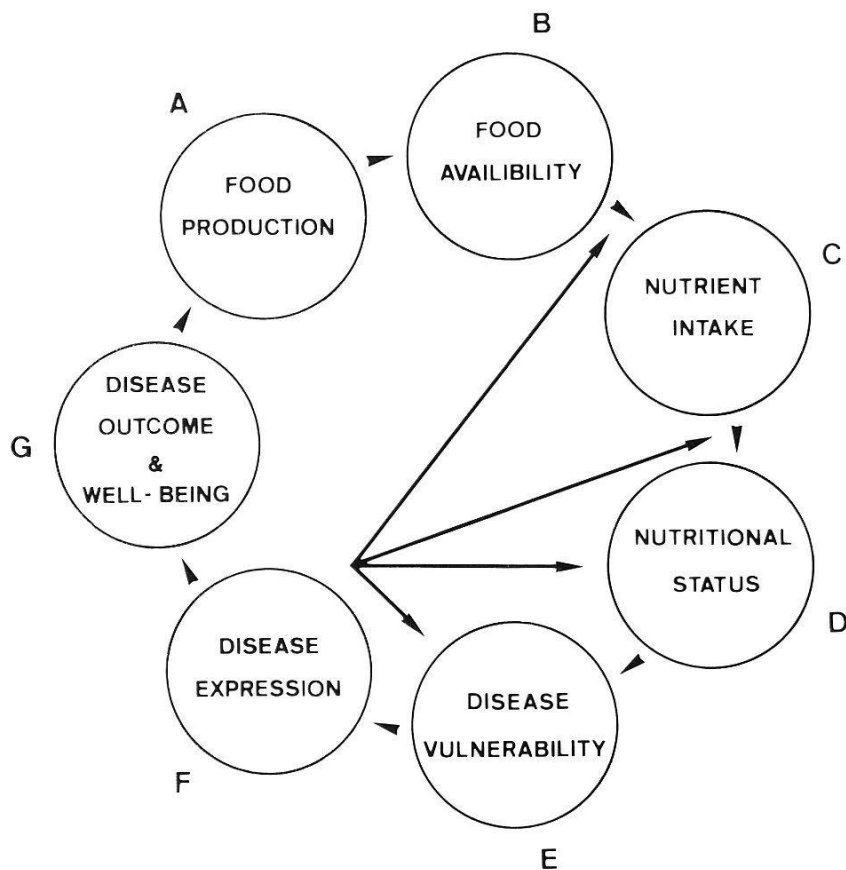


Fig. 1. Nutrition, disease and impact for the community; linkages between different factors at the micro-level (partly based on Chandra, 1981). With regard to the community-based study in Kikwawila the references referring to the studies on each of the elements of the cycles are listed:

- A. Zehnder et al. (1986, 1987);
- B. and C. Lukmanji and Tanner (1985), Tanner and Lukmanji (1987);
- D. Tanner et al. (1982, 1987b), Betschart et al. (1987), Stürchler et al. (1987);
- E. Stürchler et al. (1987), Tanner et al. (1986b), Del Giudice et al. (1987);
- F. Tanner et al. (1983, 1987b), Degrémont et al. (1985, 1987), Burki et al. (1986);
- G. Lwihula (1985), Tanner et al. (1986a), Degrémont et al. (1987).

miasis transmission (Lwihula, 1985) and the cross-sectional studies on food production (Fig. 1A) and food-consumption (Fig. 1B, C) gave us some insight into the prevailing social and economic conditions. In future, the social and economic analysis including work-load assessments of all community members should be strengthened at household level and attuned to the socio-medical approach (see below) in order to ensure continuing flexibility and responsiveness to local needs, which are a prerequisite for sustained community participation and development (Cochrane 1979; Chambers, 1979; Sussmann, 1980; Freyvogel 1986; Tanner et al., 1986a). The agricultural survey (Zehnder et al., 1987) and the study on food consumption (Tanner and Lukmanji, 1987) further indicated the need of studies that will directly relate the impact of the multiparasitism to productivity at household level. These data will be required to tailor appropriate long-term interventions for the community of Kikwawila.

As elaborated earlier (Tanner et al., 1987b), the disease pattern was only

selectively monitored. The emphasis was almost entirely on parasitic diseases, although other communicable diseases such as measles, diarrhoea and respiratory tract infections were also prevalent in the area and definitely also contributed to the impairment of child growth and the very high infant mortality rate in the study area which was far above the most recent regional and national estimates (UNICEF, 1985a, b; Tanner et al., 1987a). The question of infant and child death is particularly interesting since preliminary surveys showed a non-random distribution among families suggesting particular as yet unknown risk factors. Furthermore approximately two thirds of all deaths in the village are of children. The vital statistics surveys also indicated a substantial neonatal mortality rate suggesting that factors other than those nutrition-related are operating. Objective information on the direct causes of child and infant death will be valuable in view of the interventions planned and for a better understanding of the health forces at work at community level. Also in view of the PHC programme and its meagre resources, data on high risk factors and families may allow more effective focusing on critical problems.

2. Primary health care (PHC) component

The study village was without health care facilities (no village health post, dispensary or health centre at the start of the project. Only a mobile MCH (mother child health) service was provided by the district hospital in the Kikwawila and Lower Kilama sectors every months. The aim of the project and the Tanzanian policy and guidelines for the implementation of PHC (Ministry of Health, 1983) suggested that a mutual exchange between the PHC component and the applied and operational research component had to be achieved in order to create a positive impact for the community under review and for the communities pin-pointed to become extension areas of the Kilombero Health Research Programme. Adhering to the national guidelines (Ministry of Health, 1983), village health workers (VHW) were selected and installed in the three sectors (Kapololo, Kikwawila, Lower Kilama) of Kikwawila village in 1982 (STIFL/DHO, 1985; Tanner et al., 1987a). The training and up-grading of VHW differed from the national guidelines inasmuch as the initial training course lasted 14 days and up-grading courses were held every 3–4 months for 5 to 10 days. The VHW provided basic curative health services at comparatively low cost for the community. VHW also participated in the monthly MCH services provided by a mobile team of the St. Francis Designated District Hospital, which allowed them to monitor child health and child growth in the community and to identify risk families (e.g. with malnourished children or those not attending MCH services). VHW were well accepted by the community and showed good job-satisfaction. The latter was reflected by the low drop-out ratio and their continuous service even in the absence of any monthly remuneration from the village government.

The analysis of the first three years allowed us to conclude that the PHC component showed a steady improvement despite some intermittent lack of drugs and absence of payments (STIFL/DHO, 1985). The presence of VHW and the acceptance of their services definitely fostered participation in the health status surveys (Tanner et al., 1987b), in health interventions (Tanner et al., 1987a, b), in the food consumption surveys (Tanner and Lukmanji, 1987) and the schistosomiasis transmission control activities (Lwihula, 1985; Suter et al., 1986; Suter, 1986). One may even suggest that the PHC component should guarantee the longitudinal character of all the research components. However, given the time frame of only four years, it cannot be concluded with certainty that it was a major factor in enabling the project to become community problem-oriented.

Both prerequisites of the study design, i.e. the multidisciplinary approach and the PHC component, also influenced the nature of the data collection in all the studies and complicated the data analysis. The research part of the project could neither be planned as a cohort study nor as a randomized intervention study. The project had to be set up as a quasi experimental study with multiple group comparisons (Kleinbaum et al., 1982). Randomization was not the basis for the selection of most samples and strata, and the continuous activities of the VHW with all their influence on the community, both measurable and imperceptible, paralleled the research components. There was no control village or control village sector. The great tribal diversity within the study area and the Kilombero plain (Tanner et al., 1987a) would also have hampered attempts to achieve random selection and representativeness. The existing epidemiological methods are not yet adapted to analyse the intersectorial and interdisciplinary linkages, as indicated in the present study. New approaches to assess these interactions at household level (micro-level) have been proposed (Popkin, 1982). They may become important in planning PHC activities. In view of these facts our data were chiefly evaluated by a descriptive approach. Moreover, the trends observed can be of relevance for control strategies and measures to be applied.

Relevance for the community context

A plethora of community problems and needs became evident during the initial four years of the project in Kikwawila, a community representative for the Kilombero District (Lwihula, 1985; Tanner et al., 1987b; Degrémont et al., 1987). No single parasite- or nutrient effect on child health and growth could be identified on the parasitological (Tanner et al., 1987b), biochemical (Betschart et al., 1987; Stürchler et al., 1987) or clinical levels (Degrémont et al., 1987). Biomedical predictors for child health and growth were therefore difficult to establish within a constantly changing relationship of infection and nutrition during one year and from one year to the next. No child remained parasite-free

for more than one year. Substantial differences were found for food consumption during the lean and the post harvest seasons which reflected the agricultural production and potential of the area.

These findings can explain why single mass treatment oriented towards a parasite had little impact on the present community. Furthermore, targeted, selective or blanket mass treatment can exert a beneficial impact on transmission and morbidity in a community only if it is placed within a health care system which already aims at providing basic measures against prevalence and nutritional consequences of infection, i.e. immunization, oral rehydration programmes for diarrhoeal diseases, growth monitoring, improved environmental sanitation, safe water and continuous education (cf. Ministry of Health, 1983; Keusch and Scrinshaw, 1986). Hardly any of these measures were present when we launched our first mass treatment/latrine campaign in 1983. Since those days the PHC situation has constantly improved (STIFL/DHO, 1985) and it would now be possible to promote targeted mass treatment, provided by VHW against hookworm at household level and against urinary schistosomiasis at village health post level. Finally, the time-frame of four years for this initial evaluation of the longitudinal study and a follow-up period of 18 months after the first combined interventions (latrine campaign and single mass treatment) are too short to allow more definite conclusions about how the observed trends towards a better nutritional status (Tanner et al., 1987b) can be consolidated for the benefit of child health in Kikwawila village. The continuation and the expansion of the study based on the initial experience will help to achieve the overall goal, i.e. to develop a strategy for health care that could be applied to rural communities with similar features to Kikwawila village.

The research project context looks for a highly sequential approach to health problems in order to specify single parasite-, nutrient- or immunity effect, while the community context asks for a more simultaneous one. This dilemma might be overcome within the Kilombero Health Research Programme for the benefit of the biomedical research and for the communities concerned, by launching comparative quasi-experimental community-based studies in areas with clear-cut differences in the transmission of a particular disease such as malaria (riverplain vs mountainous areas), *G. lamblia*, hookworm. Such areas are now being identified within the Kilombero District and may become the places for the extension of the project based on experience in Kikwawila.

During the initial phase of the project, the villagers themselves provided useful indicators for the monitoring and evaluation of the health interventions. Anthropometric, clinical, parasitological and biochemical parameters only revealed a slight or transient improvement of the health status of children during the first three years (Tanner et al., 1987b; Betschart et al., 1987; Degrémont et al., 1987). On the other hand, the pattern of disease perception and the attitude towards health problems and interventions started to change among

the population (Lwihula, 1985; Tanner et al., 1986a; Degrémont et al., 1987). The villagers indicated the areas where they felt improvement had been achieved (intestinal problems), where they were satisfied with the curative services of VHW (wounds, malaria) and where they wanted strengthening of the control measures (water/sanitation). The ranking of individual health problems of children and adults matched with the data from the health status surveys and the registers of the village health posts. These findings not only stress the importance of social science research in health care projects, but highlight the use of cultural perceptions of disease as a tool for community diagnosis. Recent investigations in Liberia (Jackson, 1985) and India (Nichter, 1984) indicated that the indigenous perspectives on disease, signs and symptoms can have a high predictive power and could be used as an integrative tool to monitor health care programmes.

A comprehensive survey on the occurrence and use of medical plants in the Kilombero and Ulanga Districts (Haerdi, 1964) has identified over 600 plants which were used by the various tribes to treat an enormous variety of diseases and complaints. The study also indicated and confirmed our observations in the villages that the population is aware of many major health problems. Harjula (1980) studying traditional medicine in northern Tanzania made similar observations. A well perceived and carefully formulated indigenous symptomatology seems to exist which has been neglected by most health and rural development activities in Tanzania.

Consequently a sociomedical approach with indigenous disease perception as a cornerstone could be applied and evaluated in the monitoring of the impact of the Kikwawila gravity water supply system, the ongoing PHC activities, the mapping of schistosomiasis foci and the identification of major health problems in the communities of the extension phase. This also forms a continuation of the approach which stimulated elements of community participation (Tanner et al., 1986a; Tanner and Degrémont, 1986). Furthermore, it may offer the chance to introduce a participatory element in the process of community diagnosis, which has been shown to be a crucial first step towards community involvement in PHC (Nichter, 1984). In addition, the understanding of the health/disease perception of any community is a basis for communication in health (i.e. health education instead of health information) and can help to prevent the medicalization of PHC (Nichter, 1984).

With regard to the initial phase of any community-based health care projects it is suggested that participatory community diagnosis and the appraisal of indigenous health perspectives can be crucial. They form sensitive indicators to monitor project implementation and might even determine measures that will help to consolidate PHC activities.

Due to the approach chosen during the initial phases of the Kikwawila project and the related extension projects in other areas, there are good chances for future consolidation. On the one hand, tools for monitoring and evaluation

of control measures and health status have been established and can be provided in the communities (Tanner and Degrémont, 1986; Degrémont et al., 1987). Furthermore, long-term control measures such as sanitation and water supply are being implemented (Tanner et al., 1986a) and plans also exist to improve food production at household level. Furthermore, Kikwawila became one of the villages marked for the Morogoro Region Programme for Child Survival and Development 1987–1991 (UNICEF; 1985b). This programme will result in inputs in the areas of health, sanitation, child care, infrastructure support, village information systems and appropriate technology. Since the ongoing Kikwawila programme has generated a wealth of base-line data for various elements of rural development, Kikwawila village will become well situated to provide feedback concerning the implementation and health impact of the UNICEF programme. On the other hand, the PHC activities in Kikwawila, Kapolo, Kilama and Namwawala are continuing and being strengthened (STIFL/DHO, 1985; Tanner et al., 1987a). Plans also exist to extend the PHC programme emphasizing VHW to other communities of the Kilombero District. The future for PHC in rural Tanzanian communities has a sound basis since the efforts towards PHC implementation and national development policies are complementary (Heggenhougen, 1984; ILO, 1982). These conditions will certainly contribute to the translation of basic needs into specific proposals, projects and actions which will allow sustained rural development (Chambers, 1979).

- Betschart B., Rieder H. P., de Savigny D., Gautschi K., Degrémont A. A., Tanner M.: Serum proteins and zinc as parameters to monitor the health of children in a rural Tanzanian community. *Acta trop. (Basel)* 44, 191–211 (1987).
- Burki A., Tanner M., Burnier E., Schweizer W., Meudt R., Degrémont A.: Comparison of ultrasonography, intravenous pyelography and cystoscopy in detection of urinary tract lesions due to *Schistosoma haematobium*. *Acta trop. (Basel)* 43, 139–151 (1986).
- Chambers R.: Rural development: putting the last first. Longman, London 1979.
- Chandra R. K.: Immunocompetence as a functional index of nutritional status. *Brit. med. Bull.* 37, 89–94 (1981).
- Cochrane G.: The cultural appraisal of development projects. Praeger Publishers. Praeger Special Studies, New York 1979.
- Degrémont A. A., Burki A., Burnier E., Schweizer W., Meudt R., Tanner M.: The use of ultrasonography to study *Schistosoma haematobium* related morbidity. *Lancet* 1985, 662–665.
- Degrémont 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).
- Del Giudice G., Biro S., Engers H. D., Degrémont A., Lambert P.-H., Pessi A., Tougne C., Verdini A. S., Weiss N., Tanner M.: Antibodies to *Plasmodium falciparum* sporozoites in Tanzania detected by ELISA with synthetic peptide: Their frequency and three-year follow-up of 132 children. *Amer. J. trop. Med. Hyg.* 36, 203–212 (1987).
- Freyvogel T. A.: Environmental management for the control of parasitic diseases. *Insect Sci. Appl.* 7, 297–304 (1986).

- Haerdi F.: Afrikanische Heilpflanzen. – Die Eingeborenen-Heilpflanzen des Ulanga Distriktes Tanganyikas (Ost-Afrikas). Acta trop. (Basel) Suppl. 8, 334 (1964).
- Harjula R.: Miran and his practice; a study of the ethnomedicinal repertoire of a Tanzanian herbalist. Tri-Med, London 1980.
- Heggenhougen H. K.: Will primary health care efforts be allowed to succeed? Soc. Sci. med. 19, 217–224 (1984).
- ILO (International Labour Office): Basic needs in danger, a basic needs oriented development strategy for Tanzania, 416 p. ILO, Addis Ababa 1982.
- Jackson L. C.: Malaria in Liberian children and mothers: biocultural perceptions of illness vs clinical evidence of disease. Soc. Sci. Med. 20, 1281–1287 (1985).
- Keusch G. T., Scrimshaw N. S.: Selective primary health care: strategies for control of disease in the developing world. XXIII. Control of infection to reduce the prevalence of infantile and childhood malnutrition. Rev. infect. Dis. 8, 273–286 (1986).
- Kleinbaum D. G., Kupper L. L., Morgenstern H.: Epidemiologic research. Van Nostrand Reinhold Company, New York 1982.
- Lukmanji Z., Tanner M.: Food consumption patterns in a rural Tanzanian community (Kikwawila village, Kilombero District, Morogoro Region) during lean and post-harvest season. TFNC Report No. 940, 49 p. Dar es Salaam/Ifakara/Basel 1985.
- 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.
- Ministry of Health: Guidelines for the implementation of the primary health care programme in Tanzania. Ministry of Health, Dar es Salaam 1983.
- Nichter M.: Project community diagnosis: participatory research as a first step toward community involvement in primary health care. Soc. Sci. Med. 19, 237–252 (1984).
- Popkin B. M.: A household framework for examining the social and economic consequences of tropical diseases. Soc. Sci. med. 16, 533–543 (1982).
- Schad G. A., Anderson R. M.: Predisposition to hookworm infections in humans. Science 228, 1537–1540 (1985).
- Stürchler D., Tanner M., Hanck A., Betschart B., Gautschi K., Weiss N., Burnier E., Del Giudice G., Degrémont A.: A longitudinal study on relations of retinol with parasitic infections and the immune response in children of Kikwawila village, Tanzania. Acta trop. (Basel) 44, 213–227 (1987).
- Sussman G. E.: The pilot project and the choice of an implementation strategy: community development in India. In: Politics and policy implementation in the Third World, ed. by M. S. Grindle, Princeton, N.J. 1980.
- 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 Basle 1986.
- Suter R., Tanner M., Borel Ch., Hostettmann K., Freyvogel T. A.: Laboratory and field trials at Ifakara (Kilombero District, Tanzania) on the plant molluscicide *Swartzia madagascariensis*. Acta trop. (Basel) 43, 69–83 (1986).
- Swiss Tropical Institute and Kilombero District Health Office: Collaboration primary health care project in Kolombero District, Tanzania. Working Document STIFL/DHO 1 (1985).
- Tanner M., Degrémont A.: Monitoring and evaluating schistosomiasis control within a primary health care programme. Trop. Med. Parasit. 37, 220–222 (1986).
- 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. (Basel) 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., Holzer B., Marti H. P., Saladin B., Degrémont A. A.: Frequency of haematuria and proteinuria among *Schistosoma haematobium* infected children of two communities from Liberia and Tanzania. *Acta trop. (Basel)* 40, 231–237 (1983).
- 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 (1986a).
- Tanner M., Del Giudice G., Betschart B., Biro S., Burnier E., Degrémont A., Engers H. D., Freyvogel T. A., Lambert P. H., Pessi A., Speiser F., Verdini A. S., Weiss N.: Malaria transmission and development of anti-sporozoite antibodies in a rural African community. *Mem. Inst. Oswaldo Cruz* 81, Suppl. II (1986b).
- Tanner M., Degrémont A., de Savigny D., Freyvogel T. A., Mayombana Ch., Tayari S.: Longitudinal study on the health status of children in Kikwawila village, Tanzania: study area and design. *Acta trop. (Basel)* 44, 119–136 (1987a).
- Tanner M., Burnier E., Mayombana Ch., Betschart B., de Savigny D., Marti H. P., Suter R., Aellen M., Lüdin E., Tayari S., 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. (Basel)* 44, 137–174 (1987).
- 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. Dar es Salaam/Ifakara/Basel 1986.
- Zehnder A., Jeje B., Tanner M., Freyvogel T. A.: Agricultural production in Kikwawila village, southeastern Tanzania. *Acta trop. (Basel)* 44, 245–260 (1987).

