EVALUATION OF SCHISTOSOMIASIS CONTROL PROGRAMME AMONG SCHOOL-AGE CHILDREN AFTER THREE YEARS OF INTERVENTION IN KOROGWE DISTRICT

BY

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"Evaluation of Schistosomiasis Control Programme Among School Age Children after Three Years of Intervention in Korogwe District": In partial fulfilment of the requirements for the degree of Master of Public Health (MPH).

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DEDICATION

This work is dedicated to my beloved wives Veronika and Clara. My son Mbelwa and my daughters Subira, Maimuna, Mariam, Mkunde and Msekwa.

ABSTRACT

A cross-sectional study was carried out between the last week of May to mid June 2002, in Korogwe district. The main objective was to evaluate to what extent the school based deworming project has controlled urinary schistosomiasis three years post-intervention, focusing on the reduction of prevalence and intensity and improvement of haemoglobin status as well as knowledge on disease transmission and prevention in comparison with the data from the baseline survey. A simple random sampling method was used to select five primary schools, whereby all pupils from class V to VII totaling 371 were investigated. Prevalence and intensity of *Schistosoma haematobium* eggs were assessed by the urine filtration technique, while haematuria was assessed by Hemastix and haemoglobin estimated by the Hemacue. Knowledge, attitudes and practices regarding urinary schistosomiasis were explored by semi-structured interviews using questionnaires.

The findings of the study are as follows: -

The overall prevalence dropped from 57.8% to 52.3%, mean egg count dropped from 200 to 100 eggs/ 10 ml of urine, mean haemoglobin level raised from 107.6 g/L to 124.4 g/L. and improved health knowledge from 46% to 81%. Therefore it is recommended that the district health authority should organize a health screening programme to schoolchildren; organize training to primary school teachers who can be deployed in screening and providing treatment for schoolchildren; involve various sectors (e.g. government, NGO's and the community) in the control of urinary schistosomiasis in the district. It is also recommended that urinary schistosomiasis should be given high priority when planning preventive health activities in the district.

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LIST OF ABBREVIATIONS

WHO	-	World Health Organization
UKUMTA	-	Ushirikiano wa Kumuendeleza Mtoto wa Tanzania
SPC	-	Selection Population Chemotherapy
G/L	-	Gram per litre.
Ml	-	Millilitre
Df	-	Degree of freedom
χ^2	-	Chi-Squared
P-value	-	Probability value
Kg	-	Kilogramme
MoH	-	Ministry of Health
IEC	-	Information Education Communication
CI	-	Confidence Interval usually at 95% level
µl	-	Microliter
Σ^2	-	Marginal error
BCC	-	Behavioural Change Communication
NIMR	-	National Institute of Medical Research
M.Med	-	Master of Medicine
KAP	-	Knowledge, Attitude and Practice
UK	-	United Kingdom
Mm	-	Millimetre
NGO	-	Non-Governmental Organization

CHAPTER ONE

1.0 INTRODUCTION

Schistosomiasis is a disease that has been known for centuries to be endemic in Africa. Therefore Africa is believed to be the probable origin *for Schistosoma haematobium* and *Schistosoma mansoni*, causing what is sometimes collectively referred to as African schistosomiais. The causative worms (the schistosomes) and their eggs with terminal and lateral spines representing *S. haematobium* and *S. mansoni* respectively, were discovered in Egypt by Theodor Bilharz in 1851 on post mortem materials. Globally, schistosomiasis affects about 200 million people causing a significant burden of morbidity (WHO, 1993). The earliest recognized endemic foci for *schistosomiasis haematobium* in Tanzania were demonstrated in Zanzibar and on the mainland in Kwimba. The intermediate snail hosts for *S. haematobium* belong to *Bulinus* species of the africanus group and for *S. mansoni* belongs to *Biomphalaria* species. Schistosomiasis is a disease of major medical and public health concern. It is estimated that about 8-9 million people are infected in Tanzania (MOH, 1983; Jordan and Webbe, 1982). Concern about the disease is worldwide and this is reflected in the WHO efforts to assist research on, and control of schistosomiasis in various countries. Variety of approaches have been adopted to contain the disease with varying results. Such approaches range from elimination of reservoirs and vectors, sanitation and clean water supply, health education and community participation. However, the impact of these control programmes is far from being satisfactory. Failure to realize the desired impact cannot

be well understood without an assessment of the control measures used and circumstances in which they have been applied.

1.1. STATEMENT OF THE PROBLEM

A survey carried out in Tanzania by UKUMTA to determine the prevalence of urinary schistomiasis and other parasitic infections among schoolchildren in 1996 found a prevalence of urinary schistosomiasis ranging from 36.3% to 64.9% in six districts. This prevalence was almost similar to that observed 10 years back as demonstrated in Tanga and Mwanza when the prevalence ranged from 9.0% to 60.0% (Rugemalila, 1985). However, the prevalence was high in Korogwe district. The overall prevalence of infection hides the fact that there was a high degree of heterogenicity in the prevalence of infection between children from different schools.

The data from the UKUMTA survey (1996) revealed that children 11-14 years old had the highest prevalence of urinary schistosomiasis, consistent with previous studies in Tanzania and elsewhere (Savioli, *et al* 1990), which showed that the prevalence of infection was highest in children age 10-19 years. Furthermore, the study showed various morbidity effects including stunting (82%), underweight (68%) and low haemoglobin concentration (79%) among the studied population.

The low anthropometric status observed among schoolchildren is likely to have both immediate and long-term consequences for their education and general well being of children. Studies reviewed by Bundy (1994) showed that stunting can have important negative consequences for school enrolment, and educational achievement, as well as for

productivity and employment in later life. For adolescent girls, it may place them at a risk of complications during pregnancy and thus have consequences for their children and therefore extending the low levels of nutrition to future generations.

A number of studied have documented anaemia as a major health problem among schoolchildren. Although the causes of anaemia are multifactorial, in the study by UKUMTA (1996), anaemia was found to be related with urinary schistostomiasis and low weight for age by the Z score. Although the deworming programme was envisaged to reduce infection prevalence and intensity as well as morbidity due to *S. haematobium,* there was no evaluative study done three years post - UKUMTA intervention in Korogwe district.

1.2 Research question

Urinary schistosomiasis is a chronic debilitating disease, endemic in Korogwe district, affecting majority of school children. A baseline study conducted by UKUMTA in 1996 revealed a prevalence of 57.8%. The high prevalence of infection here is being stressed because schistosomiasis is associated with low haemoglobin levels among infected school children with heavy worm loads and impaired cognitive development. Furthermore, infection with *S. haematobium*, is due to poor environment sanitation, indiscriminate urinating in water sources and poor health education. Following the above-mentioned factors and public health importance of the disease, schistosomiasis control intervention was implemented in Korogwe district in 1998. The research

question here is to know to what extent the deworming project in Korogwe has controlled schistosomiasis three years post intervention.

1.3 Research objectives

Broad objectives: -

(i) To assess the effectiveness of schistosomiasis control intervention in the reduction of urinary schistosomiasis prevalence, intensity and morbidity rate.

(ii) To assess knowledge, attitude and practice changes regarding urinary schistosomiasis.

Specific objectives:

(i) To determine the proportion of primary schoolchildren infected with *S. haematobium* after the intervention propgramme.

(ii) To determine the intensity of infection with *S.haaematobium* by egg output count.

(iii) To assess urinary tract morbidity by the history of visible haematuria and semi-quantitatively by Hemastix, as well as history of dysuria and cystitis; and to assess anaemia morbidity by haemoglobin estimation.

(iv) To explore knowledge and attitudes on haematuria as a symptom of, and the mode of transmission, as well as practices regarding preventive measures against urinary schistosomiasis.

1.4. Hypothesis

This study is supposed to answer the following hypothesis:

That mass chemotherapy using praziquantel combined with health education has an impact in the reduction of the prevalence, intensity and morbidity of urinary schistosomiasis among school children in Korogwe district.

1.5. Expected benefits

1. The results from the study are expected to add knowledge to the existing information on the evaluation of schistosomiasis control programme in the Country.
2. The results would assist in the planning of control programmes in the district
3. The results may be of use to:
   - (i) The national school health programme
   - (ii) The national deworming programme launched in 1992
   - (iii) The Ministry of National Education and Culture

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 The situation of urinary schistosomiasis, and public health importance: -

Tanzania is a developing country, where parasitic infections including *S. haematobium* are widely spread in rural communities of low socio-economic background. Other reasons put forward for the high prevalence of parasitic infections include: poor environmental sanitation, as reflected by absence of latrines, unprotected water supplies and lack of knowledge on disease causation (Eshuis and Manschot, 1993). Urinary schistosomiasis occupies a position of public health importance in Tanzania. This is because of its widespread distribution, high prevalence and effects on nutritional status of the people, especially school children. A global questionnaire survey by larotski and Davis (1981) showed that about three million (19%) of the 16 million people in Tanzania, were estimated to be constantly exposed to schistosomiasis infection. According to the report by the Ministry of Health, Tanzania (1983) 8-9 million people are infected . It is believed that the exposure risk to the disease as well as its prevalence are increasing.

Age specific prevalence shows that children are most infected. In some areas around lake Victoria, prevalence of over 90% of *Schistosomiasis haematobia* in children aged between 10 and 15 years are not uncommon.

Furthermore egg excretion counts, which are generally accepted as a measure of the infecting intensity and potential severity, are also highest in this age group. *Schistosomiasis haematobia* has been studied extensively for its morbidity effects, thus community based studies in Mwanza and Tanga showed that 498 out of 906 (55.0%) of the studied subjects had patent infections, and that 453 out of 498 (91.0%) of the infected subjects had one or more of the symptoms namely haematuria, micturition frequency, urine incontinence and lower abdominal pain (Rugemalila, 1979). *Schistosomiasis haemotobia* has also been causally associated with decreased scholastic performance, physical exertion and retarded growth (Jordan, 1962).

Furthermore, in a random sample of 100 patent infections studied by excretion urography at Mwanza, 72 had one or more of the infection sequalae namely calcification of the urinary bladder and/ or ureters, hydronephrosis, and renal dysfunction (Rugemalila, 1979). Squamous cell carcinoma of the urinary bladder was not only highly significant, but more prevalent in areas of high endemicity for *Schistosomiasis haematobia* in the country (Kitinya *et al,* 1986).

Unfortunately of all studies undertaken in Tanzania none could demonstrate causal relationship between *Schistosomiasis haematobia* and systemic hypertension, urinary bacterial infection and abnormal renal function by biochemical tests (Forsyth and Bradley, 1964; Rugemalila, 1979). This is an area, which need further research.

Measurement of mortality rate due to schistosomiasis are difficult to make as post-mortem examinations are not routinely carried out, and the lack of diagnostic facilities in hospitals makes deaths reported due to the disease be of doubtiful quality.

2.2 Distribution of schistosomiasis in Tanzania

S. haematobium has a predominant distribution, beside small discrete foci, there are two extensive zones of intense transmission, one along the shores of the Indian Ocean including the islands of Pemba and Zanzibar and the other along the eastern shores of lake Victoria. All areas with irrigation schemes studied in 1965 in Tanzania were found to be associated with the transmission of *S. haematobium*. Similarly, the new water development projects i.e. Mtera and Rufiji Basin have been found to have schistosomiasis transmission potential. Thus, all the 25 administrative regions in the country are endemic for *S. haematobium*.

2.3 Economic significance of parasitic worms in Tanzania: -

In Tanzania about 80% of the population resides in rural areas where people are engaged in agricultural activities. The rural population bear the heaviest burden of the common parasitic infections, including *S. haematobium*. The economy of Tanzania depends on its rural population for economic survival. It is therefore true that any disease or condition that may lead to impaired health of the rural population must be considered as seriously undermining the economy. Unfortunately direct evidence of economic loss resulting from *S. haematobium* infection is lacking, but there is evidence of economic

loss resulting from *S. mansoni* in Tanzania. There is therefore need to investigate the extent of economic loss resulting from *S. haematobium* infection and other common parasitic infections.

2.4 Schistosomiasis control

Transmission of schistosomiasis requires contact with water harbouring snail intermediate hosts in an area where sanitation is at low level and there are infected people.

Preventing transmission of schistosomiasis thus involves measures aimed at: -

- Reducing contact with infected water.
- Reducing contamination of water with schistosome eggs.

Each of these can be attained by disease specific and non-disease specific methods. Specific measures such as chemotherapy have the advantage of curing the disease and preventing transmission of the disease to others, while non-specific measures concern improved living standards and are the long-term measures for all developing countries. With the advent of praziquantel, there has been a considerable shift in the philosophy of schistosomiasis control; with an emphasis on chemotherapy. However, most authorities now accept the provision of health education, improving water supply and sanitation, control of snail, in addition to repeated mass or targeted chemotherapy, are necessary so as to achieve adequate and sustained schistosomiasis control. In spite of the demonstrated public health importance of schistosmiasis in Tanzania, no national control

programme against the disease has yet been started, although a suggested policy for controlling the disease has been drawn up.

However, despite the lack of a national policy, several pilot control projects have been carried out in areas such as Misungwi (Lake region), Bunju (Dar es Salaam region), Mbozi (Mbeya region) and Tanganyika planting Company (Kilimanjaro region). All these projects were temporary, vertical and lacking proper planning and personnel for sustaining the initial promising results. Hence, the current control projects operate within a primary health care setting using evaluation and monitoring criteria that take into account the recent conceptual changes in schistomiasis control from the control of transmission to the control of disease (Langeler, 1989; Savioli and Mott, 1989; Tunner, 1989). The Kilombero district study by Kilima *et al* (1989) and Langeler (1989) showed that by using appropriately designed questionnaires for school children and teachers, screening costs could be as low as US $ 215 to screen about 6772 children. Questionnaires successfully identify communities at high risk, and also identify children at risk of developing severe morbidity. Whichever methodologies of control are selected, there is a need to ensure that the achievements made during the attack phase can be sustained by the local authorities and by the communities themselves. This requires the need for communities to perceive the disease as a public health problem requiring control measures. This also requires the communities' active role in the planning, implementation, monitoring and evaluation of control measures that should aim at communicable diseases in general rather than targeted at only one specific disease.

2.4.1 CHEMOTHERAPY DELIVERY SYSTEMS

The selection of the appropriate system must be based on the endemicity of infection, and the infrastructure or availability of designated personnel to undertake diagnostic and treatment schedules with reliable logistic support and supervision. At present parasitological techniques are the basic tool for determining endemicity and the appropriate treatment regime. The parasitological techniques used are: -

- Urine filtration which has been widely used in individual and community diagnosis.
- Urine analysis reagent strip which is used to detect microhaematuria, as it has been known since ancient time that haematuria especially in school age children has an association with urinary schistosomiasis.

  Currently recognized chemotherapy delivery systems are: -

  (i) Mass treatment

  (ii) Selection population chemotherapy (SPC)

  (iii) Targeted therapy

However, as prevalence and intensity of infection drop following chemotherapy, it may be appropriate to change the delivery system.

2.4.2 CHEMOTHERAPY INTERVENTIONS

The primary purpose of schistosomiasis control is to reduce morbidity/disease in the community to a level at which it is no longer of public health importance. In general this goal will be achieved when the intensity of individual *S. haematobium* infection is below

50 eggs/10 ml of urine. This level can be rapidly achieved in individuals treated with an appropriate schistosomicidal drugs (Metrifonate, Praziquantel, Oxamniquine) used in standard doses.

Strictly, mass chemotherapy implies the treatment of the entire population without prior individual diagnosis. Total population coverage was attempted in Brazil where epidemiological data from an index group of school children (4 -18 years of age) showed the prevalence to be greater than 20%, implying a high prevalence in adults. With prevalence between 4% and 20% mass treatment of children was attempted (Machado, 1982). The advantages of mass treatment are that diagnostic costs are low as diagnosis is confined to preliminary survey but however, costs can be high as in theory all persons are treated, including uninfected persons. Maximum impact on morbidity, disease and transmission control can be expected but only if population compliance is good.

While mass chemotherapy is ideal for areas of high prevalence, it may be the method of choice in countries where, for cultural, religious or other reasons the collection of urine is not possible. However, some authorities, and individuals, may be reluctant to give drugs to uninfected persons, although in the context of African culture and conditions, mass treatment programmes were considered to stand a better chance of acceptance than selective systems (Chandiwana *et al,* 1990). After a community-based chemotherapy campaign, the following can be expected among those treated: -

- Symptoms of the disease will be partially or completely relieved

- Early pathological changes will be reversed with the risk of serious sequelae being reduced
- A high proportion of those treated will be cured (with the elimination of the parasite) and those not cured the intensity of infection will be appreciably reduced.

2.4.3 Health education and schistosomiasis

When morbidity control became a practical proposition with the definitive host, (man) becoming the target of attention, health education became a top priority to all schistosomiasis control projects with emphasis on children and adolescents. Unfortunately no research has been done on the most effective way(s) of reaching the public. We do not know for example the relative effectiveness of talks, slide shows, films, posters, etc. There is a need to develop suitable indicators for monitoring and evaluation of health education. A major problem of concern is that when generally lip service is paid to the subject of heath education, most governments give it low priority within their health service compared with curative services. As a result few career posts are available and if financial cuts are ever required, health education is most at risk. Health education in relation to schistosomiasis aims to help people understand that man is the reservoir of the infection that is transmitted through indiscriminate urination and defaecation and that infection is from water contact. The fact that changing man's behaviour can have a profound effect on transmission, should be stressed in relation to teaching the life cycle of the parasite.

Before a control project starts, the aims and the objectives of the project should be explained and discussed with all who have authority in the villages, including elders, religious leaders, local chiefs and politicians, and the need for community cooperation and participation stressed (Hubley, 1984; Menaruchi, 1986). Discussions at an early stage of a programme may bring to light potential problems which can be discussed and possibly solved through finding areas of agreement. The objectives of health education programmes for schoolchildren must be clearly defined in relation to local epidemiological conditions, the design of the control strategy and the different population groups involved. The treatment of school children will probably be a part of all programmes and health education in support of this must take up top priority, preferably as part of an on going health education programme within the normal school curriculum. The formal teaching of children is done by local teachers, therefore special familiarization courses should be given to teachers so that they understand the problems and the control strategy. Children cannot be expected to stop swimming and playing in water but they should be taught to urinate before doing so.

As emphasis is on children and much of the education is in schools, where latrine and water are part of the control programme, school authorities should set an example and provide adequate facilities in school. Children can be taught how to use and maintain latrine and water facilities, and how to get maximum benefit from them, by the teaching of basic hygiene. Older children should be encouraged to teach younger children and their parents as well.

When treatment is to be given to adult groups they should be given greater attention, particularly to women in view of their frequent cloth washing activities. This cannot be stopped, but if laundry units are not provided, women should be encouraged to use soap and wash clothes in a basin on the river bank or lake shore rather than in the main body the of water.

2.4.4 Water supplies and schistosomiasis

The conclusion of Leiper (1915) for the control of transmission included the provision of safe water. Safer water in terms of schistosomiasis control implies carcariae free water. As with Leiper's conclusion other principles of control, after 75 years little can be said to improve on them. Although the provision of water was, in theory, an integral part of the WHO - assisted control programmes in the 1940s and 1950s, it was generally considered to be too costly.

When water supplies are provided in rural areas in developing countries, they are invariably for political and social reasons. Heath benefits, particularly the lowering of parasitic diseases and other infections, are often of secondary consideration. Nevertheless, lower schistosomiasis prevalence rates among communities having access to well water in the Gezira were reported (Greany, 1952). In Egypt it was noted that even partial use of protected water markedly reduced prevalence rates (Farooq and Mullah, 1966). The first experimental projects to evaluate water in the control of schistosomiasis were made in South Africa where a communual water supply was

supplemented by simple pools for children and wire fences to infected water (Pitchford, 1970), and in Brazil where latrines were also constructed (Barbosa *et al,* 1971). Both projects led to lower prevalence rate.

In farm lands in Zimbabwe *S. haematobium* and *S. mansoni* were less common in children in villages with piped water (Manson-Bahr and Apted, 1986) but in Kenya bore hole wells failed to affect transmission of *S. haematobium*. Although the well water was used for drinking, cooking and dish washing, bathing and clothes washing continued in the sites of infected water (El Kholy *et al,* 1989). With all examples given above experience indicates that the supply of water for domestic purposes to prevent exposure to cercariae - infested water must be: -

(i) Carcarie free and of good quality

(ii) Adequate for all domestic water needs of the community at all times of the year

(iii) Available at sites convenient to users and more convenient than the nearest alternative sources of infected water.

(iv) Available at facilities acceptable to the users for bathing and clothes washing, with approved washing tubes, or washing slabs, at approved height.

(v) It should be in a delivery system that is easily maintained and readily repaired.

2.4.5 Sanitation and schistosomiasis

Although there is little evidence that latrines reduce transmission in a community, but in Egypt lower prevalence was reported as a result of latrine usage. (Farooq and Mullah, 1966). Nevertheless their use should be encouraged as part of long term health

improvement programmes and as a supplement to other schistosomiasis control measures in particular, chemotherapy (MacDonald, 1965).

2.4.6 Elimination of the vector (snail control)

Physical alteration of the habitat (e.g. drainage of swamps) may solve the problem by eliminating the breeding sites of the snails. During the past decade numerous control projects in Brazil, Congo, Egypt, Ghana, Zimbabwe, Tanzania and elsewhere have shown that snail control by molluscides in combination with other methods can reduce or eliminated transmission (WHO, 1985). However the availability of molluscides that are safe, i.e. not toxic to mammals and other acquatic organisms, and stable in storage is yet a research issues. Research has shown that although chemical molluscides have been used successfully to kill snails, the method proved to be costly, particularly where large masses of water are involved. The important costs of chemicals particularly where they cannot be manufactured locally, may become a great burden to the country especially among developing countries with scarce foreign exchange. Further, snails are sometimes known to escape molluscides by burying in the mud (Rosenfield, 1979).

Where radical chemotherapy measures are not feasible other measures have been used by rendering the environment hostile to the snails e.g. removal of vegetation, altering the flow rate of the streams, building concrete linings to the wall of the drains. Although these measures could be effective, they are very costly in terms of the real cash for the exercise as well as the community that rely on the reservoirs for subsistence fishing. Biological control measures has also been attempted by the use of predators. The most

successful biological method has been the use of the *Marissa cornuarietis* snails. It feeds the egg masses as well as young snails of *Biomphalaria glabrata*.

2.4.7 Community Participation

When people perceive intervention to be in conflict with their cultural expectations or perceive them as having no advantage at all, they behave with resistance, which reduces the effectiveness of intervention programmes in many societies. Unfortunately, such cases of resistance have been seen and interpreted by health planners and promoters as passivity, anti-development spirit, conservatism etc. hence such programmes fail to elicit the desired impact not because they were not noble, with all the good intentions or technically sound, but rather because they lacked an appreciation of the local constraints and cultural context in which people think and act.

An understanding of social, cultural and religions forces surrounding human behaviour and consequently his role in the transmission of schistosomiasis, is vital for an effective control measure that require community participation efforts to involve community participation in the control of schistosomiasis should be through primary health care approach. The communities should be involved right from the beginning of problem identification, priority setting, implementation, monitoring and evaluation.

Since human behaviour is determined by local culture, it may not be easy for control programs to achieve appropriate behavioural changes within a short time. It is thus vital

for health workers to take some time to understand the community and pick up vital behaviours that could easily be modified though proper health education so as to improve community participation. A beneficial modification of behaviour would be for example, to change the time for bathing collecting water and irrigations of farms to early mornings when the cercariae count is low.

Community participation in schistosomiasis control is crucial in developing countries for several reasons: -

First, the infection is preventable, second, anti-schistosomiasis drugs for chemotherapy and molluscides for snail eradication are far too expensive for countries that cannot produce them, and third, a proper education on the correct use of latrines for human excreta disposal and provision of safe water is cheap and can easily be done through self-help initiatives once the community understands the implications of such action to the health of its members. The success of community participation or lack of it, in community based diseases control programmes such schistosomiasis is highly dependent on the preparation of the people through provision of adequate information of what it is that they are trying to control and why. Further, horizontal integration within individual programs, interprogram cooperation, as well as intersectoral coordination among various ministries, together with religions bodies and political parties should be highly encouraged as they all work to promote community health and enhance overall social welfare.

2.4 ASSESSMENT OF CONTROL

Control programmes should have an in built monitoring/assessment system to check on the quality and quantity of different control inputs and to assess results. Since chemotherapy is the cornerstone of modern day control, every effort must be made to get the maximum benefit from it, for the individual and the community. Whichever chemotherapy delivery system is used, mass, selective or targeted the greatest number should be treated. Compliance is usually good at the start of a programme but gradually falls. Therefore monitoring the compliance rate in the community is an intergral part of an on-going assessment programme. The process of evaluation and monitoring in schistosmiasis control with special emphasis on the maintenance phase has been received and a conceptual framework of evaluation suggested five levels each addressing specific indicators such as input, process, output, outcomes, (effects and coverage) and impact.

In the maintenance phase control and evaluation activities should be integrated into existing health care delivery services, monitoring being perceived as a special form of continuous evaluation concentrating on the process and the outcomes, thus facilitating early recognition of problems, and in consequence, the reinforcement and fine tuning of intervention strategies.

Effects of control will vary from one area to another, the main factors influencing the results being the pre-control level of endemicity and the intensity of different control inputs.

Measuring the effect of control: In the future ultrasound will be used to show changes in the pattern of disease of the liver and urinary tract (Hatz *et al,* 1990) but until then the frequency of symptoms and signs of the infection can be assessed. Morbidity from *S. haematobium* as indicated by gross haematuria among children, was reduced by 91% and 85% in Ghana and Pemba Island (Tanzania) respectively, 12 months after praziquantel treatment (Mott *et al,* 1985; Savioli *et al,* 1989). Overall, haematuria (gross plus positives by reagent strips) was reduced by 52% in Pemba and by 77% in Ghana and Kenya; where results were the same for praziquantel and metrifonate treated children (King *et al,* 1990). Even ultrasound studies showed the two drugs caused similar reduction in bladder granulomas and bladder thickening, but no reduction in hydronephrosis. However, obstructive upper urinary tract lesions, including hydronephrosis showed marked improvement in another study (Doehring *et al,* 1986).

With morbidity/disease control through chemotherapy, there is a rapid reduction in symptoms and prevalence and intensity of infection in those treated, regression of pathology occurs more slowly.

Transmission may be affected with reduced incidence of new infection among children and falling prevalence and intensity among those not treated. Reinfection occurs only slowly so that infrequent retreatments will be needed, possibly after two to three years. However, in areas with very high prevalence and intensities, reinfection can occur very quickly. When chemotherapy is less intense i.e. with an annual treatment of schoolchildren only, *S. haematobium* prevalence and intensity was not affected, unless villages also had a piped water supply (King *et al,* 1990). Depending on endemicity, prevalence and intensity, re-treatment is necessary after only 1 or 2 years, but invariably reinfection in adults is less than in children (Gryseels and Nkulilyinka, 1989).

2.5 WHO RECOMMENDATION ON MASS TREATMENT

The WHO has made various recommendations regarding the treatment of schistosomiasis. Essential agents for the treatment of schistosomiasis listed by the WHO include:

(i) praziquantel for all species of schistosomes.

(ii) Oxamniquine for *S. mansoni* only

RATIONALE OF THE STUDY

The prevalence of *S. haematobim* among school children in Korogwe district was 57.8% as it was indicated during the baseline survey carried out in 1996 by UKUMTA (*Ushirikiano wa Kumwendeleza Mtoto Tanzania).* Following the baseline survey three rounds of chemotherapeutic control were carried out in 132 selected primary schools, with a total of 34054 participants in the programme. The final survey was in 1998. To date no evaluation has been done. The overall objective of this study therefore was to evaluate to what extent the school based deworming project in Korogwe has controlled schistosomiasis three years post intervention.

The findings of the study would enable the researcher and other health planners to organize schistosomiasis control strategies especially in school health programmes and was also expected to reveal problems that prevailed earlier and consequently reinforce and fine-tune the intervention.

CHAPTER THREE

METHODOLOGY

3.1 Description of the study district

3.1.1 Geography

Korogwe district covers an area of 3756 square kilometers and is one of the six districts in Tanga region. It is situated in the central part of the region. Its boundaries are Handeni district in the Western and Southern border; Muheza district in the Eastern border and Lushoto district in the Northern border. The district is divided into 3 zones according to the physical features and climatic characteristics, that is: -

- The northern mountainous zone, which has a cool temperature with an annual rainfall of 1000 – 2000 mm/year.
- The wet low lands from South to Eastern part of the district with a rainfall of 800 – 1000 mm/ year.
- The warm lowlands occupying the Western part which get an average rainfall of below 800 mm/year.

3.1.2 Administrative structures

The district is divided into four divisions with a total of 20 wards and 132 villages.

Table 1(a). Korogwe district administrative structure and population per division: -

Division	Total wards	Villages	Population
Korogwe	6	30	76757
Mombo	6	41	79972
Bungu	4	36	57832
Magoma	4	25	39892
Total	**20**	**132**	**254453**

Source:- Annual primary health care report Korogwe (1999)

3.1.3 Transport and communication: -

The length of passable roads in the district is 472 km of which 110 km has tarmac. The tarmacked portion is part of Dar es Salaam, Arusha and Tanga highway. The northern railway line passes through the district connecting to the Tanga line. It has three railways stations namely; Korogwe, Mombo and Mazinde. Postal and telephone services are available.

3.1.4 Social-economic status

The major tribes inhabiting the district are the Sambaa, Zigua and Bondei. The inhabitants of the district depend mainly on agriculture, growing maize, rice, bananas,

cassava and beans as food crops, while cash crops include vegetables, coffee and tea (small scale farmers) and sisal in big estates. Livestock keeping is of small scale and is mainly poultry, cattle and goat keeping. Majority of women are involved in farming activities while the men are involved in small business ventures and farming.

3.1.5 Education

The adult literacy rate is 75%. There are 143 primary schools, 7 secondary schools, one teacher training college, one public health nurse-B school, and one vocational training centre.

3.1.6 Health

Korogwe district has a total of 42 health facilities, 37 of them are government health facilities, the rest are voluntary agencies and private.

Table 1(b). Korogwe district health facilities by type and ownership

Type	Government	NGO's / Private	Total
Hospital	1	2	3
Health centres	3	1	4
Dispensaries	33	2	35
Total	37	5	42

Source: - Annual primary health care report Korogwe (1999).

3.2 Selection of the study area

The study was conducted in Korogwe district, Tanga region. The region was chosen following the baseline survey by UKUMTA, (1996) so as to obtain comparison data. Findings from the study showed that parasitic infections are a major health problem among children of school age in the region, particularly infection with *S.haematobium* and hookworm. The region was then picked on convenience basis. Korogwe district was randomly selected from the six districts in the region using a simple random sampling procedure.

3.3 Study type

A comparative cross - sectional evaluative study that involved five selected primary schools was carried out in Korogwe district. Comparative data from the UKUMTA intervention studies were available.

3.4 Study population

The target population included schoolchildren in class V to VII.

3.5 Sample size

The sample size was based on the prevalence rate of urinary schistosomiasis of 65% in Korogwe as previously reported by Kihamia (1997). The sample size required was 349 subjects. This was arrived at by using the following statistical formula (Armitage and Berry, 1987).

$N = \frac{Z^2Pq}{\varepsilon^2}$. $\quad q = 1-P$

Therefore: $N = \frac{Z^2P(1-P)}{\varepsilon^2} = 349$

n = is the sample size

P = is the prevalence of the problem in question.

q = 1-P

ε = is the marginal error on P.

Z = is the percentage point of normal distribution corresponding to a two sided significance level.

Now taking Z = 1.96; ε = 0.05 and P = 65% by using Epi Info calculation n = 349.

Add 5% of none response so the actual sample size was 371.

This figure was taken as a rough estimate of the sample size required for the purpose of this study in order to detect an estiamte of the true prevalence rate.

Sampling

- Cluster sampling
- Intentional randomization

Since the target population was children of school age, the sampling unit was primary schools (clusters) randomly selected. Within each selected cluster, intentional randomizing of the subjects was done. This means that subjects included in the study were all those pupils in class V to VII who participated in the 1998 UKUMTA deworming programme.

School selection was based on the following criteria:

- Those schools which had high prevalence of schistosomiasis during the UKUMTA baseline survey, 40% or greater.
- Reasonably accesible by the field team.

3.7 Organization of fieldwork and data collection: -

A formal letter to introduce the reseacher and two field assistants to the schools was obtained from the District Education Officer of Korogwe district, and also verbal introduction to the school head teachers was done to inform them about the purpose of the researcher's visit.

3.8.1 Manpower

- Fieldwork: This was done by the researcher and two field assitants trained on how to administer the questionnaire before the selection of the study sample was done.
- Laboratory work : One qualified laboratory assistant from the regional hospital was recruited for the work in addition to the researcher.

3.8.2 Pre-test

Pre-testing of the data collection tools was done before starting the research activities. This included the pre-testing of the questionnaires, counter-checking the weighing scales and the haemoglobin apparatus. The fieldwork and data collection was done by the research team, all tests and interviews were completed in each school on the same day.

3.8.3 Registration of subjects and collection of social data.

Each schoolchild was given a serial number. Basic information was collected about each subject from details kept by the school or by means of an interview with the child. The date of birth of each subject was recorded, if available, but for most subjects only the year of birth was availale and was reproted by teachers.

The following basic information was collected:-

- The date of interview
- The sex of the child
- The child's age in years
- The class the child is enrolled in.

3.8.4 Knowledge, Attitude and Practices (KAP): -

A questionnaire with open and close- ended questions was used to obtain information on the knowledge, attitudes, and practices (KAP) of all subjects in class V to VII who were present at the day of the survey. The questionnaire had been developed and pre-tested to school children at Boma primary school before the survey. Each child was inteviewed separately by one of the two trained interviewers and the researcher. The main emphasis of the questionnaire was on urinary schistosomiasis. A copy of the questionnaire is given in Appendix 1.

3.8.5 Weight

Each child was weighed wearing as little clothes as possible, without shoes and with no objects in the pockets. The child stood bare footed at the centre of the platform balance on the Soelinic 7600 elecronic scale (CMS weighing Equipment, UK) with their feet placed together while relaxed but standing still. Weight was recorded to the nearest 0.1 kg.

3.8.6 Haemoglobin estimation

Procedure: The side of the part of a finger was sterilized with a cotton swab soaked in spirit. Then a clean deep puncture was made using a new, sterile lancet. The first two drops of blood were wiped away using a clean dry cotton swab bacause they contain tissue fluids from the cells punctured by the lancet. The Hemocue cuvette (Hemocue, UK) was held downwards at a slight angle to prevent air getting trapped between the

plates. Blood was drawn into the cuvette by capillary action. After being completely filled, the microcuvette was wiped by clean dry cotton swab. The filled microcuvette was placed on the cuvette holder of the photometer then pushed to its inner position in a battery-operated Hemacue haemoglobinometer (Hemacue, UK). The concentration of haemoglobin was recorded on the spot in grams per litre of blood. A child was categorised as anaemic if the haemoglobin concentration was less than 120 g/l (WHO, 1975).

3.8.7 Urine collection and examination

Urine was collected from each child and tested for the presence of blood using a reagent strip, and was examined microscopically after filtration for eggs of *Schistosoma haemotobium.*

Procedure: - A wide mouthed glass bottle labelled with the subject's serial number was used to collect a fresh urine sample from each child. Urine samples were collected between 10.00 hour and 14.00 hour because the adult worms of *Schistosoma haemotobium*, which live in blood vessels of the bladder wall tend to lay eggs around midday, therefore eggs are most likely to be found in urine samples collected about 2 hours before or after noon. The child was asked to collect the whole content of bladder. The volume of urine was roughly estimated by comparison with an identical bottle which had been marked with volumes between 20 – 200 mls in 20 mls divisions. Blood visible to the naked eye was noted and the sample was semi-quantitatively tested for

blood using a reagent strip which changes colour in the presence for haemoglobin (Hemastix, Bayer Diagnostics). The result of the test was recorded as follows;

0 = no blood; 1 = trace of haemolysed blood

2 = trace of non- haemolysed blood; 3 = + (25 erythrocytes/µl) 4 = ++ (80 erythrocytes µL); 5 = +++ (200 erythrocytes/µl).

A sample of 30 mls urine preserved by adding one drop of 4% formalin was collected from each child for microscopic examination at the district laboratory. A sample of a well-mixed urine was drawn into a 10 ml syringe and then passed through a 13 mm diameter polycarbonated membrane filter with a 12 micron pore size (Costar, UK) held in a pop-top membrane holder (Costa, UK). Normally, the ejection was smooth and no leakage around the apparatus if assembly was properly done. After the urine specimen has passed through, to ensure complete filtration, the syringe was disconnected from the apparatus and drawn an equivalent volume of air. This was passed through the inlet of the apparatus similarly like the urine specimen, such that any remaining urine droplets bubbled out through the outlet, leaving the membrane with the retained substances just wet enough for microscopic examination.

After reaching this stage, the apparatus was dissassembled and by using a fine forceps, the membrane was removed and placed on a clean slide with the surface having the retained material facing up, then a drop of Lugol's iodine was added to the specimen to allow easy visuability of *Schistosoma haematobium* eggs. The filter was then examined

microscopically under a low power objective in which the whole surface area was scanned through for schistosome egg count. The number of eggs was recorded as egg/10 ml of urine. Children whose urine contained the eggs of *Schistosoma haematobium* were defined as infected.

3.9 Data analysis

This was handled by the researcher and a computer programmer, the Epi-Info version 6 programme was used in the analysis of data of this study. Chi squared test (X^2) and 95% confidence interval (Cl) was used for comparison of different proportions. The results were considered significant if P value was < 0.05.

3.10 Limitations of the study

The methodology used in this study has its merits and demerits. The method used of choosing 5 primary schools has bias, this is because 5 primary schools cannot be expected to represent the characteristics of all the primary schools in Korogwe district. Also the study is cross-sectional, which gives the characteristics of the diseases at that particular time. Also it provides the prevalence of the disease at one time and not for any other time. A potential problem of the questionnaire and an alternative explanation for the nature of health knowledge presented in this study may be the difference in closed and open ended questions. In response to answers where there were only two options, children were more likely to provide correct answers than in response to open ended questions, where they had to specify the answers themselves.

Despite all these problems the researcher managed to get useful information, reflecting the actual situation and magnitude of the problem in the area. In general, the result can be used in Korogwe district as a whole as well as other areas in the country. This is because most of our schools have similar conditions as the studied schools and school children had the same habit.

3.11 Ethical issues

The author applied and obtained permission to conduct the study on human subjects from the Research and Ethical Committee of the Muhimbili University College of Health Sciences, University of Dar es Salaam. Further, the author was granted permission from the regional and district authorities.

The teachers and the school children were all consulted and informed about the objectives of the study and they all accepted to participate in the study. Treatment was provided free of charge to all school children identified with infection.

CHAPTER FOUR

4.0 RESULTS

In order to evaluate the impact of schistosomiasis control programme on the health of schoolchildren in Korogwe district, it was necessary to examine all children from class V to VII who received treatment and health education during the first UKUMTA annual follow up survey in 1997 and the final UKUMTA treatment survey in 1998. The evaluation focused on the prevalence, morbidity and intensity of *Schistosoma haematobium* and assessment of the Knowledge, Attitude and Practice (KAP) three years post intervention. The study results from the selected schools do represent schools in Korogwe district, as previous studies (UKUMTA, 1998) show that urinary schistosomiasis is a common problem to most schools in Korogwe district.

4.1 Schools chosen

Five primary schools were chosen in Korogwe district, on the basis of having a prevalence of urinary schistosomiasis (as reported by schoolchildren during the questionnaire survey) of 40% or greater, and being reasonably accessible. The distribution of the studied schoolchildren in relation to the chosen schools is shown in Table 1(a).

Table 2(a): The distribution of the schoolchildren in relation to the chosen schools.

District	School	Number of children
Korogwe	Makumba	72
	Msambiazi	84
	Mgila	68
	Kwasemangube	106
	Magunga	41
Total	**5**	**371**

4.2 Subjects selected

A total of 371 children were included in the study. The distribution of the study population in relation to age and sex is shown in table 2.

Table 2(b): The distribution of the study population by age group and sex

Age group in years	Sex				Total both sex	
	Male		Female			
	Nº	%	Nº	%	Nº	%
10 – 14	58	34.7%	94	56%	152	41%
15 – 19	109	65.3%	110	44%	219	59%
Total	167	100%	204	100%	371	100%

4.3 Prevalence of urinary schistosomiasis by sex

The prevalence of urinary schistosommiasis was not significantly different between boys and girls (Table 3a).

Table 3(a): Prevalence of Schistosoma haematobium among school children by sex.

	Schistosoma haematobium					
	Positive		**Negative**			
Sex	Nº	%	Nº	%	Nº	%
Boys	84	50.3%	83	49.7%	167	(100%)
Girls	110	53.9%	94	46.1%	204	(100%)
Total	194	52.3%	177	47.7%	371	100%

$X^2 = 0.48$ Df = 1 P-value 0.487

4.4 Prevalence of urinary schistosomiasis by age group

The overall prevalence of urinary schistosomiasis was 52.3%, while in children 15-19 years old the prevalence was 54.8% and 48.7% in the age group 10-14years (Table3 b). However, the difference in prevalence was not statistically significant between the two age groups

($P > 0.05$)

Table 3(b): Prevalence of urinary schistosomiasis among schoolchildren by age group

Age group	No examined	Number + ve
10 – 14	152	74 (48.7%)
15 – 19	219	120 (54.8%)
Total	371	194 (52.3%)

$X^2 = 1.34$ Df = 1 P-value 0.21

4.5 Prevalence of urinary schistosomiasis by survey

The prevalence of urinary schistosomiasis was as follows: - 57.8% during the baseline survey, 23.7% follow up survey, 37.6% final survey and 52.3% during the evaluation (present) survey. After mass treatment with praziquantel the number of cases dropped from 57.8% to 23.7% as observed in the follow up survey, thereafter followed by a trend of increasing rate (Table 4).

Table 4: Prevalence of urinary schistosomiasis by survey

	Baseline*	Follow up*	Final*	Evaluation
Sample size	1016	1123	1485	371
Percentage	57.8%	23.7%	37.3%	52.3%

***UKUMTA data**

4.6 Knowledge, attitudes and practice (KAP)

In the study, children were asked a series of questions to determine the health knowledge, specifically their knowledge of urinary schistosomiasis, included the awareness of the disease, transmission and preventive measures against the infection. The knowledge, attitudes and practice (KAP) questionnaire was administered to all 371 children.

4.7 Awareness of the respondents about schistosomiasis by sex

Majority of the schoolchildren were aware of what schistosomiasis was (96.5%) and only 3.5%) of schoolchildren were not aware of the disease (Table 5 a). Awareness on urinary schistosomiasis was significantly high among girls and boys, but however girls had a significantly better knowledge about the disease than boys ($P < 0.05$).

Table 5(a): Awareness of the respondents about urinary schistosomiasis by sex

Sex	Aware		Not aware		Total	
	Nº	%	Nº	%	Nº	%
Boys	156	93.4%	11	6.6%	167	100%
Girls	202	99.0%	2	1.0%	204	100%
Total	358	96.5%	13	3.5%	371	100%

$X^2 = 8.54$ Df = 1 P-value = 0.003

4.8 Awareness of the respondents about urinary schistosomiasis by age group

Awareness of urinary schistosomiasis was 98.0% in the age group 10-14 years and 95.4%in children 15-19 years old. However, awareness was not significantly different between the two age groups (P >0.05), as shown in Table 5(b).

Table 5(b): Awareness of the respondents about schistosomiasis by age group

Age group	Aware		Not aware		Total	
	Nº	%	Nº	%	Nº	%
10- 14	149	98%	3	2%	152	100%
15 - 19	209	95.4%	10	4.6%	219	100%
Total	358	96.5%	13	3.5%	371	100%

X^2 = 2.05 Df = 1 P-value = 0.15

4.9 Awareness on the symptoms of the disease

Majority of schoolchildren were able at least to mention one symptom of the disease (93.5%) and only (6.5%) did not know any symptom of the disease, (Table 6). Knowledge on at least one symptom was not significantly different between the two age groups (P >0.05).

Table 6: Proportion of the respondents who knew at least one symptom of the disease by age group.

Age group	Symptoms				Total	
	At least knew one		Didn't know			
	N⁰	%	N⁰	%	N⁰	%
10- 14	145	95.4%	7	2%	152	100%
15 - 19	202	92.3%	17	4.5%	219	100%
Total	347	93.5%	24	6.5%	371	100%

X^2 = 0.01 Df = 1 P-value 0.92

4.10 Prevalence of reported haematuria during the interview

The overall reported prevalence of haematuria during the interview was 33.4% (Table 7a). Significantly more boys than girls reported an history of haematuria during the interview ($P < 0.05$).

Table 7(a): Proportion of the schoolchildren who reported haematuria during the interview by sex

Sex	History of haematuria					
	Yes		No		Total	
	Nº	%	Nº	%	Nº	%
Boys	69	41.3%	98	58.7%	167	100%
Girls	55	27%	149	73%	204	100%
Total	124	33.4%	247	66.6%	371	100%

X^2 = 8.51 Df = 1 P-value 0.003

4.11 Reported haematuria during the interview by age group

The prevalence of reported haematuria was 34.7% in the age group 15-19 years and 31.6% in the age group 10-14 years (Table 7b). However, the history of haematuria was not significantly different between the two age groups (P >0.05)

Table 7(b): Proportion of the schoolchildren who reported haematuria during the interview by age group

Age group	History of haematuria: Yes Nº	Yes %	No Nº	No %	Total Nº	Total %
11 – 14	48	31.6%	104	68.4%	152	100%
15 – 19	76	34.7%	143	65.3%	219	100%
TOTAL	124	33.4%	247	66.6%	371	100%

$X^2 = 0.39$ Df = 1 P-value 0.51

4.12 Reliability of self-reported haematuria

Ninety one (73.0%) schoolchildren out of the 124 who reported to have had blood in their urine, were confirmed by microscopic urine examination to have urinary schistosomiasis.

4.13 Awareness of the transmission of urinary schistosomiasis

Analysis was done to assess if respondents knew how the transmission of schistosomiasis took place (Table 8 a). The majority (81.4%) knew at least one mode of transmission of schistosomiasis, that is swimming in infested water, while 18.6% did not know the mode of transmission of the disease. There was a borderline significant

difference between boys and girls regarding awareness on the mode of transmission of the disease (P <0.05).

Table 8(a): Proportion of the respondents who knew of at least one mode of transmission by sex

Sex	Knew at least one		Didn't know		Total	
	Nº	%	Nº	%	Nº	%
Boys	144	86.2%	23	13.8%	167	100%
Girls	158	77.5%	46	22.5%	204	100%
Total	302	81.4%	69	18.6%	371	100%

X^2 = 4.67 Df = 1 P-value 0.03

4.14 Awareness of the mode of transmission of urinary schistosomiasis by age group

Awareness about the transmission of the disease was 83.6% in children 15-19 years of age and 78.3% in the age group 10-14 years (Table 8 b). However, the difference was not statistically significant. (P >0.05).

Table 8(b): Proportion of the respondents who knew at least one mode of transmission by age group.

Age group	Knew at least one		Don't know		Total	
	N⁰	%	N⁰	%	N⁰	%
10 -14	119	78.3%	33	21.7%	152	100%
15 - 19	183	83.5%	36	16.4%	219	100%
Total	302	81.4%	69	18.6%	371	100%

X^2 = 1.62 Df = 1 P-value 0.21

4.15 Awareness of preventive measures against urinary schistosomiasis

Analysis was done to assess awareness on the preventive measures for *Schistoma haematobium* infection. Of the 371 school children, 82.0% knew at least one preventive measure, while (18.0%) did'nt know any preventive measure (Table 9 a). Of those who knew the preventive measures, majority believed that prevention was to avoid swimming. Significantly more boys (86.8%) than girls (78.0) knew at least one preventive measure against urinary schistosomiasis ($P<0.05$).

Table 9(a): Proportion of the respondents who knew at least one preventive measure against schstosomiasis by sex

Sex	Knew at least one		Don't know		Total	
	Nº	%	Nº	%	Nº	%
Boys	145	86.8%	22	13.2%	167	100%
Girls	159	78%	45	22%	204	100%
Total	304	82%	67	18%	371	100%

$X^2 = 4.90$ Df = 1 P-value 0.02

4.16 Awareness of the preventive measures against urinary schistosomiasis by age group.

Awareness of the preventive measures against urinary schistosomiasis was 84.9% in children 15-19 years of age and 77.6% in the age group 10-14 years (Table 9 b). However, the difference was not statistically significant (P >0.05).

Table 9(b): Proportion of the respondents who knew at least one preventive measure against urinary schistosomiasis by age group.

	Knew at least one		Didn't know		Total	
Age group	Nº	%	Nº	%	Nº	%
10 – 14	118	77.6%	34	22.4%	152	100%
15 – 19	186	84.9%	33	15.1%	219	100%
Total	304	82%	67	18 %	371	100%

$X^2 = 3.23$ Df = 1 P-value 0.07

4.17 Association of swimming habits with infection

Analysis was done to find out whether there was any association of water contact behaviour with *S.haemotobium* infection (Table 10) Of the 323 school children who reported swimming, 160 (49.5%) had been infected while 163 (50.5%) had not been infected. Moreover, among the 48 school children who had never ever swum, 17 (35.1%) had been infected. However, there was no statistically significant difference between those who swam and those who had never ever swum (P>0.05)

Table 10: Relationship of swimming habits with *S. haematobium* infection among school children

	Infected		Not infected		Total	
Practice	**N^{o}**	**%**	**N^{o}**	**%**	**N^{o}**	**%**
Swimming	160	49.5%	163	50.5%	323	100%
Not swimming	17	35.1%	31	65%	48	100%
Total	177	47.7%	194	52.3%	371	100%

$X^2 = 3.34$ Df = 1 P-value 0.06

4.18 Habits of schoolchildren to urinate in water bodies

Analysis was done to find out whether there were school children urinating in water (Table 11) A total of 135 (36.4%) schoolchildren urinated in water bodies, while 236 (63.6%) did not. There was no significant difference between boys and girls regarding their habits of urinating in water bodies ($P > 0.05$)

Table 11: Distribution of the respondents according to their habit of urinating in water bodies by sex.

Sex	Urinating in water				Total	
	Yes		No			
	N°	%	N°	%	N°	%
Boys	61	36.55	106	63.5%	167	100%
Girls	74	36.3%	130	63.7%	204	100%
Total	**135**	**36.4%**	**236**	**63.6%**	**371**	**100%**

$X^2 = 0.00$ Df = 1 P-value 0.91

4.19 Intensity of *S. haematobium* infection as expressed by egg count

Table 12 shows the intensity of *S. haematobium* according to the category of egg count among the studied subjects. The intensity of *S. haematobium* infection fell under light category in 31.5%, moderate category in 10.8% and heavy category in 5.4% of the schoolchildren.

Table 12: Category of *S. haematobium* by egg count. (N = 371)

Category	Number of eggs/10 ml urine	N⁰	%
Light	1 - 99	119	31.5%
Moderate	100 - 499	40	10.8%
Heavy	500 and above	20	5.4%

4.20 Distribution of parasite worm load among schoolchildren by sex

In the distribution of parasite worm load by sex (Table 13), 46 (12.4%) boys had mild worm load, 14 (3.8%) had moderate parasite worm load while 11 (3%) had heavy parasite worm load. Among girls, 71 (19.1%) had mild parasite worm load, 26 (7%) had moderate parasite worm load , while 9 (2.4%) had heavy parasite worm load. However, there was no significant difference between the sexes in relation to the parasite worm load ($P>0.05$).

Table 13: Distribution of parasite worm load by sex.

Sex	Parasite worm load							
	1 - 99		100 - 499		500+		Total	
	N°	%	N°	%	N°	%	N°	%
Boys	46	12.4%	14	3.8%	11	3%	71	19.1%
Girls	71	19.1%	26	7%	9	2.4%	106	28.6%
Total	**117**	**31.5%**	**40**	**10.8%**	**20**	**5.4%**	**177**	**47.7%**

4.21 The mean egg count by survey

Mean egg count was as follows:

200 eggs/ 10 ml mean egg count during the baseline survey,

107 eggs/ 10 ml mean egg count during the follow up survey

62 eggs/ 10 ml mean egg count during the final survey,

100 eggs/ 10 ml mean egg count during the evaluation survey.

Comparing these results, it shows that there was a trend of decrease in the mean egg count from 200 to 100 eggs/ 10 ml mean egg count, indicating a reduction of worm load, as shown in Table 14.

Table 14: Table showing the mean egg count in eggs/ 10 ml by survey

Parasite	Baseline*	Follow up*	Final*	Evaluation
	n = 425	n = 351	n = 476	n = 371
	Mean	Mean	Mean	mean
S. haematobium	200	107	62	100

***UKUMTA data**

4.22 Haemoglobin concentration and prevalence of anaemia

Table 15 shows the haemoglobin status among school children according to the severity. The overall prevalence of anaemia was 35.8%, mild anaemia was observed in 33.4% and moderate anaemia in 2.4% of the schoolchildren. No children had severe anaemia.

Table 15: Distribution of haemoglobin status among school children (n = 371)

Haemoglobin status	Haemoglobin g/L	N^{o}	%
Normal	Above 120	238	64.2%
Mild	90- 119	124	33.4%
Moderate	50 - 89	9	2.4%
Severe	Below 50	0	0%
Total		**371**	**100%**

4.23 Distribution of haemoglobin status by sex.

In the distribution of haemoglobin level by sex (Table 16), 72 (62.7%) girls had mild anaemia, while 4(2.1%) had moderate anaemia. Among boys, 52 (31.2%) had mild anaemia, while 5(3%) had moderate anaemia. However, there was no significant difference between those who have low haemoglobin and those with normal haemoglobin in relation to sex (P>0.05).

Table 16: Distribution of haemoglobin status according to severity by sex.

Sex	Haemoglobin status						Total	
	Normal		Mild anaemia		Moderate anaemia			
	N⁰	%	N⁰	%	N⁰	%	N⁰	%
Boys	110	65.8%	52	31.2%	5	3%	167	100%
Girls	128	62.7%	72	35.3%	4	2%	204	100%
Total	238	64.2%	124	33.4%	9	2.4%	371	100%

4.24 Relationship between *Schistosomiasis haematobium* infection and anaemia among school children: -

Table 17 below shows the relationship between *S. haematobium* infection and anaemia. Of the 133 positive cases, 82 (61.6%) had low haemoglobin in contrast to 51 (38.4%) negative cases. Schoolchildren who were positive for *S. haematobium* infection were significantly more likely to have a haemoglobin < 12g/dl than those who were negative.

Table 17: Relationship between *Schistosoma haematobium* infection and haemoglobin level among schoolchildren.

Hb (g/dl)	*Schistosoma haemotobium* infection				Total	
	Position cases		Negative cases			
	N⁰	%	N⁰	%	N⁰	%
< 12	82	61.5%	51	38.4%	133	100%
> 12	112	47.1%	126	52.9%	238	100%
Total	194	52.3%	177	47.7%	371	100%

X^2 = 7.29 Df = 1 P-value 0.006

4.25 The mean haemoglobin levels by survey

The mean haemoglobin levels were as follows: - (Table 18)

107.6 g/L during the baseline survey, 112.8 g/L during the follow up survey, 118.4 g/L during the final survey. Comparison between these results shows that there was a trend of increase in the mean haemoglobin level indicating improvement of the nutritional status among school children.

Table 18. Mean haemoglobin levels among schoolchildren by survey

Baseline Mean	Follow up Mean	Final Mean	Evaluation Mean
107.6	112.8	118.4	124.4

4.26 Detection of blood in urine by Hemastix

Table 19 shows the prevalence of haematuria as detected by Hemastix

Table 19: Prevalence of haematuria as detected by Hemastix according to sex

		Hemastix category						
Sex	Sample size	None	Trace	1+	2+	3+	N	%
Boys	167	83	13	15	11	45	84	49.1%
Girls	204	94	14	16	20	60	110	53.9%

4.27 Prevalence of haematuria by school

Table 20 shows prevalence of haematuria among schools included in the study. The prevalence of haematuria was low at Kwasemangube primary school (30.2%) but very high at Makumba primary school (72.2%).

Table 20: Prevalence of blood in urine among schoolchildren by school

School	Number examined	Positive	%
Makumba	72	52	72.2%
Msambiazi	84	50	59.5%
Mgila	68	38	55.9%
Magunga	41	20	48.8%
Kwasemangube	106	32	30.2%

The prevalence of haematuria was significantly different between schools ($X^2 = 34.46$, $P<0.001$)

4.28 Proportion of subjects who had blood in the urine as detected by Hemastix according to sex.

The prevalence of blood in urine as detected by Hemastix was 53.9% in girls and 50.3% in boys (Table 21a). However, there was no statistically significant difference in the presence of haematuria between girls and boys ($P > 0.05$).

Table 21(a): Proportion of subjects who had blood in the urine as detected by Hemastix according to sex

Sex	Test				Total	
	Positive		Negative			
	N⁰	%	N⁰	%	N⁰	%
Boys	84	50.3%	83	49.7%	167	100%
Girls	110	53.9%	94	46.1%	204	100%
Total	**194**	**52.3%**	**177**	**47.7%**	**371**	**100%**

$X^2 = 0.48$ Df = 1 P-value 0.487

4.29 Proportion of subjects who had blood in the urine as detected by Hemastix according to age group.

The prevalence of blood in urine as detected by Hemastix was 54.8% in children 15-19 years olds and 48.7% in the age group 10-14 years (Table 21 b). However, there was no statistically significant difference in the presence of haematuria between the two age groups. (P >0.05)

Table 21(b): Proportion of subjects who had blood in the urine as detected by Hemastix according to age group

Age group	Test				Total	
	Positive		Negative			
	N^{o}	%	N^{o}	%	N^{o}	%
10-14	74	48.7%	78	51.3%	152	100%
15-19	120	54.8%	99	45.2%	219	100%
Total	194	52.3%	177	47.7%	371	100%

$X^2 = 1.34$ Df = 1 P-value 0.246

4.30 Sensitivity and specificity of Hemastix in the detection of urinary schistosomiasis

The sensitivity of Hemastix was 92%, whereas the specificity was 84% (Table 22)

Table 22. Shows sensitivity and specificity of Hemastix test

	Disease Status		
Hemastix test	**Positive**	**Negative**	**Total test**
Positive	163 (TP)	31 (FP)	194 (T+)
Negative	14 (FN)	163 (TN)	177 (T-)
Total	**177 (D+)**	**194 (D-)**	**371 (N)**

Sensitivity = $\frac{TP}{\text{Total D+}} \times 100 = \frac{163}{177} \times 100 = 92\%$

Specificity = $\frac{TN}{\text{Total D-}} \times 100 = \frac{163}{194} \times 100 = 84\%$

Where TP = True Positive

TN = True Negative

FP = False Positive

FN = False Negative

D+ = Disease Positive

D- = Disease Negative

N = Total study population

4.31. Positive predictive value of Hemastix

163 (84%) schoolchildren out of 194 who had positive Hemastix were confirmed by microscopic urine examination to have schistosomiasis.

CHAPTER FIVE

5.0 DISCUSSION, CONCLUSIONS & RCOMMENDATIONS

The present study which was designed to find out the impact of mass chemotherapy of schoolchildren on urinary schistosomiasis control was conducted in an area endemic for urinary schistosomiasis. In such an area, it was expected that the school community would be quite aware of the disease. The expectations were actually found to be true. As there is no study of this kind, which has been done for comparison purposes, reference will be made to those findings obtained elsewhere and to the isolated research data available in Tanzania.

5.1 Prevalence of urinary schistosomiasis

The results show that urinary schistosomiasis is still a public health problem among the study population three years post mass chemotherapeutic intervention. Among 371 school children examined for urinary schistosomiasis, 194 (52.3%) were found infected with schistosomiasis with no significant difference to the baseline prevalence (57.8%)

The prevalence rate of *S. haematobium* infection had no big difference from that found by Rugemalila (1985) who conducted a study in Mwanza and Tanga and elicited among the examinees a prevalence of patent infection ranging from 9% to 60%. Moreover, the prevalence was not different from that found previously by Birnie *et al* (1995) who conducted a study at a rural village in Ethiopia. The high prevalence of 52.3% in Korogwe is not surprising because factors that favour the transmission are prevalent in this district. Behavioural factors like swimming and urinating in water sources have

been reported in this study, thus 323 (87%) school children reported swimming in water bodies that are potentially contaminated. Of the 323 children who reported swimming in water bodies 160 (49.5%) were infected. Likewise, of the 135 schoolchildren who reported urinating in waterbodies, 81 (22.0%) were infected, and 96 (25.8%) schoolchildren out of 236 not urinating in water were infected indicating the potential for the transmission of infection. This study has shown that there was only a slight decrease of the prevalence from (57.8% to 52.3%) when compared to the UKUMTA baseline prevalence. The baseline was done in 1996 and was followed by two rounds of mass chemotherapy with praziquantel. The slight decrease is most likely to due to the fact that there has been reinfection due to lack of sustainability of the programme by the district health authorities as well as persistence of favourable behavioural factors for transmission.

Another factor, which could have predisposed to reinfection was the exclusion of out-of-school children and adults during the programme intervention since these people share the same water sources for domestic and recreational activities. So, leaving them untreated would provide a source of contamination and therefore transmission of infection. This lends support to the recommendation of (WHO 1990) that mass chemotherapy in areas having a prevalence of 50% and above should be annually, which was not the case in this study.

5.2 Effectiveness of mass chemotherapy

In order to determine the effectiveness of praziquantel mass chemotherapy conducted by UKUMTA in Korogwe primary school children, a comparison had to be made between urinary schistosomiasis before and after the deworming. The overall baseline prevalence was 57.8%, highest in older children, especially in boys. There was much heterogenicity in the prevalence of infection between different schools. Infection with *Schistosoma haematobium* was associated with lower haemoglobin concentration. The association was stronger for girls aged 11-14 years old ($P < 0.001$) than boys of the same age group; the mean haemoglobin was 107.6g/L during the baseline survey. After mass chemotherapy with praziquantel the haemoglobin level rose to 124.4 g/L in the present study, indicating that regular mass chemotherapy has the potential to improve anemia morbidity among schoolchildren in areas endemic for urinary schistosomiasis.

The intensity of *S. haematobium* infection as expressed by egg count was high, mean egg count of 200 eggs/10 ml of urine during the baseline survey dropped to 100 eggs/10 ml of urine in the present study. Results revealed that after mass chemotherapy conducted by UKUMTA for the past three years, the prevalence of urinary schistosomiasis dropped from 57.8% to 52.3%. The decrease in prevalence over time can be calculated as follows: Initial prevalence minus final prevalence divided by initial prevalence times one hundred. Thus, the effectiveness of mass chemotherapy for the parasite was 58 - 52/58 x 100 = 10.4% while the effectiveness in the final survey was (36.2%).

Praziquantel was used for mass chemotherapy in the study. This drug, though expensive, was found to be safe and effective. In the Schistosomiasis Integrated Control Project conducted in Kondoa district (1993-1995), praziquantel was used in the project and the results showed significant reduction of both prevalence and intensity. The prevalence of urinary schistosomiasis fell from 79% to 8% in school children and from 50% to 11% in pre school children (Molteni and Nyange, 1996) . The children with severe infection (classified as having more than 50 eggs/10 of urine) were 12% in the second year while in the third year of follow up survey, severe infections were not detected at all. These results of Kondoa Schistosomiasis Control Project have similarities with the Korogwe (present) study findings in terms of reduction of egg excretion and decreased intensity. Egg excretion in the present study has dropped from a mean of 200 eggs/10 ml of urine during the baseline survey (1996) to 100 eggs/10 ml of urine.

Focusing on the morbidity indicators, the results showed an increase of the mean haemoglobin from 107.6 g/dl to 124.4 g/dl and there was no child detected to have severe anaemia. This was due to reduced worm burden. In a comparative study of the efficancy of praziquanted and metrifonate conducted by King *et al* (1990) in Coast province of Kenya, 1813 school-age children were included in the study. Urine filtration technique and chemical reagent strips were used for screening the children. Prevalence of morbidity was reassessed 12 months later for each group. Results indicated an equivalent patient improvement in response to either drug regime; prevalence of

haematuria fell from 75% to 17% after either praziquantel or metrifonate therapy. The major drawback with metrifonate is that it is given in three doses at two weekly intervals while praziquantel has the advantage of being a single dose drug.

5.3. Association of urinary schistosomiasis and low haemoglobin concentration

An important result of the analysis was the association of urinary schistosomiasis with low haemoglobin concentration. The association was stronger for girls 11-14 years old. (P. value < 0.01) than boys of the same age. It is possible that the additional blood loss through menstruation might have partly contributed to this. This supports the finding of the study done by Otito (1994) in Kisarawe district, which revealed that 13.9% of the 228 school children had low haemoglobin.

5.4 The prevalence of *S. haematobium* infection by sex

The overall prevalence of infection was 47.7% and it was higher in girls (28.5%) than in boys (19.2%). The difference of infection by sex is explained by the frequency of water contact behaviour, girls usually combine domestic and recreational water activities, and especially when these activities occur during the high risk period between 10.00 hrs to 14.00 hrs whereas boys are most involved in recreational water activities (Lwihula, 1986).

5.5. Awareness of the disease

Although there was improved health knowledge on disease transmission (81.4%) as well as on disease prevention (82%) still there was a proportion of school children (36.4%), who urinate in water bodies and swim in contaminated water (87%). Such behaviours predispose to the spread of the disease. This would account for the reinfection observed in this study. This, to a certain extent, explains the fact that health knowledge to school children may not be reflected in their daily practices. Children may know what is wrong, but may not know why it is wrong and so not knowing the appropriate health behaviours (UKUMTA, 1996). The limited nature of children's knowledge also emphasizes the need for firm health education to be targeted towards specific diseases and health problems.

5.6 Self-reported schistosomiasis

Interestingly, however, was the respondents who reported to have blood in their urine during the interview. Of the 124 (33.4%) reported to have blood in their urine 91 (73.0%) were confirmed by microscopic urine examination to have schistosome ova. This supports and extends the previous findings by Ansell *et al*, (1997) who conducted a questionnaire study in Muheza district and revealed that 75% of children were correct in their self diagnosis. The prevalence of reported urinary schistosomiasis in the interview was strongly correlated with the prevalence of infection determined by microscopy and consistently under estimated the latter by 20% across a range in prevalence from 22% to 93%.

5.7 Positive predictive value of Hemastix

Of the 194 school children who had positive Hemastix, 163 (84%) were confirmed by urine microscopic examination to have schistosome ova. This supports and extends the previous findings by Savioli, *et al* (1988) who conducted a study in the Coast Province of Kenya and revealed that a single examination for microhaematuria with reagent strips detected a higher proportion of those with > 50 eggs/10ml of urine and even with those who had at least 1 egg/10 ml of urine. Therefore the diagnosis of microhaematuria by reagent strips is at the moment best technique for use at the primary health care level. This means that in areas where there is no microscope screening, monitoring and evaluation of urinary schistosomiasis can be done by using a well designed questionnaire and chemical reagent strips. Unfortunately Hemastix strips are costly; one stick for one person and it costs about Tsh. 150/= per stick.

5.8 Attitude to treatment

The study revealed that 350 (94.3%) of children knew that the disease was harmful and could be treated in hospital. Only 4.9% said that urinary schistosomiasis could be treated by a herbalist and 0.8% did not know wherefrom treatment could be obtained. Such positive attitudes need to be reinforced in the in the Information, Education, and Communication (IEC) messages and Behavioural Change Communication (BCC) strategies.

5.9 Information gathered from the schools

Teachers reported that urinary schistosomiasis was really a health problem, so they wanted all school children to have their urine tested and for those who would be found positive to receive treatment instead of investigating only class V to VII. They also stated that there was decline of the problem in those years when school children received mass chemotherapy from the UKUMTA project. This implies that chemotherapeutic interventions delivered through schools would conceivably be effective.

Thus, in general, this study revealed that health knowledge was not a factor influencing school children to change their behaviour as it has been stated earlier, and mass chemotherapy with praziquantel if given annually in those areas with prevalence of 50% and above will improve infection prevalence and intensity, and morbidity as well. Unfortunately praziquantel is not among the essential drugs in the MOH list of drugs, hence its availability could be a problem.

5.10. CONCLUSIONS

The research objectives that were to assess the effectiveness of schistosomiasis control intervention in the reduction of urinary schistosomiasis prevalence, intensity, and morbidity and changing knowledge, attitude and practice among schoolchildren in Korogwe were fulfilled. Various data collection techniques which included urine filtration, semi quantitative method using chemical reagent strips, haemoglobin estimation using Haemacue method, structured interview using close and open ended questionnaire were applied with various degrees of success as stipulated below: -

- This study has shown that the prevalence of urinary schistosomiasis among schoolchildren in Korogwe district was 52.3%, very close to the prevalence of 57.8% found prior to the UKUMTA intervention programme. This means that after the UKUMTA programme ended reinfection occurred and prevalence came back almost to the baseline level because the programme was not sustained by the district and education authorities in Korogwe district.
- This study has been able to show that haematuria is really a major symptom of schistosomiasis. This was found in 91 schoolchildren out of 124 children reported to have blood in their urine and confirmed by urine microscopic examination.
- Another important observation seen in this study was the tremendous effect of praziquantel in reducing the intensity and prevalence of schistosomiasis as well as improvement of the haemoglobin level among school children.

- Another observation was the positive predictive value of Hemastix in the diagnosis of urinary schistosomiasis as 163 (84.0%) schoolchildren out of 194 who had positive Hemastix were confirmed by microscopy to have urinary schistosomiasis.
- Health knowledge of schoolchildren does not reflect their health practice, this was in fact due to observed proportion of schoolchildren who urinate in water (36.4%) and swimming in contaminated water (87%), although majority of schoolchildren had good knowledge on disease transmission (81.4%) and disease prevention (82%).
- The results obtained from the interview were suggestive of a hypothesis that haematuria is associated with urinary schistosomiasis.
- The study has also supported the hypothesis that water contact has an association with schistosomiasis.

5.11. RECOMMENDATIONS

From the study, the following recommendations are made: -

- The health sector and the education sector should start and maintain efforts to inform, educate and communicate with the community in Korogwe about the problem of schistosomiasis.
- The district health authorities should organize health-screening programmes to schoolchildren. This will help to identify problems earlier and find appropriate corrective measures in time.
- The district health authorities should organize training to primary school teachers, so that they can be deployed in screening and providing treatment for schoolchildren, this will help in sustaining the programme.
- Health education on schistosomiasis in schools in the district should be strengthened.
- Mass chemotherapy should be adopted for primary schoolchildren using praziquantel at reasonable intervals depending to the prevalence rate. This could be a meaningful control measure to reduce both the prevalence rate and worm burden of *S. haematobium* infection.
- Schistosomiasis should be given a high priority when planning health activities in the district.

CHAPTER SIX

6.0. REFERENCES

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