TEACHING POPULATIONS AS A MEANS OF IMPROVING GENERAL HEALTH

Training provided to the village populations in Northern Ghana to prevent and treat guinea worm, trachoma and lymphatic filariasis

5th year project, stage IV – the medical faculty of the University of Tromsø

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1. Summary

We have tried to find out if health education is an effective way of preventing certain diseases. In our survey, we have talked to about 250 people in 7 different villages in Northern Ghana; 4 villages for guinea worm, 2 for trachoma and 1 for lymphatic filariasis. The villages were similar except for their level of health education. Our conclusions are based on our findings through asking these villagers about the health education they had received, and through literature studies. In our survey, we have found significant differences between the villages with different levels of health education, showing that health education is important to improve general health. For guinea worm, the differences were significant for the prevalence of cases ($p<0,01$), but not for the level of knowledge. This still gives an indication that health education is effective, as it turned out that a volunteer had given health education in the "non-educated" village two months before, and it takes one year to see the results from actions done to prevent guinea worm transmission. For trachoma, there was no significant difference in the level of self-reported cases, but the difference in knowledge was significant ($p<0,01$). In the LF village, there was no knowledge about the scientific explanation for the disease, nor how to prevent it. Literature studies show different opinions on the matter. The reduction of guinea worm cases world wide, due mainly to health education, strongly suggests that this should also be effective to prevent other diseases.

2. Introduction

Our project focuses on plans and strategies for educating populations, and the effect of these strategies on fighting three infectious diseases: Guinea worm, trachoma and lymphatic filariasis (LF). Our main question is whether giving health education really has a measurable impact. We also try to find out how to measure the success of teaching as an intervention, seeing how diseases can have effect on other areas than mortality, such as economical impact, morbidity and life quality in general as experienced by the patient.

Ghana was chosen as a good place to learn because it is endemic for all three diseases and it has programs going on to prevent them. We also found it interesting because Ghana was one of the first countries to start the Guinea Worm Eradication Program, but has had less success in diminishing the number of guinea worm cases than most other countries. As Karin had lived in Ghana for a year in 1996/-97, some of the cultural barriers that one may encounter when going to a new country were less likely to prevent us from understanding or being understood. During her stay in Ghana at that time, she worked for the Guinea Worm Eradication Program and was therefore also familiar with where to go, who to talk to and how the program worked. Also, let's keep no secrets; she really wanted to go back.

The reason why we chose Northern Region and the Nanumba district for our guinea worm-survey was again because Karin knew the place and knew a lot about how the program was run in this area. It's also one of the most endemic areas in Ghana. For trachoma and LF we went to the Upper West Region (UWR). We had been told that this area was the most endemic area for these two diseases, and in Ghana we learned that the national coordinator for trachoma had his office in Wa in UWR.

For a fuller understanding of the work against the different diseases on international level, we also went to The Centers for Disease Control and Prevention (CDC) and The Carter Center in Atlanta, USA.

Definition of health education:
We define health education in this context as *education given to rural communities by trained health personnel or people taught by such, through whichever means available.*

We will present briefly clinical features and epidemiology of each disease, and the effect of the diseases on people's health, ability to work and social life.

3. Method

We have gathered information for our project in two ways: Using structured interviews in villages in Northern Ghana and doing literature studies.

The questionnaire contained questions about people's thoughts on etiology, whether they had received health education, whether they actually did what they had been taught, their own personal experiences with the diseases, and whether they had received treatment (appendix 1).

We used the questionnaire talking to about 100 people each for trachoma and guinea worm and fifty for lymphatic filariasis. Each interview lasted for about 10-20 minutes. In each village, we only talked about one specific disease; i.e. no village population and no person was asked about all three diseases. The villages were selected by talking to local health personnel about which villages had received health education and which had received little or no health education. The guinea worm programme has been going on for several years, and antibiotics have been distributed for trachoma without organized health education. Therefore, also some people in the lesser health educated villages said they had received health education. For simplicity, we will still call these villages the "non-educated villages" throughout this paper. The villages were supposed to be as similar as possible apart from the level of health education. We then went one of each category, as suggested by the local health personnel, within the same area for each disease, talking to about fifty people in each village. For lymphatic filariasis, we talked to people in only one village, as there had been no organized health education anywhere. The population was unselected; we went from household to household trying to cover as much as possible of the village and talking to one or two in each compound. We talked both to people who approached us and to people who stayed in the background, women and men of all ages, including children, regardless of whether they had or had had the given disease. As many villagers don't speak English, we had to use translators who we found through the local health personnel working on the programs for the different diseases.

Where we later refer to "the educated population" for the different diseases, we refer only to the level of health education as we were told it would be in the different villages. "Educated population" in this context therefore means only that they were said by the local health personnel to have received health education. It is in no way related to any other level of education, nor to what they themselves present of knowledge about the diseases and level of health education. The same goes for "uneducated population", which also refers only to what we were told by the local health personnel before we entered the villages about their level of health education. The "uneducated population" is not supposed to be less or more educated than the educated population on any other level than the health education for the specific disease. Most of the people in both populations received little or no general education.

The questionnaires were plotted in to EpiInfo 2000, from where we have later gathered the frequencies of different answers. When the questions were asked, we used open questions where otherwise is not specified in the questionnaire (appendix 1). However, as many people replied the same to our questions, we have made different categories of answers to make a better structure and more easily find out what was said most often. All open questions also had a textbox in the EpiInfo 2000 where we could add things that didn't fit in the different categories. The categories are different for each disease.

We have calculated the frequencies and percentages of answers in the different categories. The chi squared test for contingency tables has been used where there was any doubt of significance of differences between the different populations.

All our work was cleared with the people on national level, both on international and government run programs, for the different diseases in Ghana, and we also discussed with them their strategies in treatment and prevention.

For literature studies we used Medline to search for relevant articles, and after reading the articles we looked up some of the references that seemed interesting. Most of our sources are from articles in journals of epidemiology and tropical medicine, though we've also used some from other journals, some internet sources and a few that are unpublished, such as program manuals.

4. Some facts about the diseases

4.1. Guinea worm

Etiology/life cycle

The guinea worm, or *Dracunculus medinensis*, is a nematode transmitted through drinking water. A person drinks stagnant water containing water fleas (copepods/Cyclops) infected with mature, third-stage, guinea worm larvae. When the copepods reach the stomach, they are broken down and the larvae released. The larvae move to the free abdominal space, where they grow for two months and then mate. After mating, the male worm dies and the adult female worm migrates through the tissues, usually to the lower extremities of the human body, growing and maturing as the year progresses. About a year after the host's ingestion of infected water, the female worm begins to emerge through a painful blister of the skin. Upon contact with water, the worm releases first-stage larvae. The first-stage larvae can survive in the water without a host (copepod) for up to three days. After having been eaten by the water flea, the larvae develop within the flea's body for two weeks to a third-stage larvae, again ready to infect people (1). There is no animal reservoir for the disease (2).

Clinical features

The guinea worm appears as a blister on the skin. After rupture of the blister, the worm emerges as a whitish filament in the center of a painful ulcer, which is often secondarily infected. It can emerge from any part of the body, though most often the lower extremities. The worm itself is about 1 mm in diameter and about 30-100 cm long. It takes anywhere from a few days to several weeks to emerge, depending on the host's tissue where the worm emerges and the treatment the worm gets when it comes out. From body areas with only soft tissue, such as the abdomen, breasts and male genitals, the worms emerge the fastest. Areas with more structures, such as the hands and feet, take the longest. Severe secondary infections are often seen, and a person can be disabled for several months because of one guinea worm. One person can have several worms at the same time – occasionally up to 25-30 worms in the same person. As soon as the worm(s) are out, the person is free of guinea worm and has to be re-infected to get another one. No laboratory diagnosis is useful for any practical purposes (3), but the clinical features are easily recognized.

The direct mortality is not the biggest problem with the disease. The big problem is the morbidity and how it reduces people's ability to work and attend school. The worm often emerges in the season for harvesting or planting, thus magnifying the socioeconomic impact on agricultural productivity and school attendance of people living in endemic areas (2). One small study of farmers' loss due to guinea worm makes a rough estimate of the cost of interventions compared to the farmers' loss. If there were to be built cement ring wells for the entire community, each shared by 300 people, and if in addition each household received one filter, the cost would be about 29% of what the farmers in the same community lost due to guinea worm in one season (4).

School attendance is affected not only because the children themselves get sick, but also because children of affected parents may be held home from school to do the tasks the adults are unable to perform during the course of the disease, such as fetching water, cleaning the house and working on the farm. In a study from Benin, the incidence of the disease among school age children was found to be 17,7%, with an average bed-ridden period of 32 days during the disease. The correlation between the incidence and the percentage of missed class was significant (5). A Nigerian study found 29% of the children in the transmission season absent due to guinea worm infections, and in addition 13% of the children absent due to guinea worm infection of their parents (6).

Permanent disability from guinea worm has been estimated to between 0,5% and 0,9% annually (7).

Treatment and prevention

There is no drug available to kill the nematode (3). It has, however, been suggested to use metronidazole to decrease inflammation and thereby facilitate removal of the worm (8), though we haven't seen any article giving evidence that this is effective as treatment. Treatment starts when the worm has emerged, with local cleansing of the wound and mechanical extraction of the worm over several days to weeks. In Ghana, the wound is cleaned with Tamale oil, an oil made from parts of the Nim tree and said to have anti-inflammatory and, to some degree, desinfective effect, helping the worm to emerge faster. The nematode is rolled on to a peace of gauze moistened with Tamale oil, the dressings being changed every 2-3 days until the worm is fully emerged – normally after 1-2 weeks.

The best treatment of guinea worm is to prevent infection, which is easily achieved by filtering drinking water and, for people with an emerging worm, to avoid stepping into water.

Epidemiology

In 2002, 54 642 cases of guinea worm were reported in 12 countries (9), all situated in Africa. 75% of the cases were in Sudan, 11% in Ghana, 7% in Nigeria and 7% in other African countries (10). In 1986, when the plans of the eradication project were still in their beginning, there was an estimated 3,32 million cases worldwide (11). In Ghana, the incidence development has been from 179 556 registered cases in 1989 to 5606 registered cases in 2002 as showed in figure 1 (9,12).

4.2. Trachoma

Etiology

Trachoma is caused by the bacteria *Chlamydia trachomatis*. It can be transmitted from person-to-person by ocular and nasal secretions, either directly or through sharing a cloth to clean the face or a bowl to wash the face in. The transmission may also occur through insect vectors such as face-seeking house flies, primarily the Musca sorbens (13).

Endemic disease is found in rural areas with limited economic means and poor sanitation and water supplies.

Clinic

Chlamydia trachomatis causes follicular conjunctivitis. Repeated infections result in a chronic conjunctivitis that leads to scarring in the conjunctiva. This again causes the upper eyelids to turn inwards so that the eyelashes irritate the cornea (trichiasis). This not only affects the vision – it is also very painful. Ultimately, corneal opacification and blindness occurs. Active infection is normal in children under 10 years. However, as decreased vision and blindness occur after repeated infections, this is seen in adults.

The degree of disease is graded into:

- TF (Trachomatous follicular)- presence of follicles in the tarsal conjunctiva.
- TI (Trachomatous intense) – presence of inflammation in the tarsal conjunctiva.
- TS (Trachomatous scarring) – presence of scarring on the tarsal conjunctiva.
- TT (Trachomatous trichiasis) – at least one eyelash rubbing on the eyeball.
- CO (corneal opacity) – Visible corneal opacity over the pupil.

The first two grades, TF and TI, are called 'active trachoma' and is an indicator of *current* trachoma prevalence. TS, TT and CO demonstrate past infections, as these conditions only occur after a history of the active grades (14).

Treatment / prevention

In July 1996, WHO hosted a *Global Scientific Meeting on Future Approaches to Trachoma Control* which had proposed the integrated **SAFE** strategy for trachoma control. The four letters stand for Surgery, Antibiotics, Facial cleanliness and Environmental improvement.

The **surgery** is for people with trichiasis. It's a 15 min procedure that rotates the eyelashes away from the eye and prevents further scarring of the cornea. It's done using local anesthetics, and it can be done in the communities. Nurses can be trained to do the surgery. Studies have shown that surgery for major trichiasis produces a significant improvement in visual acuity in operated vs nonoperated fellow eyes (15). This might be by relieving photophobia and corneal edema. Though it hasn't actually been shown that surgery prevents progression to corneal opacity, this effect in addition to pain relief is likely. Surgical treatment gives a recurrence rate of 20 – 60% of trichiasis, though often to a smaller extent than before the surgery (16).

Antibiotics is given both to *treat* active infection and to *prevent* spreading. Topical tetracycline used to be the drug of choice – this eye ointment had to be applied twice a day for 6 weeks to treat the infection, and compliance turned out to be a big problem. In 1993 results from a randomised, single blind trial from the Gambia was published, showing that a single oral dose of azithromycin was as effective as the tetracycline eye ointment (17). Several other studies have later shown that oral azithromycin is at least as effective as topical treatment (18,19,20). Both have been shown to reduce the prevalence of both infection and disease for at least 12 months (20).

Arguments *against* the use of antibiotics are, among others, that it's possible to get rid of the disease by simply improving the water supply and the hygiene, the risk of bacterial resistance to the drug (also other bacteria than *C. trachomatis*), and that the drug treatment is expensive, as this disease is a disease of the poorest people in the world. The latter argument is not a problem; since 1998 Pfizer Inc. (New York, NY) has been donating large amounts of azithromycin for trachoma. Clamydial resistance to azithromycin has not been reported (21), however; *Streptococcus Pneumoniae*, a common respiratory pathogen, is known to acquire resistance to macrolides (22). The study concluded that '*it appears that the selective effect of azithromycin allowed the growth and transmission of preexisting azithromycin-resistant strains. More research is needed to clarify the clinical relevance and implications of azithromycin use*'.

So there are reasons not to rely on antibiotics alone. It's also hard to tell for how long these mass treatments will have to be carried out in order to avoid the trachoma prevalence to go back to the pretreatment figures, and it's unreasonable to expect Pfizer Inc. to donate azithromycin indefinitely. Studies have shown that mass treatment can reduce infection and transmission in the short term, but has not given lasting control (20,23).
Keeping the **children's faces and the environment clean** prevents the disease from spreading. Studies have shown that small amounts of water can keep children's faces clean, and that children with clean faces are much less likely to get or spread trachoma infection (24,25,26,27). A single litre of water can keep up to 30 faces clean (28). However; another study has shown that an intense facial cleanliness program had only modest (and statistically insignificant) effect on clinically active trachoma. It showed no differences in the prevalence

of active trachoma cases (TF and TI) between intervention (= face washing) and control villages, but face washing was associated with lower prevalence of severe trachoma (TI) (29).

Flies are important in the transmission of trachoma (30). Therefore; fly control should be part of the program to defeat the disease. There are different ways to do this, but the most sustainable and economical way is to educate the villagers to bury their faeces or to build latrines. The Musca sorbens (the fly associated with trachoma) breeds on solid faeces lying on the ground, but not in latrines, where the contents liquefy rapidly. In Egypt, less trachoma was found in households in which simple pit latrines were present (31).

In short; improving the availability and use of water, and the management of animal and human waste are the main issues where health education on trachoma can be expected to have an impact. This refers to the **F** and the **E**-part of the SAFE-strategy.

A study recently published has reviewed the SAFE-strategy, and the study concludes that there are strong supportive evidence for the surgery and the antibiotics in preventing trachoma, but only weak supportive evidence for the facial cleanliness and the environmental improvement. Still; because of high rates of refusal of surgery among people with trichiasis, the cost of the antibiotics and the potential development of resistance the long term sustainability of trachoma control may depend on promoting facial cleanliness and improving environment and sanitation (16).

Epidemiology

Trachoma is endemic in 49 countries - mostly in Africa, but also in the Eastern Mediterranean, Southeast Asia and the Western Pacific (32). WHO estimates that approximately 6 million cases of blindness due to trachoma and 11 million cases of trichiasis occur yearly. The prevalence of active disease in children may be as high as 40 % in some African countries (33). Blindness from trachoma is linked to poverty, and it is 2-3 times more likely to occur in women than men (34,35).

For Ghana, trachoma is a problem mainly in the Northern and Upper West Regions. In 1998, a rapid assessment study was carried out to assess the situation in these areas. This study indicated that around 70% of the villages examined would gain "significant benefit from implementation of the SAFE strategy" (36). A prevalence study done in two districts in the

Upper West region (Wa and Sissala) showed a prevalence that ranged from 0-40.0 % for TF and from 0-21.2 % for TT (37).

From table 1, we can clearly see how the active infection tends to be a problem among the children, while the chronic parts (TS and TT), which are the ones threatening the vision, are adult problems.

4.3. Lymphatic filariasis

Etiology

Lymphatic filariasis (LF) is caused by three nematodes (roundworms): *Wuchereria bancrofti* (about 90%), *Brugia malayi* (about 10%) and *Brugia timor* (only in very limited areas) (38,39). There is no non-human reservoir of *W. bancrofti*, and only a very minor animal reservoir of *B. malayi* that probably plays little or no role in transmission to humans (40).

Life cycle

The larvae of the nematodes are transmitted through bites of infected mosquitoes enjoying a blood meal. As the worms enter the body, they migrate to the lymphatic tissue, where they, in a process that takes up to several months, develop to adult worms producing micro-filariae. The female W. bancrofti worms measure 80 to 100 mm in length and 0.24 to 0.30 mm in diameter, while the males measure about 40 mm by 0.1 mm. Infection of the mosquitoes happens as they bite infected individuals and ingest microfilariae together with the blood. Inside the mosquito, the worm develops into a third-stage larvae within 1-2 weeks, before it is ready to infect new individuals (38). The normal life-span of the parasite is 4-6 years in the lymphatic tissue (40).

Clinical features and pathogenesis

Adult filarial worms live in lymphatic tissue, where they cause dilatation and thus disturb the function and cause edema in the affected area. Patients with damaged lymphatic vessels often have more bacteria on the skin and more cuts than other people. Secondary infections lead to further lymphatic damage, increasing the lymphedema even more, and a "vicious circle" begins (39)

Lymphatic filariasis is asymptomatic in most cases, though microfilariae are detectable in the blood. Some patients develop lymphedema and elephantiasis (frequently in the lower extremities) and, with *Wuchereria bancrofti*, hydrocele and scrotal elephantiasis (38). Elephantiasis is defined as severe or advanced lymphedema (39). The physical symptoms of lymphedema, hydrocele and elephantiasis are caused by lymphatic dysfunction created by the parasite. There may be episodes of febrile lymphangitis and lymphadenitis. Persons who have newly arrived in disease-endemic areas can develop afebrile episodes of lymphangitis and lymphadenitis. An additional manifestation of filarial infection, mostly in Asia, is pulmonary tropical eosinophilia syndrome, with nocturnal cough and wheezing, fever, and eosinophilia. Circulating filarial antigen (CFA) detection should now be regarded as the 'gold standard' for diagnosing *Wuchereria bancrofti* infections (41), though detection of the parasite in the blood as seen by microscope is also possible and has been much used. (38).

Treatment

The drugs of choice are diethylcarbamazine (DEC) (39,42) and ivermectin, with albendazole improving the effect of these in keeping the blood free of microfilariae (39). Patients can also greatly improve their physical condition by simple measures such as taking care to clean the affected limb or area with soap and water daily to avoid secondary infections, exercising if possible, keeping the affected area elevated when seated or lying down and using antibiotic creams or, in rare and very special situations, prophylactic systemic antibiotics (39). In addition to external pathogens, the adult worms may continue to induce lymphatic pathology and consequent morbidity even when microfilariae have been eliminated (40).

Epidemiology

About 120 milllion people in more than 80 countries are infected with the LF parasites. At the same time, one billion, i.e.20% of the world's population, are at risk of acquiring the infection. *W. bancrofti,* accounting for about 90% of the infections, infects only people, whereas *B. malayi,* accounting for most of the remaining 10%, also can infect some monkey and feline species, though mainly human beings are affected. The parasites are transmitted through certain species of mosquitoes. Brugian parasites are found only in Asia, *Brugia timori* only on some islands of Indonesia, whereas *W. bancrofti* is found in tropical areas worldwide (38,43).

5. The effect of teaching populations

5.1. The Guinea Worm Eradication Program, effects of strategies to eradicate guinea worm

The campaign to eradicate guinea worm globally began with an initiative from the Centers for Disease Control (CDC) in 1980, just before the International Drinking Water Supply and Sanitation Decade started (2). The official Guinea Worm Eradication Program (GWEP) was launched by the World Health Organization in 1986(44,45). In Ghana it started in May 1988 (46).

The year the GWEP was started by WHO, studies estimated the annual incidence of guinea worm world wide to a minimum of 3,32 million cases, with an at-risk population of 120 million people (45). The total number of cases reported in 2002 was 54 642 (9); a reduction of 98,4% since the first estimate. The reduction in Ghana has been from 179 556 cases reported in 1989 (12) to 5606 cases in 2002 (9), a reduction of 96,1% (see table 2). Still, Ghana is the second worst country when it comes to incidence of guinea worm, after Sudan. Sudan had about 75% of the globally reported guinea worm cases in 2002, Ghana had about 11% (10).

How has the immense reduction in the number of guinea worm cases been achieved? There is no medication available to treat or immunize against guinea worm. The interventions to prevent guinea worm can be divided into four parts: 1. Health education/community mobilization 2. Filtering or boiling drinking water 3. Case management/containment and 4. Vector control (47).

Let's start from the bottom, with vector control. Vector control is achieved by eliminating the intermediate hosts - the Cyclops - and thereby guinea worm, from the drinking water. In 1990, WHO estimated the coverage of safe water sources for households in rural Africa to 44%. In 2000, the coverage was increased to an estimate of 47%. In Ghana, the corresponding percentages were 43% and 49% respectively (48). Though the water sources treated with temephos (Abate®) to kill the Cyclops are not accounted for in these percentages, it seems unlikely that an increase in safe and treated water sources is solely responsible for the reduction in guinea worm cases.

It's hard to give an estimate of how much of the reduction is due to health education, case containment and provision of filters, but it's certain that the amount is significant and that the three are closely bound together. One reliable study done in Northern Ghana in 1996 shows the impact of health education and distribution (sale) of filters alone, with a significant decrease in guinea worm incidence from 10,4% in 1990 (pre-intervention) to 7,4% in 1991 (post-intervention). Though part of the number was accounted for by a generally lower incidence in the area, the decrease was greater among those who bought filters (49). In Uganda, only training, filters and health education reduced the number of guinea worm cases from 126 369 reported in 1992 to 10 425 reported in 1994, when they also started case containment (50).

Our survey

In our survey, we compared two guinea worm endemic populations. We talked to 51 randomly selected people in two villages that were said to have received good health education on guinea worm; Tusari and Gbungbaliga. We also talked to 46 people in two villages that were said to have received little or no health education; Gmantindo and Tokorodo. All villages are situated in the Nanumba district in the Northern Region of Ghana, one of the country's most endemic districts for guinea worm.

As the GWEP has been going on for 12 years in Ghana, it was not realistic to believe that any of the villages would be completely without health education, which may be a reason of inherent flaw in this study.

Among the people asked, there were a few more women than men (52,9% in the health educated population, 56,5% among the less educated). This difference between the two populations is not significant ($p>0,1$). We talked to people in the age range 7 - 75 years old, though the main part of the population asked was adult (defined by us as 16-50 years old). As most people don't know their own age, most ages in our questionnaires are our own estimates, which we often made sure were in accordance with the estimates of the translators, as they were more used to estimate the ages of the local population than we were.

Tusari, Gmantindo and Tokorodo were without safe drinking water, though the people in Gmantindo had access to a borehole in Gbungbaliga, about 1,5 km away. They were all small villages of comparable sizes (we estimate 4-500 inhabitants), except for Gbungbaliga, which was a bit larger (we estimate about 1000 inhabitants). None of the villages had electricity or pipe water. In Gbungbaliga, a containment centre for guinea worm opened while we were there.

The people we talked to mainly fetched their water in rivers, dams and scattered sources, though a smaller proportion fetched in boreholes (8 people (17,4%) of the non-educated population, 9 (17,6%) of the educated). A few fetched drinking water in the borehole and used dam water for washing.

37 (80,4%) of the uneducated population had had guinea worm at some point in their lives. The corresponding number in the educated population was 28 (54,9%), a significant difference ($p<0.01$).

The main population in all four villages belong to the Konkomba tribe, though we interviewed a very few Dagombas in Gbungbaliga. The Konkombas, we were told by the guinea worm staff in Tamale, have had more cases of guinea worm during the last few years than the Dagombas. One explanation for this is that they may possibly have received less health education, after the tribal wars between the two tribes – the last one in 1994 (51). Another explanation may be that they have listened less to the Dagomba educators, for the same reason. Though the two tribes now seem to live peacefully side by side, people we talked to had not forgotten about the wars.

Some of the differences in knowledge between the two populations are shown in table 3.
As one person could give more than one answer, the numbers in table 3 add up to more than a total of the people who participated in the survey. Of the ones who are marked as "Other", all mentioned water, but a bit differently than the rest: One blamed guinea worm on the fact that they didn't have pipe water; two told us "They say it comes from water", showing a more doubting approach to what they had heard. One man had been told it came from water, but he didn't believe it. Interestingly, the same man told us he had been filtering the water always for two years, and that he thought the best way to get rid of guinea worm was if other people did the same thing.

From table 4, we see that 46 (90,2%) of the respondents in the health-educated population had learned to filter their water to prevent guinea worm. The corresponding number in the villages that had received less health education was 39 (84,8%). The difference between the two populations is not significant (p>0,25). Calculating the level of difference by using the number of people who have replied correctly to one or more of the three main issues (drink safe water - borehole, make the water safe - filter, avoid contamination – don't step in water with guinea worm) also shows an insignificant difference between the two populations (p>0,25). Dressing of emerging worms has not been counted among the main issues, as a worm can contaminate water and then be dressed and some people mentioned only dressing of worms and not the other issues. The main message on how to prevent guinea worm is, if we are to believe our small numbers, pretty well known in both populations.

Of other answers, six mentioned pipe filters specifically, three mentioned pipe water, two mentioned treatment of the water – which we understand as using abate – and one mentioned boiling the water. Two also mentioned keeping the drinking pots, water containers and filters clean. Of less relevant answers, two people mentioned prayers – one of them saying specifically that Global 2000 had been there to teach them to pray to avoid guinea worm. Our theory on this is that someone giving health education may have ended his session saying something like "and then we can just pray that the guinea worm will go away..." Most of the staff and the people in the study area are highly religious, and this is a phrase that may commonly be used.

Table 5 tells us from where the people in the villages have their knowledge. Of the answers marked "Other" in table 5, a few of the interviewees in the health-educated villages mentioned the Red Cross women and the zonal coordinator. Several gave more than one answer. It is clear that the people in Gmantindo and Tokorodo had received the main part of their health education from their village volunteers, whereas a much larger proportion in Gbungbaliga and Tusari had also received health education from white people and health personnel from out of town. When we were in Tokorodo, the village volunteer had recently received health education in Bimbilla, the capital of the Nanumba district, and had passed this on to his village about 3 months before we came. Some of the ones who said that guinea worm is caused by water, also said that they didn't know, or that they had thought something else, before the village volunteer had given them health education.

The main part of the health education in both populations had been done with group discussions, though quite a few also mentioned house visits.

Do people actually do what they have been taught? This was one of the main questions we asked ourselves and wanted to find out of while in Ghana. As there was no other way of finding out during our short stay, we had this as a question in our questionnaire. We are aware that this may only tell us what they want us to believe, as self-reporting is shown often to indicate higher levels of actions than are actually being performed (25,52,53). Of the respondents in the health-educated population, 42 people (82,4%) said that they always did what they had been taught. Eighteen out of these (35,3%) had been doing it always for one year or more – though only 23 had been asked about the duration of their actions, as we didn't think of this question at first. The remaining five asked had been doing it for less than a year. Of the population with less health education, 40 people (87,0%) replied that they always did what they had been taught – the remaining six had not received health education or were unable to perform the tasks. 22 (47,8%) had been doing it for one year or more, 16 (34,8%) for less than a year and two were not asked. The difference between the educated population and the uneducated on how many who claimed to always do all the things that they had been taught, was not significant ($p>0,5$).

Three people, all in the health-educated villages, did only partly what they had been taught. Two didn't filter in the rainy season when the streams were running, one stopped filtering for about 6 months after the water had been treated with abate. One didn't believe in the health education and therefore didn't do what he had been taught at all, though he knew all the aspects of the health education and did have a filter.

19 of the uneducated and 13 of the educated people we talked to were not currently able to perform their work. Of these, the respective numbers of people who currently had guinea worm were 12 and 8. Of the total population of people we talked to who were not currently able to work, 19 (59,4%) were unable to work due to guinea worm infection. Only one person wasn't prevented from working by her guinea worm, which hadn't yet emerged. The average period of disability among the guinea worm patients currently attacked was 2,3 months up to the time of the interview (worm still in their bodies), with no large difference between the two populations.

Of the 65 who were able to work the day we were there, 19 of the educated and 16 of the uneducated said that they had had guinea worm at some time during their lives. Two of these 35 had been able to work during the infection. For the others, the average period of disability had been 2,0 months in the educated population and 3,3 months in the uneducated. The disability lasted from 2 weeks to one year. Three people were disabled for more than six months, and were not counted when we calculated the average period of disability.

A significantly larger number of people among the educated (49 people) than the uneducated (37 people) knew what they were to do to if they got guinea worm ($p<0,025$). Most mentioned the village volunteer, but quite a few in the villages close to the containment centre said that's where they would go. These interviews were done before the official opening of the centre, and within a few days from when they started receiving patients.

However, as seen in table 6, only ten (35,7%) of the people in the educated population who had had guinea worm had ever gone to someone to receive treatment, and only 14 (37,8%) of the same group in the population without education. The difference between the two groups is not significant ($p>0,5$).

Short conclusion about guinea worm is found in the general conclusion.

5.2. The effect of teaching populations on trachoma

Globally the focus on trachoma has increased over the last years. In 1997 the WHO established an alliance for the elimination of trachoma as a blinding disease by the year 2020. The alliance was called Global Elimination of Trachoma – 'GET 2020', and it supports the work of a broad spectrum of collaborating international organizations, nongovernmental development organizations (NGDOs) and foundations.

The SAFE-strategy (*see 'Facts on trachoma'*) is used by most of the trachoma programs. The focus seems to be on the S and the A-part of the strategy. 5 million trichiasis surgeries will be provided between 2000 and 2010. In addition, at least 60 million people with active disease will receive treatment in the same period (32). Still, in order to make the villagers take the tablets or undergo the surgery, health education is needed for them to know *why* this is something they should accept.

The trachoma program in Ghana is a rather new program. In 1999, a Trachoma Rapid Assessment (TRA, a method to quickly identify trachoma) was used to assess the situation in the Northern and Upper West Region (NR and UWR) of Ghana. This rapid assessment indicated that trachoma *is* a problem in some districts of these regions. In 2000 an epidemiological study was done. The range of prevalence of active trachoma (TF/TI) was found to be between 4.7 % in Tamale Municipal in the Northern region (the most urban of all the districts), and 16.5 % in the Wa district in the Upper West region (54).

Also in Ghana the SAFE-strategy is the strategy in use. And the different parts of the strategy are highly integrated. In order to make the villagers take the antibiotics, they need to know what it's for. Health education is therefore an important part of the community mobilization activities conducted in preparation for antibiotic treatment. As of November 2001, the Ghana Trachoma Control Program (GTCP) treated 71 438 persons with Zithromax ® (81 % coverage) and 7 082 with topical tetracycline ointment in 205 villages (55).

In 1999, an estimate was made that there are 9000 cases of trichiasis in Ghana (56). As of October 2001, 177 persons had trichiasis surgery done. (55)

Beginning in June 2001, health workers, teachers and 'village volunteers' have educated the people in 77 villages in NR and 101 villages in UWR on trachoma prevention and control. The program plans to expand the reach of health education activities through school health programs, to work with environmental officers and to form radio listening groups. (55)

The radio listening groups are not a new way of spreading information, and it seems to be an effective way. In several developing countries radio listening groups are used by different organizations. Examples are Women for Change in Zambia, and Uganda Media Women Association with their 'Rural Outreach Program'. In Ghana there has been a Rural Broadcasting since 1962.

The listening groups are modelled after the oral traditions of the African people, which have been found to be effective in the promotion of learning. Each listening session is followed by a discussion of the programme content, where the participants should try to connect the information given in the program with their daily lives.

In Ghana we were told that the Upper East Region (UER) had used radio listening groups as a way of informing the villagers both on trachoma and guinea worm prevention with great success – compared with the other two northernmost regions in Ghana (NR and UWR) there is hardly any trachoma or guinea worm here (according to the people working on the projects), despite the fact that the UER has the same problems with a dry climate and lack of water sources as the other two regions in the north.

Our survey:

The two villages Ponyamayiri and Chago are trachoma-endemic villages in the Upper West Region. The difference is that the people in Ponyamayiri have received organized health education, while the villagers in Chago have not. We talked to 49 persons in Ponyamayiri – 17 of them were women and 32 men. 9 of the persons we interviewed were 15 years or younger, 31 were between 16-50, and 9 were more than 50 years old. In Chago we talked to 52 persons – 32 female and 20 men. The agegroups were almost as in Ponyamayiri – 9 below 15 years, 32 between 16-50 and 11 above 50.

We notice in table 7 that among the people without health education, a lot more say that they don't know where trachoma comes from, and they also tend to have other answers than the listed ones to a much higher extent than people who have received health education. Some believed that it came from dirty drinking water, some from contaminated food. The sun and smoke were also mentioned, as both these things can make the eyes hurt. They have also experienced that dust and sand that get into the eyes during farming can be painful, and therefore many of them thought that this was the cause of trachoma. And while almost 40 % of the Ponyamayiri-villagers knew that flies had something to do with the transmission of trachoma, only 15 % of the people in Chago had the same knowledge. This is a significant difference between the educated and the non-educated populations ($p < 0,01$).

With the next question, we wanted to find out what kind of health messages the people we talked to had received.

To make the comparison of the two villages easier, we have decided to group the answers in table 8 into 1) **Answers that relate to the F-part of the SAFE-strategy** ('*Wash my face*', '*Wash my children's face*' and '*Bathing*'), and 2) **Answers that relate to the E-part of the**

strategy (*'Clean environment'*, *'Wash plates after eating'*, *'Burn rubbish'*, *'Bury faeces'* and *'Build latrines'*). After counting the answers given on the questionnaire, we find that 23 of the villagers in Ponyamayiri have answered 1 or more of the 3 F-alternatives (see table). 18 in Chago gave the same response. 39 persons in Ponyamayiri mentioned one or more of the factors to improve the environment, while only 16 did the same in Chago. So we see that even in the village that had not received organized health education (Chago), many people knew about the facial cleanliness in relation to preventing trachoma. There is no significant difference here ($p > 0,1$). However, there is a significant difference between the educated and the non-educated villagers on the E-part ($p < 0,001$). This is interesting, as some studies conclude that facial cleanliness has little impact on the trachoma incidence (58), while environmental improvement, that in turn will reduce the fly population, is more important on this matter (13).

Most of the education was given by 'health personnel from out of town' (most people did not know exactly where they came from or which program they represented). The education was usually given as group discussions (40 persons (82 %) in Ponyamayiri and 13 persons in Chago), but also through house visits (5 in Ponyamayiri and 12 in Chago). Some school children said they had learned it in school, and 4 people in Chago said they learned it from the radio. There has not been any organized radio listening groups neither in Chago nor in Ponyamayiri.

The next question is: Do they actually do what they have been taught?

We notice in table 9 that only a few people admit to do the things they were taught only partly, and no one says that they never do it. The reliability of this is discussed later.

The numbers of people who reported to have had trachoma was almost the same in both villages, as seen in table 10.

In Chago, 32 people said they know what to do if they get an eye infection. Only 10 of the people who said they had had the infection had gone to someone to receive treatment. 9 persons say they received treatment from traditional healers, and 8 persons say they were helped by 'trained medical personnel'. This may indicate that most people in the uneducated population don't trust only the traditional part or only the 'school medicine' part of the treatment, but seem to combine the two to be sure.

In Ponyamayiri, 44 people claimed to know what to do if they get an eye infection. This is significantly more than in the uneducated population ($p < 0,01$). However, only 6 of the people who had had the infection had gone to someone to receive treatment. Among these, only 2 persons had gone to a traditional healer.

A short conclusion about trachoma is found in the general conclusion.

5.3. The effect of teaching populations on lymphatic filariasis

Lymphatic filariasis (LF) is recognized as one of the world's most disabling diseases. The International Task Force for Disease Eradication stated in 1993 that LF was one of 6 diseases that could, in theory, be eradicated. In 1997 the World Health Assembly encouraged endemic countries to develop programs to eliminate LF as a public health problem, and in 2000 the Global Lymphatic Filariasis Program was started (57).

The global elimination program is a big challenge, as there are about 1 billion people at risk that need to be reached. In control programs, mass distribution of tablets should entirely replace the previously used 'selective treatment' strategy, which was based on individual detection and treatment of infected persons (40). It's possible to give out this amount of tablets thanks to the donation of albendazole by GlaxoSmithKline and the additional commitment of Merck&Co Inc to expand their donation of Mectizan ®. Reports from Trinidad & Tobago, Surinam, Costa Rica and China suggest that eradication / freedom of transmission can be achieved by chemotherapy alone (57). However, vector control would increase the pressure toward reduced transmission (58).

The health education part of the LF program is mainly concentrated on people already infected, and how to avoid superinfections that will increase the risk of exacerbation of lymphedema and elephantiasis. Simple hygiene measures, occasionally supplemented by the use of antiseptic fluids or topical antibiotics, have a good effect in preventing and alleviating debilitating and damaging episodes of adenolymphangitis (59,60).

Education in order to make people accept the mass drug administration is also important. In Egypt a comic book was designed to improve knowledge and attitudes of school children.

The book significantly reduced the fear of LF among the children, and the knowledge about treating and preventing LF was significantly increased (61)

Our survey

As far as we were told, there had been no health education done to teach people in Ghana about the origin of LF and how to prevent it. We therefore went to only one village and talked to 50 people about their beliefs around the disease. We were told that one person in the village had LF, but we didn't get to see this person. When asking whether the person we talked to had the disease, we always made sure there was nobody else from the village around, as the swelling may also include intimate body parts and they would be less inclined to reply honestly if other people heard them. However, nobody confirmed having LF or swelling of any body parts, and we therefore assume they didn't.

Three people were ignorant that the disease even existed, two had heard about it but never seen it, but most people knew of and had seen it. The vast majority (38 people) didn't know the origin, but one traditional belief stood out compared to the others: LF comes from getting stung by thorns from a certain kind of grass that the elephant eats when stepping in elephant faeces. As there are not many elephants these days, some meant that mean people would go to the bush to find elephant faeces to spread around the village, others that you may accidentally step on some while farming. Other explanations on the etiology of the disease included hatred, spiritual medicine, stepping in bush pig faeces, stepping on a certain kind of small lizard, wearing the same sandals as an affected person, dirty environment and that it comes through God.

Those who said they had received health education (26 people said they hadn't), said mainly that they had learned to keep their environment and their bodies clean, drink clean water, always wearing sandals on farm to avoid stepping in elephant faeces and to always eat good food were also among the things mentioned.

It seems there had been some mix-up with the health education for trachoma, as quite a few people mentioned weeding around the house, digging holes to bury faeces, avoiding flies in the food – in short, keep the environment clean. To always clean their bodies, as many mentioned, could also be a mix-up with health education messages for trachoma, but daily washing of limbs with soap and water is a central message in health education for LF, so it is difficult to differentiate and in any case beneficial for both diseases.

Ten people said that people had come to give them medicine against LF, but no health education. One said that he didn't get any medicine, as they ran out of it before everyone had gotten, another that he had been given medicines, but he didn't know what they were for. 21 (44%) of the people we talked to said that people had approached them offering medicine against LF, which they had accepted.

6. Discussion

Guinea worm, trachoma and lymphatic filariasis (LF) have primarily one thing in common: Programs to eliminate the diseases as a public health problem all include health education. We wanted to see if it's possible to say anything about the effect of the health education given.

As there was no program on health education for LF, this discussion is concentrated mainly on the programs to eliminate guinea worm and trachoma.

The Guinea Worm Eradication Program (GWEP) and the Ghana Trachoma Control Program (GTCP) have very different histories. The guinea worm program has been going on for 14 years, while the trachoma program only started 3-4 years ago. Still, it was interesting to see how far the trachoma program has come in a short time. The trachoma program has several messages concerning both hygiene / facial cleanliness and environmental improvement. Many people we talked to knew quite many of these messages, and also how the disease is transmitted.

The knowledge on guinea worm is also good – as we would expect it to be after 14 years of educating the villagers. There is no discussion about the fact that the GWEP has achieved a lot. However, guinea worm is still a public health problem in Ghana and even in the villages we went to there were several cases. People seem to know in general that the disease is transmitted through water, but not the actual details of how the transmission is done, as opposed to many of the people who had received education about trachoma.

It would be interesting to find out more about why there is a difference in this area of knowledge between the groups. Possibly, the guinea worm program has focused more on the simple messages, not having believed in people's ability to grasp more complex ideas. Another reason may be that Ponyamayiri, from our impression, was a kind of "test village" for trachoma health education and therefore may have received more health education than can be realistically expected in later mass programs. This may not be important, but it's among the major differences we noticed and is therefore worth mentioning.

Things that may have biased or caused inherent flaw in our survey include the time of day that most of the questions were asked, as many people go for farming or to fetch water during the day and the safest time to reach most of the population is early in the morning. As our interviews took a certain amount of time, we had to spend the whole day in the villages interviewing people. The number of people in Tokorodo was reduced the day we were there, as many people had gone to the weekly market in a larger village nearby.

We were told by the local staff for the different programs (GWEP, GTCP and the regional public health officer in the Upper West Region for LF) which villages would be good to go to to see the classes of people we were looking for (with and without health education). There may have been other villages where less education had been done than the ones where we went to see people who had not received formal health education, but this is no certainty and we have every reason to believe that these people gave us information to the best of their knowledge. It is interesting to see, however, how health education was performed in villages without the local staff knowing it, such as was done by the village volunteer in Tokorodo. In a program as extensive as the GWEP, with volunteers in every village, naturally things will happen without the knowledge of everyone. It is hard to see how this could be different, seeing the infrastructure in rural Africa, but possibly closer surveillance through closer follow-up of the zonal coordinators might help with some of the problem.

One large possible source of bias is the use of translators. For guinea worm, we used people recommended by the local GWEP staff. Most of these were themselves guinea worm volunteers, though not in the villages we went to. These volunteers may still have been known by the villagers, who may therefore have said what they thought we wanted to hear. The translators may also have been reluctant to tell us when people said things that didn't fit with the program, though we don't have any major reason to believe this. For trachoma and

LF, we used two translators who were recommended by the local public health authorities. They were not connected with the programs, and had been used as translators for similar purposes before. With these we also went through the whole questionnaire to make sure that they understood all the questions and would ask them as similarly as possible. Still; we have noticed that some answers were only given to Karin, where as others were only given to Anne. This was typical for the trachoma questions only, which indicates that the two translators had asked the questions differently.

In the first village we went to for guinea worm, Tusari, the village volunteer came with us for most of our interviews, which may also have made people say what they thought we wanted to hear. Also, though we made it clear in the beginning of each interview that we were independent of the programs and that their names or identities would not be recorded anywhere, people may still have seen us as guinea worm/trachoma/LF health workers and given us answers according to what they thought we wanted to hear.

For instance, practically every person who admitted to having received health education claimed to always do as he/she had been taught. For guinea worm, this was obviously not the case, as many of the people we talked to were infected with guinea worm when we were there. We later thought that an interesting question to ask in addition to "do you actually do what you have been taught?" would have been "does your neighbor do as he/she has been taught?", which would possibly have revealed a different picture of compliance. Several studies on facial cleanliness (and distance to water source) that are based on self report have the problem with overreporting (25,52,53). This seems to be a problem in our survey too.

Now having mentioned many possible sources of inherent flaw, what have we actually found in our study?

We found no significant difference in the level of knowledge between the two guinea worm populations we talked to, though the significant difference ($p<0,01$) in the level of guinea worm infections makes us believe that the health education still has had greater impact and has been going on longer in the population defined by us as "health-educated" than in the one defined as "uneducated". Many people said that there had been no program to eliminate guinea worm until the last two years or less. These included people from villages where Karin specifically remembers having treated guinea worm patients and doing health education in 1996/-97, probably indicating that the health education must be repeated with intervals that are not too long. That these people have not been aware of the program going on, must also mean that they haven't known about the village volunteers. Further work to make these known in the communities may be important to the programs – especially since a large proportion of both communities had received their health education from the village volunteer.

On trachoma, on the other hand, we did find some significant differences in people's knowledge about the disease between the "educated" and the "uneducated" population.

We also noticed that even the people who we were told had received no organized health education seemed to have 'picked up' some important messages, either from health personnel distributing antibiotics or from the radio. And they all claim to do what they have been told, at least partly. It's also an important observation that 89 % of the people who had received health education on trachoma knew where to go if they get an eye infection, while only 64 % had the same knowledge in the uneducated population. The question is, of course; would they seek treatment anyway?

We also see that there is a big difference in people's opinion on what causes the diseases after having received health education. This is especially clear on trachoma and LF. As there had been no organized health education on LF, no one gave us the right answer to where it comes from. This is an important issue, as knowledge about the etiology of the disease often is crucial to avoid the disease.

7. Conclusion

Several studies have shown the importance of health education (14,61,62). Also, the importance of health education is shown by the success of the global GWEP, which is based largely on health education.

Our survey has shown few differences between the guinea worm villages with different levels of health education. However, a significant difference between how many had had guinea worm between the two populations suggests that there has been a difference in knowledge up until recently, accounting for the larger number of cases in the "uneducated" population.

For both trachoma and guinea worm, the difference between the "educated" and the "uneducated" populations was significant when it comes to the level of knowledge of what to do if they get the infections and thus decrease transmission.

Trachoma also had a significant difference in the level of knowledge about the disease in general, and the village where they had received health education was visibly cleaner, tidier and with less flies than Chago, decreasing the chances of trachoma transmission.

The people we asked about LF didn't know at all the scientific explanation of the disease, and were therefore completely unable to make the choice to avoid infection and possible exacerbations.

Guinea worm and trachoma are great handicaps and therefore reduce general health. We find that health education seems to have an effect on general health in the communities we visited, seeing how the number of guinea worm cases was significantly smaller in the health-educated villages than in the "uneducated" and that the difference in knowledge about trachoma in the two villages was also significant. In our literature studies we have found that there is difference in opinion on the value of health education to prevent trachoma and LF. On the other hand, the reduction of guinea worm cases world wide, due mainly to health education, strongly suggests that this should also be effective to prevent other diseases.

8. Tables

Table 1:

Prevalence of TF, TFTI, TS, and TT (according to WHO guidelines for intervention) in the Sissala and Wa districts of the Upper West Region, 2002 (total number of persons examined: 6541) (37)

Area	**Subjects and Communities**	**Age group 1-9 years**	**Age group 15 years and above (women)**
The 2 districts combined (Wa and Sissala)	Total subjects: 6,541 Communities: 64	Total subjects 3,532 Mean age: 4.5 years TF = 10.3% TFTI = 11.0% TS = 0.1% TT = 0.01 (n =3)	Total subjects 3009 Mean age: 39 years TF=1.5% TFTI = 2.5% TS = 2.8% TT = 1.4% (n = 43) CO = 0.6%

Table 2:

Incidence of guinea worm globally and in Ghana from 1986 until 2002

	Number of cases estimated in 1986 (globally) and reported in 1989 (Ghana)	Number of cases reported in 2002	Percent reduction	Safe water sources rurally in 1990	Safe water sources rurally in 2000
Globally	3 320 000	54 642	98,4%	44% (Africa)	47% (Africa)
Ghana	179 556	5606	96,1%	43%	49%

Table 3:

The response to the question "what does guinea worm come from?"

	Villages with health education (Gbungbaliga/Tusari) N=51		Villages with less health education (Gmantindo/Tokorodo) N=46	
	n	%	n	%
Water	42	82,4	31	67,4
I don't know	9	17,6	13	28,3
It is in the blood/comes from the human body	0	0	3	6,5
The ground	1	2,0	0	0
Other	2	3,9	2	4,3

Table 4:

The response to the question "what kind of health messages have you received to prevent or treat guinea worm?"

	With health education (Gbungbaliga/Tusari) N=51		# of respondents with health education who have answered one or more of crucial preventing factors	With less health education (Gmantindo/Tokorodo) N=46		# of respondents with less health education who have answered one or more of crucial preventing factors
	n	%		n	%	
Filter water	46	90,2	47	39	84,8	39
Avoid stepping into water	9	17,6		1	2,2	
Use borehole	4	7,8		4	8,7	
Dressing of emerging worms	3	5,9		1	2,2	
None	4	7,8		5	10,9	
Other	11	21,6		14	30,4	

Table 5:
Response to the question "who gave you your education (ie health education)?"

	Villages with health education (Gbungbaliga/Tusari) N=51		Villages with less health education (Gmantindo/Tokorodo) N=46	
	n	%	n	%
Village volunteer	25	49	32	69,6
Health personnel from other village/out of town	23	45,1	2	4,3
White people	12	23,5	3	6,5
I just know	0	0	3	6,5
Global 2000	0	0	2	4,3
Relatives	0	0	1	2,2
Other	6	11,8	3	6,5
Not applicable	4	7,8	5	10,9

Table 6:
What people do when they get guinea worm

	With education (Gbungbaliga/Tusari) Only people who have been affected by guinea worm (N=28)		Without education (Gmantindo/Tokorodo) Only people who have been affected by guinea worm (N=36)	
	n	%	n	%
Has gone to someone to receive treatment for guinea worm	10	35,7	14	38,9
Has not gone to someone to receive treatment for guinea worm	18	64,3	23	63,9
Has been approached by someone offering treatment for guinea worm and has accepted the treatment	9	32,1	8	22,2
Has received medical or surgical treatment for guinea worm	11	39,3	15	41,7
Has received traditional treatment	5	17,9	2	5,6

Table 7:

Response to the question "what does trachoma come from?" in the two categories of villages

	With education (Ponyamayiri) N=49		Without education (Chago) N=52	
	n	%	n	%
Dirt / dirty environment	20	40,8	20	38,5
Sharing water / cloth with infected	2	4,1	2	3,8
Flies	19	38,8	8	15,4
Animal / human faeces	2	10,2	0	0
I don't know	14	28,6	28	53,8
Other	7	14,3	20	38,5

Table 8:

Response to the question "what kind of health messages have you received?"

	With education (Ponyamayiri) N=49		# of respondents with health education who have answered one or more of the 'F' and 'E' in the SAFE strategy	Without education (Chago) N=52 % of the 52 in parenthesis		# of respondents without health education who have answered one or more of the 'F' and 'E' in the SAFE strategy
	n	%		n	%	
Wash my face	14	28,6	23	11	21,2	18
Wash children's face	4	8,2		4	7,7	
Bathing	6	12,2		5	9,6	
Clean environment	31	63,3	39	14	26,9	16
Wash plates after eating	9	18,4		7	13,5	
Burn rubbish	11	22,4		1	1,9	
Bury faeces	26	53,1		1	1,9	
Build latrines	2	4,1		0	0	
Nothing / I don't know	6	12,2		21	40,4	
Other	18	36,7		22	42,3	

Table 9:

Response to the question "do you actually do what you have been taught?"

	YES		NO	PARTLY		NOT APPLICABLE	
	n	%		n	%	N	%
With education (N=49)	37	75,5	0	5	10,2	7	14,3
Without education (N=52)	23	44,2	0	8	15,4	21	40,4

Table 10:

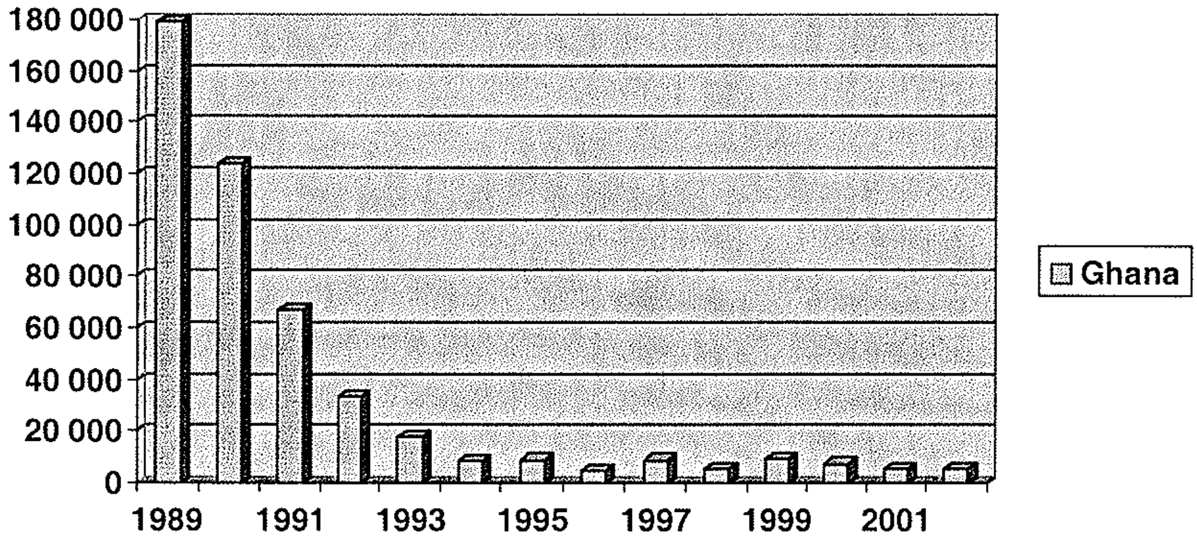
Response to the question "have you ever had trachoma?"

	With education N=49		Without education N=52	
	N	%	n	%
NO	30	61,2	32	61,5
YES	19	38,8	20	38,5

9. Figures

Figure 1:

Incidence of guinea worm in Ghana from 1989 until 2002 (9,12)



10. Appendix

Appendix 1:

QUESTIONNAIRE

Teaching Populations as a Means of Improving General Health. Training provided to the village populations in Northern Ghana to prevent and treat guinea worm, trachoma and lymphatic filariasis.

Age: Sex: Village:

1. What does GW/Tr/LF come from?

2. What kind of health messages have you received to prevent or treat GW/Tr/LF?

3. Have you been educated to do something in specific?

4. Who told you these things? (i.e. who gave you your education?)

5. How was the teaching performed (e.g. group discussions, drama, one-to-one, house visits, other)? *(The different options were specified).*
6. Do you actually do what you have been taught? If yes: Sometimes or always or some of the things but not all?

   - YES
     i. How often and for how long?
     ii. Why?
     iii. What helps you to do these things that you mentioned?
     iv. Has it been beneficial for you? If yes: How?

   - NO
     i. Why not?
     ii. What stops you?

   - PARTLY
     i. Which parts?
     ii. Which parts do you not do? What stops you from doing some of the things you have been educated to do?
     iii. What helps you to do the things you do?
     iv. How often do you do the things you do?

7. Where do you fetch your water?
   -SCATTERED SOURCES -WELL -BOREHOLE* -RIVER
   -DAM**
8. Are you currently able to perform your work?
   - YES
     i. Have you ever had GW/Tr/experienced swelling of any body parts?

If yes: WHEN, and HOW MANY TIMES?

ii. If yes; were you then able to work like now? – If no: For how long?

- NO
  i. Do you currently have GW/Tr/LF?
  ii. What stops you?
  iii. For how long have you been unable to work?

9. Have you ever been sick from GW/Tr/LF?
   - NO - YES (WHEN?)

10. Do you know what to do/who to go to if you get GW/Tr/LF (if any of your body parts swell up)?
    - NO - YES (WHAT? TO WHO?)

11. Have you ever gone to someone to receive treatment for GW/Tr/LF?
    - NO - YES

12. Has anyone approached you offering treatment for GW/Tr/LF *(here we used the actual name of lymphatic filariasis, as it might have been used if they had been offered treatment)*? If yes – did you accept?
    - NO - YES-YES - YES-NO

13. Have you ever received medical or surgical treatment for GW/Tr/LF by trained medical personnel like a nurse or a medical doctor? *(Including village volunteers)*
    - NO - YES (WHO?)

14. Have you ever received treatment from other people, like traditional healers or joujou? If yes; what was the treatment?

15. Can you think of anything that would take away GW/Tr/LF from your village?

* Do you always use the borehole?
* *Has anyone ever treated the dam?

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