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Water supply and guinea worm

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INTRODUCTION

Until the early 1980s guinea worm disease had been largely neglected in Africa. It was found in rural areas without protected water supplies and with limited health care facilities. However, as a result of the activities of the Water Supply and Sanitation Decade (1981-1990), and the growing concern with primary health care in rural areas, guinea worm prevalence rates are declining, especially in communities provided with protected water supplies. For guinea worm is the only disease which can be eliminated totally from a community as a result of the provision, and utilization, of protected year-round water supplies (refs. 1, 2).

Approximately 120 million Africans are at risk from this disease, and an estimated 3,300,000 cases occur every year, about 2 1/2 million of these in Nigeria alone. Dracunculiasis is endemic in 18 countries, in a belt extending from the sahel south to the west African coast, and from Mauritania to Ethiopia (refs 3, 4). Guinea worm is not usually fatal, but it can cause prolonged incapacitation, for three months or more. Incapacitated adults cannot work, children cannot attend school, and affected mothers cannot care adequately for their children (refs 5, 6, 7, 8).

This paper will assess the effect of protected water supplies on guinea worm prevalence in Kwara and Oyo States of Nigeria. It will examine the impact of boreholes, provided through the cooperation of local and international agencies, and of dug wells, provided by the local community with the guidance of local researchers. Some policy implications of these findings will be briefly explored.

DISEASE TRANSMISSION

Guinea worm is contracted as a result of drinking water containing cyclops which contain the embryo of the guinea worm, Dracunculus medinensis. Within 10 months to a year after a subject swallows an infective embryo, an abscess or ulcer forms on the skin, often on the lower leg or foot, and the female worm emerges. When an infected limb is submerged in water, e. g. when bathing or collecting water, many guinea worm embryos are released into the water and seek out the intermediate host. The infective cyclops are then swallowed by humans, and the cycle of transmission is complete (ref 9).

In a single visit to an unprotected pond, an infected person can contaminate an unprotected water source shared by a whole community. In Ajagusi, in Kwara State, a village woman who traded in dried fish introduced the infection into the village when she collected water at the village pond. A woman who came to the nearby village of Egbijila for a marriage ceremony introduced the infection into a stagnant pond used for drinking water in the dry season (ref 10). This pond, a seasonally flooded arm of the new Asa Lake, constructed to provide the citizens of Ilorin with drinking water, was closer to the village than the shore of the free flowing lake, where they had previously collected water in the dry season (ref 11).

The introduction of guinea worm into Egbijila is a clear example of a planned improvement for an urban population which had an adverse impact on a nearby rural area. Local authorities in this area constructed open ponds for domestic water supply, but did not protect them adequately. Hence, they became foci for the transmission of guinea worm disease. Such problems

TABLE 1

The status of guinea worm infection in 20 served and 5 unserved communities before and after intervention Afon District, Asa Local Government Area, Kwara State, Nigeria

Intervention communities	Census	1983–84 No. examined	1983–84 No. infected	1983–84 %	1986–87 No. examined	1986–87 No. infected	1986–87 %	% reduction	Borehole Date completed	Borehole Condition
Aboto Alfa	972	813	431	53.0	672	101	15.0	72	11-84	3, 5, 4
Ajagusi	210	184	121	65.8	148	7	4.8	92	2-85	1
Alata	786	606	418	69.0	485	88	18.1	38	11-84	4, 6
Budo Aro	232	192	75	39.1	175	4	2.3	92	12-84	1
Foko	618	572	229	40	313	17	5.4	86	12-84	3, 4
Gbago	206	186	98	52.7	112	0	0	100	8-84	1
Gbale Asun	216	192	132	68.7	211	13	6.2	91	9-84	2
Igbo Aran	2,002	1,440	950	66.0	882	72	8.2	87	11-84	4
Igbo Ede	166	142	74	52.9	98	5	5.1	90	8-84	1
Ita Raufu	324	256	138	53.9	168	4	2.4	92	1-85	1
Kankan	256	218	135	62.0	241	0	0	100	8-84	1
Laiyemo	181	136	83	61.0	141	10	4.1	88	10-84	6
Momo Alagbede	142	112	50	44.6	91	3	3.3	92	12-84	1
Oguntoyinbo	1,843	1,409	845	60.0	934	85	9.1	85	11-84	4
Olodomeji	192	145	65	44.8	125	0	0	100	1-85	1
Olowoko	186	146	90	61.6	150	9	6.0	90	12-84	6
Oniyere	996	840	571	68	521	50	9.6	86	11-84	4
Sapati Ile	642	589	383	65	613	218	35.6	45	2-85	2, 3, 4
Solu	302	262	147	56.1	194	11	5.8	90	9-84	2
Wara	184	168	99	58.9	151	27	17.9	69	3-85	2, 7
Total	10,656	8,608	5,134	59.6	6,425	724	11.3	81		
Control communities										
Alawon	168	124	78	62.9	138	81	58.7	7		7
Egbijila	524	204	92	45.1	236	102	43.2	4		7
Igboroko	182	128	61	47.7	109	51	46.8	2		7
Kangu	215	152	82	53.9	141	73	51.8	4		7
Osin Okete	136	94	53	56.4	117	72	61.5	−9		7
Total	1,225	702	366	52.1	741	379	51.1	2		

Borehole condition. 1. Located within a village and sited 200 m or less from the farthest house. 2. Problem of water acceptability, colour, taste, or smell. 3. Near a previously infected pond. 4. Serving a village with over 500 people. 5. Shared between two or more villages and situated 1 km or more from each village. 6. Nonfunctioning or malfunctioning for some time. 7. No borehole. Source ref 12.

are found elsewhere in Nigeria. In Sokoto State, dams constructed by SARDA (Sokoto Agricultural and Rural Development Authority) are now major foci for guinea worm transmission. In Katsina State, people resettled in the Zove dam project contracted guinea worm from ponds formed in pits left by construction work.

These examples present a challenge for the planning of rural water development. Ideally health considerations should be fully incorporated into the planning of all water supply schemes. It is in this spirit that we present our own studies of the way in which protected water sources, boreholes with hand pumps, and dug wells, can protect communities against the ravages of guinea worm.

PROTECTED WATER SOURCES

Boreholes

In 1986-7 a survey assessed the effect of boreholes on the prevalence of guinea worm disease in communities in Asa, Kwara State, Nigeria. In the 1983-4 dry season, prevalence studies were conducted in 20 intervention villages, and in 5 control villages which were not to be provided with boreholes. In the 1986-87 guinea worm season, at least three years after the construction of boreholes in the intervention villages, the villages were once again evaluated for guinea worm prevalence and, where appropriate, the condition of the borehole.

Table 1 shows the status of guinea worm infection in study villages in 1983-84 and 1986-87 dry seasons.

Guinea worm prevalence in the 5 villages where no intervention occurred remained essentially the same. In contrast, the 20 intervention villages recorded an overall decline of 81% in prevalence between the two surveys, with a reduction to zero in 3 villages. In these three villages, the borehole was accessible to, and used by, all members of the community.
Less favourably sited boreholes, or those serving more than 500 people, resulted in a less dramatic decline in prevalence. Here, people used alternative sources of water because the boreholes were too far from some houses, or queues caused delays. A malfunctioning or nonfunctioning borehole, such as that at Wara, had little or no impact on prevalence rates (ref 12).

Dug wells
Year-round wells which have a parapet to prevent people with guinea worm lesions contaminating the water, and do not allow contaminated surface water to flow into the wells, provide protection against guinea worm. Such wells can often be constructed by local people, with some help and encouragement from outside. One example of this self-help is the village of Igbon, in northern Oyo State.

In November 1978, Igbon had a 59% point prevalence rate for guinea worm (ref 13). Within four years, after the construction of wells in the village, transmission was reduced to nil and remained at that level for each of the three succeeding years. A 1986 survey showed that children born in the community since 1980-81 had never had the infection. In 1986, all households drew their water from wells (except one whose members brought piped water from the nearby town of Ogbomosho). In contrast, in the past all households had used unprotected water sources, principally ponds.

Igbon villagers used multiple strategies to eliminated guinea worm, and were assisted by the research team. Health education, the treatment of the contaminated ponds with abate, chemotherapy, and tetanus toxoid for guinea worm sufferers, had an immediate impact in terms of relieving suffering, limiting transmission, and raising community awareness. The major long-term strategy in Igbon was the construction of protected wells. The villagers collected money to hire Hausa labourers to dig wells, and to purchase cement. Later, a number of individuals dug their own private wells, and allowed their neighbours to use them.

The benefits which might accrue to a formerly endemic community as the result of the elimination of guinea worm are clearly illustrated in Igbon. Household heads reported especially their improved ability to work, and the expansion of the village. The village grew rapidly, as people were able to take advantage of its position astride the main north-south road in western Nigeria. A community secondary school, churches, a market, a town hall, and businesses such as a poultry farm and a maize project were established. Women were able to irrigate their vegetable farms with water from the ponds which had once been used as drinking water sources, and benefitted from the new periodic market founded in Igbon in 1983.

CONCLUSION
In the Middle East and southern USSR, the elimination of guinea worm was often a by-product of the introduction of improved water supplies (refs 1, 9). Where the disease is still common today, in parts of Pakistan, India, and, most of all in Africa, guinea worm elimination is seen as an integral part of rural water supply projects. The experiences described in this paper illustrate clearly the impact of protected water supplies, whether boreholes or dug wells, in bringing about a dramatic decline in the prevalence of guinea worm, and a marked improvement in the quality of life and level of economic activities in previously affected communities.

In planning rural water supplies, decisions need to be made about which communities should be served, and the location of the water sources within the communities. These are never easy decisions, given the shortage of local resources, personal and political rivalries, and the large areas of rural Africa which are still unserved. UNICEF water projects in Kwara, Gongola, Imo, Anambra, Cross River, and Niger States are now using guinea worm prevalence rates to help to decide which LGAs and which communities should be given priority in the provision of boreholes.

It is often difficult to evaluate the health impact of a protected water supply, especially for diseases such as diarrhea, which have a number of transmission routes (ref 14). However, in the case of guinea worm, sites of transmission are usually highly localized, and can be identified and monitored for the presence of infective cyclops. Prevalence studies are relatively easy to carry out and changes in prevalence rates can be clearly related to the utilization of certain water resources.

The provision of new, protected water supplies takes time. Therefore, preventive measures should be applied as soon as possible to existing water sources. Abate is an effective cyclopscide (ref 9). Clearing the pond to remove excess organic material on which the cyclops feed, and constructing a platform on which people can stand while collecting water are also helpful. Domestic treatment of water, principally the use of a simple cloth filter which is placed over the neck of the domestic water storage vessel, has also proved effective, as has a sand filter in the pond (refs 15, 16). Such preventive measures are essential as a single visit to a pond can result in contamination of a water source which may be used by the whole community and will result in an outbreak of guinea worm about 12 months later.

The experience and success of UNICEF water and sanitation projects in different parts of Nigeria and the financial and technical support of Global 2000 BCCI provided an impetus for a national eradication effort. In June 1988, the Nigerian Guinea Worm Eradication Programme was established incorporating a national Secretariat, a national task force, and state task forces in every state and the Federal Capital Territory. By February 1988 an active case search covering every village in the Federation, had been completed and the magnitude and geographical extent of the problem was established. Options and resources to implement the eradication programme have been identified, and December 1995 targeted as the date for eradication. A major political commitment has been made by the federal government; guinea worm has been made an officially notifiable disease, and the Directorate of Food, Roads and Rural Infrastructure (DFFR) directed to give priority to villages with guinea worm in the provision of protected water supplies. The achievement of eradication by the end of 1995 now appears to be a realisable aim.

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