In the Name of God

Republic of Yemen
Ministry of Public Health & Population
Sector of Medical & Primary Health Care
National Center for Epidemiology & Disease Surveillance
National Program for Guinea Worm Eradication

Country Report

For Guinea Worm eradication Programme

Republic of Yemen

Sana'a, 27 November 2003

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Executive summary

Dracunculiasis was widespread in Yemen during the first half of this century and probably earlier as mentioned by foreigner travellers. Water cisterns built some 500 years ago were likely to be the source of infection. Although no cases were officially reported during the second half of the twentieth century in Yemen, several dracunculiasis cases were reported among Yemeni immigrants and workers in neighbouring countries. Except for one case reported to WHO from Rima in 11981 by General Director in the Ministry of Health, the disease was not officially reported in Yemen till the last ten years.

In 1990, a person from Al-Ajraf Region of Wesab reported to the MoPH cases of dracunculiasis occurring in his village. Because the National Guinea Worm Eradication Programme (NGWEP) was not yet existing, he was advised to advocate boiling the water for prevention. In 1994, there was a recommendation from WHO to conduct nation-wide survey for dracunculiasis cases. But it was difficult to conduct such survey. Instead, the television announced a reward of 3000 Yemeni Rial to anybody who reports a case of dracunculiasis. As a result, a member of the parliament reported that a village in Dhamar was endemic with this disease. This prompted the Ministry of Health to send with him a team to the area to investigate such claim. Thus, a first case of dracunculiasis in Muqaiberah al Hawaz village in Dhamar was found by the team for a young woman infected in her leg. Subsequently, NGWEP was established and its Guinea worm eradication programme activities.

NGWEP concentrated on training of village health volunteers to: case detection, case containment, vector control using abate, filtration using cloth and pipe filters, protection of well by construction of parapets and dissemination of health education. The number of cases declined from about 94 cases in 1994 to zero cases in 1997 and thereafter.

Yemen entered its three-year precertification stage during which surveillance and necessary intervention activities had continued. However, rumours of dracunculiasis cases were reported. They were investigated but were not confirmed as cases since they were not active during the investigation. Those strong rumours cast doubts on the claim that Yemen interrupted dracunculiasis transmission. The NGWEP in Yemen has continued its efforts, with support from WHO, in applying Guinea worm eradication strategy including training of village health workers, strengthening surveillance and carrying on certain interventions including advertizing through media high amount of reward for informing on cases. It has kept archive of reports from formerly endemic areas and other areas.

Yemen trust that the disease transmission was interrupted in 1997 and that no cases of dracunculiasis occurred from that time till writing of this report as found through systematic surveillance and reward system in formerly endemic areas and other areas in Yemen. Knowledge about the disease among the Yemeni population is well recognized. It is not likely that the disease will be reintroduced from other countries, as Yemen is the last country to interrupt the disease outside of Africa. If this happened, the surveillance system in Yemen has been strengthened and is capable of detecting cases if it is reintroduced. Yemen is ready for certification of Guinea worm eradication.

1. Country Background

1.1. Location

Yemen is located at south-west of Asia, surrounded by Saudi Arabia from the north, Sultanate of Oman from east, Red Sea from west and Gulf of Aden and Arab sea from south. Yemen was politically divided into 2 countries for more than 100 years till both united in 22nd may, 1990 into one country and has the official name of " Republic of Yemen".

The area of the country is about 555,000 sq.m. The country is divided at the first decentralized level into 21 governorates (Map 1) which has 332 districts governed by the elected local councils.

1.2. Topography

Yemen is one of the most mountainous countries. The country is divided geographically into 4 areas, the mountains, the plateau, the coastal, and the desert area. Furthermore, several islands are scattered in the Red Sea and Arabian Sea.

1.2.1. Mountainous

Mountains in Yemen were formed of lava resulting from the famous African faulting along the North-south Red Sea Axis and the East-west Gulf of Aden axis. Geologically, this area is made of volcanic rocks between 1,000 and 3,666 m above sea level. Watershed divisions are located in these mountains and run east to west and south of these Wadis into the Red Sea. The most important ones are:

- Zabeid, More, Haradh and Surdood which flow into the Red Sea.
- Wadi Tuban, Wadi Bana and Hadramout that flow into the Gulf of Aden and the Arabian Sea.
- Other Wadies. Such as Wadi Khub, Wadi Sad, Wadi Idhuah and Wadi Al-Jawf with downpour eastward.
- Wadis such as Hareeb, Ramah and Shuath that run east and northeast.

Within the mountain chains warrant construction of dams and terraces for irrigating of vast agricultural areas. The main lands are: Sa'ada Albon, Beihan (in Shabwah), Iwah (in Hadramout) and Shuaith (in al-Mahrah).

1.2.2. Plateau regions

To the east and north parallel to the mountainous regions stretched the plateau regions towards Ar-Rub Al-Khali. These regions become wider and gradually slope down to reach an elevation of 1000m. These include Sa'adaa, Al-Jawf. Shabwah, Hadramout and Al-Mahrah which finally border Ar-Rub Al-Khali from the eastern side.

1.2.3. Coastal regions

These include coastal lands along the Red Sea and from the Oman border Southwest to Bab Al-Mandab and finally extend North to the border with Saudi Arabia.

1.2.4. Ar-Rub Al-Khali

This area forms part of the desert region. It is located eastern of the plateau regions.

1.2.5. The Yemeni Islands

These islands which are scattered in the Red Sea and the Arabian Sea, have their own distinctive climate, environment, geographical and natural characteristics. Socatra Island in the Arabian Sea is the largest Yemeni island, in addition to this one there are 112 others scattered in the Red Sea, the largest is Kamaran, Great Hunish, Little Hunish, Zugar, Az-Zobair and At-Tair.

With this mountainous topography in which most of the previously endemic districts exist, it is rare to have paved road to reach them. Some areas in Yemen are reached during the national Immunization days for polio by donkeys and some areas get the vaccines cold box by ropes.

1.3. Demography:

Population of Yemen in 2003, as projected by the Central Organization of Statistics (COS) based on the census of 1994, is 19.5 millions. The rural population represents 73% while 27% of the population live in the urban area. Around 50% of the population are under the age of 15 years old. 51% of the population are females.

1.4. Health system

Health organization system in the Ministry of Health can be seen in Figure 1.

1.4.1. Health policies and strategies

The policies and strategies of the Ministry of Public Health and Population (MoPH&P) had been approved by the first national conference for health development in 1994. It was strongly emphasized that Yemen is committed to control and eradicate diseases under global targets. So, although the dracunculiasis at the time of the conference was not considered a public health problem, but the MoPH&P had committed itself to participate with the global efforts to eradicate the disease.

1.4.2. Health indicators

Infant Mortality Rate 75.3%
Under 5 Mortality Rate 104.8
Maternal Mortality Rate

1.4.3. Primary Health Care

Yemen has adopted the approach of primary health care since 1980. Although the health care is provided through several levels (PHC units, health centers, district hospitals and governorate hospitals), there is no referral system in the country. The health care is also provided by the private sector (hospitals and dispensaries).

The government health services covers only 50 % of the population at the most because some of the primary health care units are closed either because of lack of facilities or lack of staffing or both.

1.4.4. Health Information System

For long time, the MoPH&P had several attempts to develop a health information system but this has not been materialized. During the last two years, a guideline for the system was developed and it is piloted in two governorates in order to expand the system to the entire country.

1.4.5. Surveillance for Communicable Diseases

Since the surveillance of communicable diseases is part of the health information system, it was affected badly by the absence of HIS. It was difficult for the surveillance to exist while there is no uniformed registries, forms for reporting ..etc. It was the first challenge that faced the exploring of the Guinea worm disease situation in Yemen.

1.5. Water sources in Yemen

In general the country has shortage in sources of water. It has wadis with long rivers that drain either to the Red Sea or to the Gulf of Aden and Arab Sea. Most of the rural population used to drink water from cisterns "Burkehs" or wells that depend on the rains. They are not chlorinated or chemically treated at all. The rainy season in Yemen has two periods, April-May and July-September.

1.5.1. Water sources and its contribution to dracunculiasis infection

Although for the last three decades thousands of water supply projects were implemented, still only 55% of rural population of Yemen have access to safe drinking water. Much of the government water operations in rural areas are not adequately planned, are under-funded and communities are not involved in their operation. Schemes are therefore unsustainable and have contributed to the depletion of water resources and certain areas risk entirely depleting their water supply in the medium term.

UNICEF in Cooperation with the World Bank and working closely with General Authority for Rural Electrification and Water Supply (GAREWS) are implementing several water schemes for rural areas. This is a small component of a child development programme with a proposed credit of US$ 28.9 millions. The project implementation period is 2000-2004. UNICEF and IDA will jointly finance the project with UNICEF as the implementing agency. The Governorates covered are Sana'a, Hodeidah, Hajjah, Ibb, Al-Dhale'a, Amran, Abyan, Lahj, Al-Maharah.

Similar rural water project is directly implemented by the World Bank with a credit of US$15 millions covering six villages in three governorates (Ibb, Hajjah and Abyan.

1.5.2. Existing water sources

Although construction of water systems have been in progress for the last three decades in Yemen, still the coverage of water supply in rural areas is less than 55%. Several water projects have failed because of high technology used or because the communities were not involved in its operation and maintenance. Thus many of these schemes failed and the people returned to their traditional sources. There are still many people drinking from open and probably contaminated sources such as ponds and open wells. Introduction of handpumps has started. These are installed on existing open well and not on boreholes.

a. Open well

Open wells are numerous in many villages in Yemen. They varied in their depth and diameters as well as in their water quality. In general, cyclops live more comfortably in large water bodies. Water from open wells with low diameters (less than one meter) and high depth (more than 20 meters) are safer than that with large diameter and low depth as their habitat is not suitable for the survival of cyclops. In Lahj area near Bab Al-Mandab, almost all wells are open with no protecting parapets. In Wesab Al-Safel, Dhamar, NGWEP has protected the majority of wells by construction of concrete ring parapet that can help prevent transmission of dracunculiasis. The percentage of rural inhabitants with open wells ranged from about 6% in Hadramout to 81% in Al-Jawf (Table 1).

The quality of water determines its use. In the coastal area, water from shallow wells is saline and people use its water only for washing. The inhabitants of some villages on the coastal area buy their water from villages in the interior like Al-Nabia. Therefore if the water in Al-Nabia is contaminated with Guinea worm, people in those village can be infected. In Bani Mawheb in Amran, the water of deep well has a large amount of iron and calcium and therefore people do not drink its water but they use burkeh, which can be source of Guinea worm infection.

b. Burkeh and Ponds

There are burkehs in various areas of Yemen. The burkeh is a rainwater reservoir that collects water from nearby run off. Some are well constructed and others are just ponds that are haphazardly built. The typical one is cylindrical lined with masonry and has a stone stair adjacent to its wall. In Bani Mawhab, Amran Governorate, there are several burkehs, one burkeh for each household or group of households. The burkeh is about 10 to 15 metres diameter and about 15 metres depth. It is the best mode of transmitting dracunculiasis and other water-related diseases as it is the best habitat for cyclops and other water-related pathogens.

In Al-Bura'a district, Al-Hodeideh, high in mountainous area there are small burkeh that are used by individual households and it is covered by superstructure and roof and it is locked by the owners. This is called Medfen.

During the rainy season, water can accumulates in depressions, which form ponds. These are temporary water sources that people like to use during and after the rainy season because they are nearer to their houses. It is used for different purpose including drinking.

These can spread guinea worm infection if they last for long duration, enough time to allow the Dracunculus larva in the cyclop to mault.

In some areas, such as in Al-Mahweet, there are many burkehs similar to that in Bani Mawhab in Amran. Because of availability of piped water supply project, people use burkeh water only for washing and for animals. However, contamination of water can occur when people use the same container for collecting water from both water sources in the same time.

c. Streams
Streams in the rural areas of Yemen are numerous. Streams do not form a risk of transmission of dracunculiasis if the water is continuously running. However, they become sources of dracunculiasis infection if water accumulated in adjacent areas and form ponds.

d. Other water sources
Borehole water that is used for irrigation and for drinking is usually safe for drinking. Rainwater catchment such as roof water catchment is also safe sources.

1.5.3. Human behavior in contact and collecting of water

In many areas in Yemen, there is no tendency from women to filter their drinking water as found during visit of NGWEP and WHO consultants. Women and sometimes children are the collectors of water. They use plastic Jerry cans to collect and transport water from water sources to the houses. When collecting water from the Burkeh, people may immerse their legs in water as observed during visits to these burkehs.

2. Guinea Worm Eradication in Yemen

Dracunculiasis or Guinea worm disease (*Dracunculusus medinensis*) was wide spread in Yemen during most of the last century. It was rediscovered in Yemen in 1994.

2.1. History of the Disease in the country

Dracunculiasis was widespread in Yemen during the first half of last century and even earlier, as it had been reported by several European travelers to Yemen such as Lindberg who gave a detailed description of the distribution of the disease in Yemen in 1950. No cases were officially reported in Yemen during the second half of the last century. However, cases in Yemeni workers in Saudi Arabi were reported during that period.

Dracunculiasis was rediscovered in Yemen in 1994 when WHO recommended to the Yemeni Government conducting a nation-wide search for cases. However, the implementation of this search was not feasible due to high cost and difficult access to all villages in the country. As a realistic alternative, a television announcement was broadcast offering a reward of 3000 Yemeni Rials for anybody reporting an active case of dracunculiasis. Following the announcement, one dracunculiasis case was reported from a village in Dhamar Governorate. A case search was initiated in that area which resulted in discovering 94 cases reported officially by the Ministry of Health, mainly from Dhamar area which was located in the center of the northern part of the country.

2.2. National Guinea Worm Eradication Program

In May 1993, the Minister of Health approved consultation from WHO-HQ and a national team was formulated to participate in the mission. The national team was a mixed from the ministry and the faculty of Sana'a (the medical school). The findings of the mission were that the situation of guinea worm in Yemen is still not clear and a national survey should be conducted.

The actions taken to explore the real situation of the disease:

1- Reviewing any data available about the disease in Yemen
2- Distributing of questionnaires to representatives from all the governorates of the country who were participating in a primary health care conference in Sana'a late in 1993.
3- Developing a pamphlet for a reward to be given for notifying a real guinea worm case.
4- A preparation of a national plan for the national survey" active case search" for guinea worm disease.
5- An agreement with the Global 2000 of the Presidential Carter Center in Atlanta to fund the active case search.

As a result of the above-mentioned activities, which were conducted successfully, the first officially confirmed case was reported to the WHO on 10th November 1994. According to that Yemen was considered the 19th endemic country with guinea worm disease.

The National Guinea Worm Eradication Programme (NGWEP) was launched in 1994 based on village-based volunteers. The NGWEP was based in the Ministry of Public Health, within the General Directorate for Epidemiology and Diseases Surveillance (see organogram of the Ministry of Health in Figure 1). However, it was moved in 2000 to outside the Ministry in a rented house. The Programme is composed of the National Coordinator, Dr Abdul Hakeem Al Kohlani and other staff in the Programme.

2.3. The epidemiology of dracunculiasis

During the period 1994 to 1997, the number of dracunculiasis cases declined from 94 cases in 1994 to 84, 62 and 7 cases in 1995, 1996 and 1997 respectively. The details of the decrease in the number of cases by village and other administrative levels are shown in Figure 2 and Table 2 and 3. During the period when the cases were reported, the majority of cases were reported from Dhamar Governorates (208 cases) followed by Amran (28 cases), Ibb (8 cases) and Taiz (1 case). Map 2 shows the distribution of dracunculiasis endemic areas in the country. Season of transmission

2.4. Strategies of the program

All the recommended strategies for the eradication of guinea worm in other endemic countries were applied in the program of Yemen:

- Training of village health care volunteers
- Distribution of cloth filters
- Health education for the villagers
- Monthly reporting including the ZERO reports

- Supervision and international consultations
- Treating the sources of water with abate (where it is applicable).
- Protection of the wells

The strategy adopted by the Programme since its inception consisted of surveillance, health education, filtration of drinking water, chemical treatments of sources of water and construction and protection of wells. This strategy has been successful in decreasing the number of cases from 94 in 1994 to 0 at the end of 1997. No cases of emerging Guinea worm have been officially reported after 1997. Thus, Yemen entered its three years precertification period.

2.4.1. Training of village volunteers (VVs)

All the endemic areas with guinea worm were very remote and isloated areas from health care units or any health service. This was a real challenge to the programme so a village volunteer from each village were selected and trained on the basic concept of guinea worm eradication and its activities. They were provided with a medical first aid bag to respond to the village case immeditely when notified to him and the villagers where informed to notify the case as early as the blister appears or at least immediately when it emerges.

2.4.2. Surveillance and active search for cases

Village-based volunteers conducted surveillance in endemic villages. They were trained and frequently retained to conduct their responsibilities. The governorate coordinators investigated rumors. It was conducted by the central field coordinators when there is rumors or integrated during NIDs (Table 5, 6 and 7), with the trachoma survey or with any investigating any highly suspected polio cases in remote district.

2.4.3. Health education

Health education was the main activities on which the programme did concentrate because it was clear from the beginning that continuous health education session to the villagers will play an important role in inducing any change in the villagers behavior regarding filtering their drinking water.

The first series of health education session was conducted by the National Coordinator of the programme at each endemic village. A simple hand made educational poster was hanged on the body of the programme vehicle while the villagers were sitting around listening. Same sessions were conducted at the schools of the endemic areas. Some sessions were also conducted during the afternoon community habitual meeting.

It is interesting here to mention that all these sessions were only for men since the Yemeni community is very conservative. The programme was not able to find a female health worker to move to endemic areas.

In 1996, the programme had received a TV- Video compact set funded by UNICEF – Yemen. This tool of health education was effective because it gave the programme a chance to ask the head of households to allow their women to join and watch the Film (Firrey serpent) since it could be shown in the evening where men sat in front raws and women in back raws. By doing that in all the endemic villages, the programme felt satisfied that it had a chance to educate women directly.

2.4.4. Cloth filters distribution

At the beginning of the programme cotton cloth filter which was purchased locally was distributed to the villagers. By 1995 the programme started receiving nylon filters through Global 2000 of the Carter Center. Personal straw filters, which were produced by the programme, were also distributed to the villagers under surveillance.

2.4.5. Vector control

Not all sources of drinking water in all endemic governorates were potential for vector control. Thus, abate (temephos chemicals) application was only applied in selected areas. In Amran governorate, which was the second highly endemic governorate, cistern and ponds were the only sources of water. They were not organized in shape and all health workers there were not graduated from the health institute so it was difficult to depend on them for applying abate.

In Wesab Al-Safel of Dhamar Governorate where the disease was the highly endemic, water sources (wells with circular opening and a measurable depth easy to calculate the volume of the water) were measured and treatment of abate was applied. Special tables were prepared by global 2000 guidelines for the amount of temyphos to be added according to the volume of the water. The only problem was to train the health worker how to measure the depth of the water since the diameter of the opening of the well is fixed. A colored rope made by the programme was very useful tool for the sub-district coordinator who used to treat the wells.

2.4.6. Protection of the wells

28 wells were protected by concrete parapet (90 cm high). This was funded by the Embassy of Netherlands in Sana'a that was supporting a primary health care program in Dhamar area. Although the formerly endemic area was not covered by the project but the Embassy was convinced by the GWEP to fund the wells protection.

2.4.7. Case containment

It was emphasized during training of the Village-based Volunteers to make sure that any case discovered in the village should be contained in order not to contaminate the source of water.

2.4.8. Reward system

Yemen was the first country among the 19th then endemic countries in using the reward system at the beginning of the program in 1994. This was a real challenge for the Ministry of Health because the situation of guinea worm was still not clear. Nobody was sure how many cases would be found in the country and so how much budget the program would need to spend paying for the notification.

The amount of money used as a reward evolved from 3000 Yemeni Rials in 1994 to as high as 100,000 Yemeni Rials 2002. Table 4 shows the gradual increase in the amount of rewards with the years. The increase was due to devaluation for the Rial (the local currency). But after the disease was interrupted in 1997, the Programme increased the reward because of its confidence that no active cases will be reported. By 2002, this confidence increased and the reward was raised to 100,000 Rials.

The number of rewards that were distributed by NGWEP:
One for Wesab al-Safel case (November 1994)
One for Wadi al-Khashab case (April 1995)
One for internally imported single case (from Wesab al-Safel/ Dhamar governorate to Khamis Bani Sa'ad/ Al-Mahweet governorate, in 1995).

2.4.9. Supervision

The sub-district coordinators were responsible for supervising the Village health Volunteers and Village Health Workers. The Governorate Coordinators were responsible for supervising the sub-district and district coordinators. From the central level, the program had two field coordinators (Central supervisors) who were responsible for the supervision of the governorate coordinators.

These Village-based Volunteers were visited regularly (some delay happens when no funds or their release is delaied). During the supervison visits the VVs are gathered for a meeting where refreshing /up-date trainging is conducted . Furthermore, they were provided with additional cloth filters, straw filters or abate.

In addition, visits of international consultants were used as supervision visits. Various consultants visited the country from the onset of the programme till now. They were the following:

- Dr Philip Ranque (WHO/ HQs)
- Dr Nicolas Neomine (WHO/EMRO)
- Dr Trenton Rubosh (Global 2000)
- Dr Oha (UNICEF)
- Dr Michal Kramer (CDC)
- Dr Patrich Kusher (GLOBAL2000)
- Dr Abolhassan Nadim (WHO Consultant)
- Dr Marc Karam (WHO HQs)
- Dr Ahmed Tayeh (WHO – HQs)

3. Eradication activities post interruption of transmission in 1997.

Rumours of dracunculiasis cases were reported as a result of using the polio campaign of 1999 to search for possible cases. These rumours were not verified directly after the polio campaign (during emergence of the worms if the claim that Guinea worm emerged was true). Furthermore during two WHO missions to Yemen in 2000 and 2001 rumours of dracunculiasis cases were found in three Governorates (Lahj, Hodeideh and Al-Mahweet, Map 3) different from the governorates identified previously as dracunculiasis endemic Governorates (Dhamar, Ibb, Taiz and Amran). Since from the initial part of the programme no national case search was conducted to investigate all endemic areas in the country, those rumours were taken seriously given the fact that historically most areas of Yemen were endemic with the disease. This cast doubt on the assertion that the disease had been interrupted.

Because of the doubt about the actual interruption of the disease in the country and the many rumours of dracunculiasis cases identified in governorate which were not considered endemic with the disease, the NGWEP with support from WHO decided to extend its activities to cover several other governorates and strengthen its activities in the previously identified endemic governorates. A schedule for training of 600 village health workers (VHWs) on dracunculiasis eradication took place in several governorates (Map 4) during January-February 2001. The training was conducted in the capitals of each districts by teams composed of trainers from the central and governorate level. Furthermore, information, education and communication (IEC) materials were produced such as posters, pamphlets and other documentation and were disseminated by VHWs in their villages.

It was also decided to strengthen dracunculiasis surveillance system using various approaches including routine data collection though health facilities, monthly reporting by VHWs and case search during polio vaccination and other vaccination campaigns. It was also decided to intensify monitoring and supervision of VHWs to ensure that monthly surveillance data on dracunculiasis prevalence reach the NGWEP on time. Production of TV spots was also planned through contact with The National Center for Health Education and Information (NCHEI) to develop spots on dracunculiasis eradication and to broadcast it nationwide.

Thus, NGWEP conducted the following activities:

- Development and production of Information, Education and Communication (IEC) materials. Extensive use of mass media to improve community awareness and to announce a reward of 100,00 Yemeni Rials for reporting a case. Village Health Workers (VHWs) supplemented this effort by organizing information sessions for village people, displaying posters, and distributing pamphlets and communicating face-to-face.
- Training of 600 VHW in villages throughout the country in January and February 2001. The VHWs conducted active case detection, surveillance and health education activities. Map 4 shows the governorates where the training was conducted.
- Strengthening the surveillance of dracunculiasis using various approaches, such as routine data collection through health facilities and VHWs.
- GWEP will monitor quarterly all dracunculiasis eradication activities.

The majority of these activities were carried out in 2001. No cases were reported during 2001 to 2003. In July 2002, a national meeting for all governorate coordinators was held in Sana'a. It was attended by a consultant from WHO-HQs. It was emphasized on surveillance and the importance of zero reporting and preparation for certification.

-Retraining of health workers was also conducted in December 2002 and February 2003 in all governorates under surveillance.

-Training of under-graduate medical students in Sana'a University (30 trainees in 2001, 52 trainees in 2002, 47 trainees in 2003).

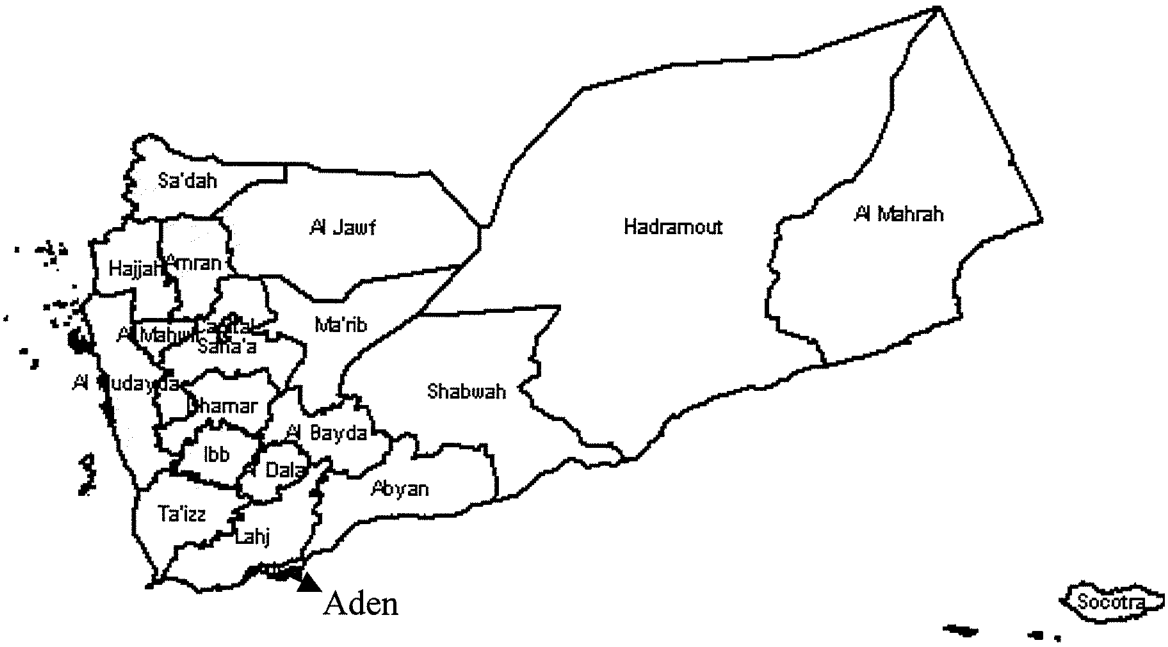
-Training of Science Technology Students (25 trainees in 2002 and 30 trainees in 2003).
-Training of post graduate students community medicals and health administrators.

Field visits were also conducted to supervise the activities as well as rumour registration and investigation of rumours.

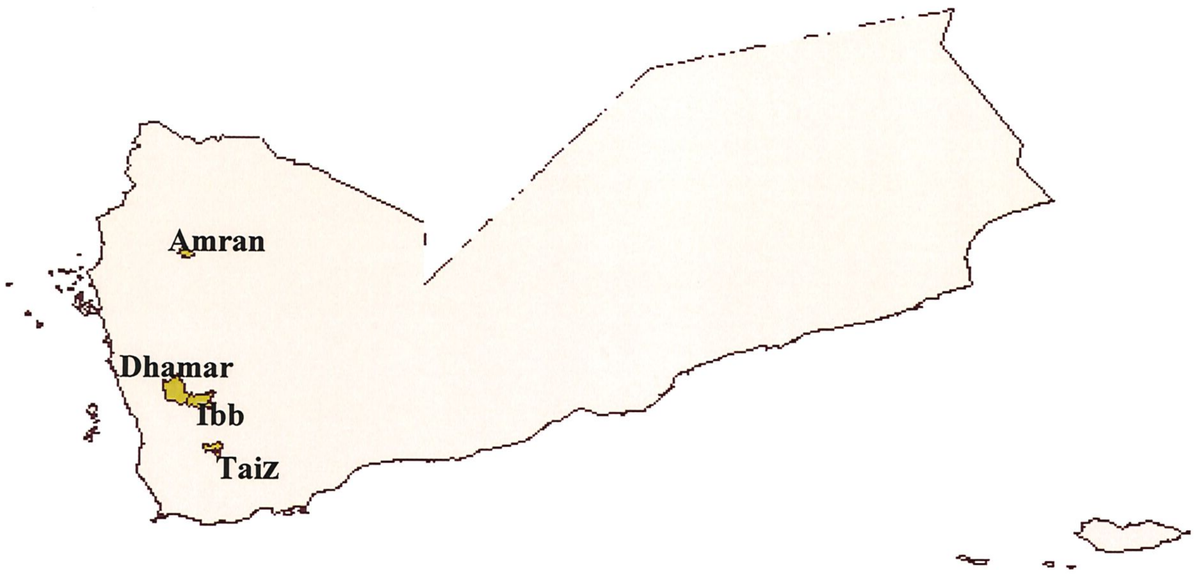
4. Conclusions

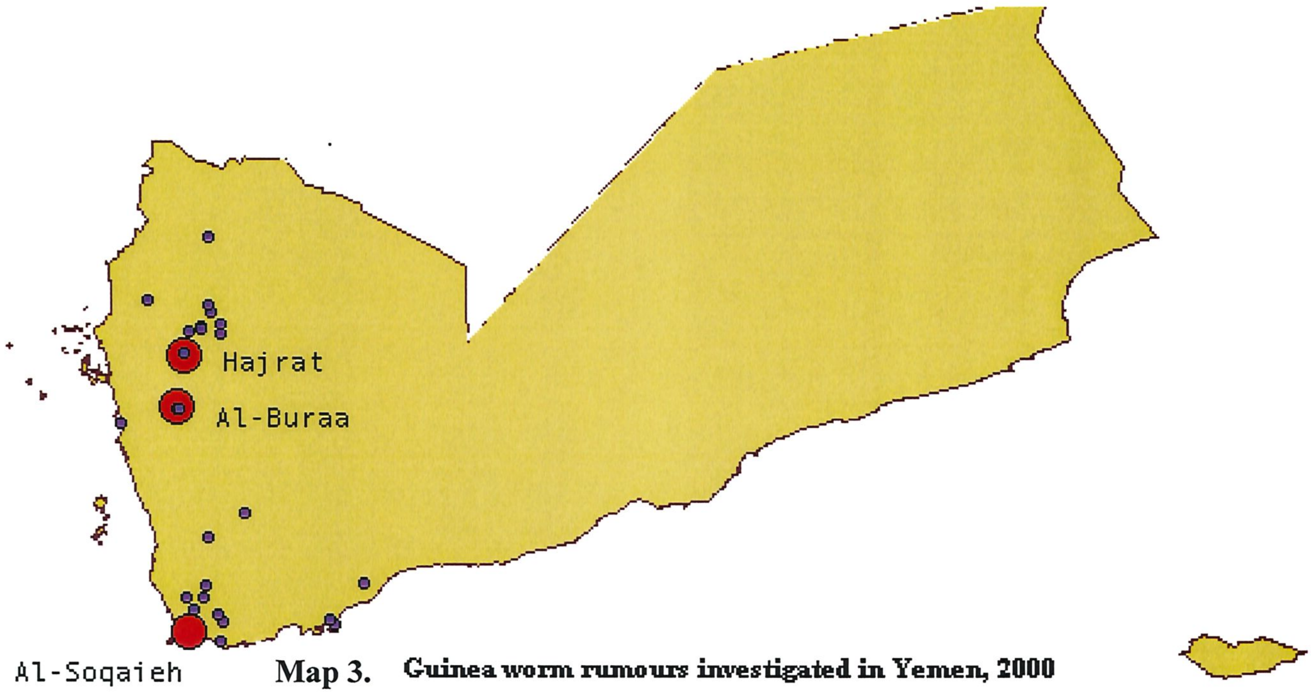
In Yemen, dracunculiasis was rediscovered because Ministry of Health efforts. As a result, National Guinea Worm Eradication Programme was launched. The programme exerted efforts to apply surveillance and intervention strategies. These efforts led to the disappearance of the disease from Yemen. The Ministry of Health believes that Yemen is disease-free.

Map 1. Distribution of Governorates in Yemen



Map 2. Dracunculiasis endemic districts in Yemen





Map 3. **Guinea worm rumours investigated in Yemen, 2000**

Map. 4. Training of VHW in district of Governorates Jan-Feb 2001

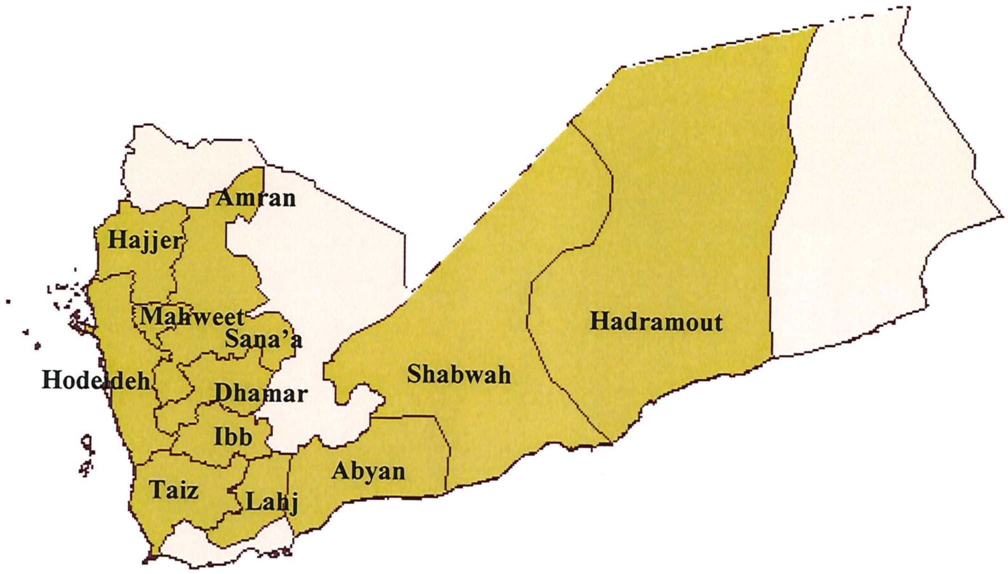


Figure 1. Organization chart of Ministry of Health Yemen

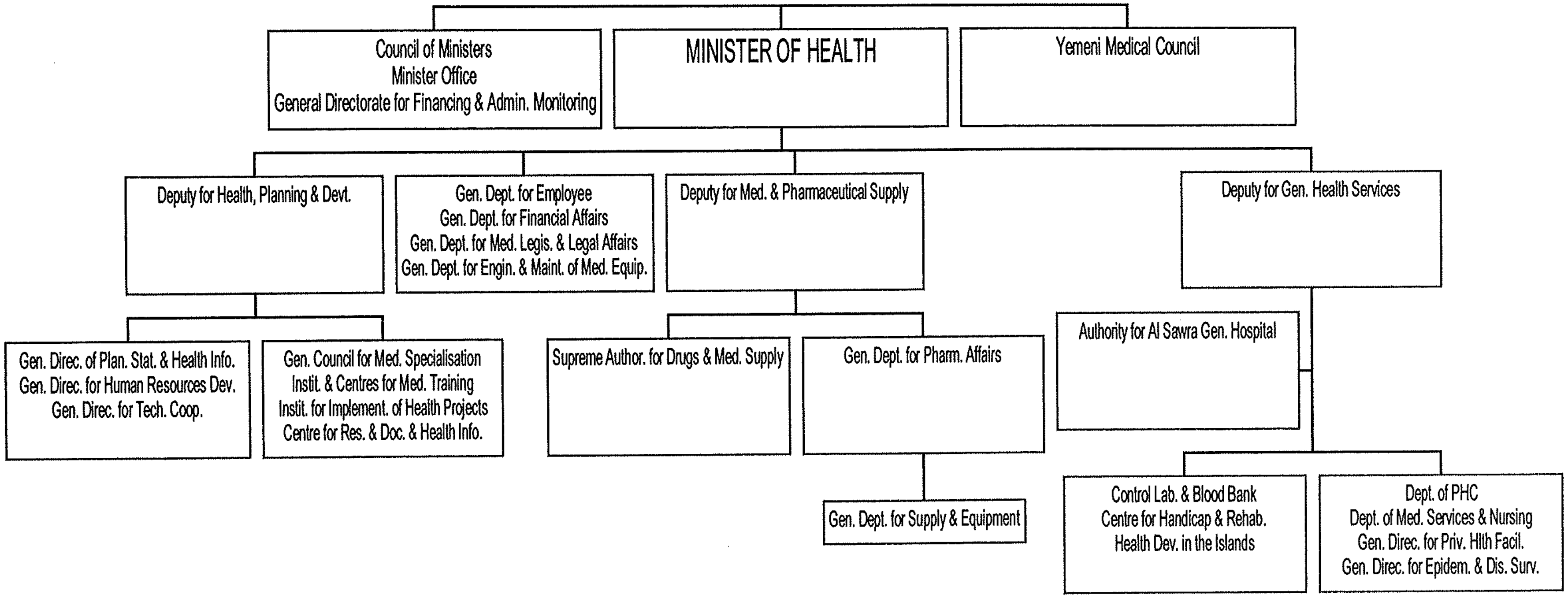


Figure 2. Dracunculiasis cases per year (1994-2003)

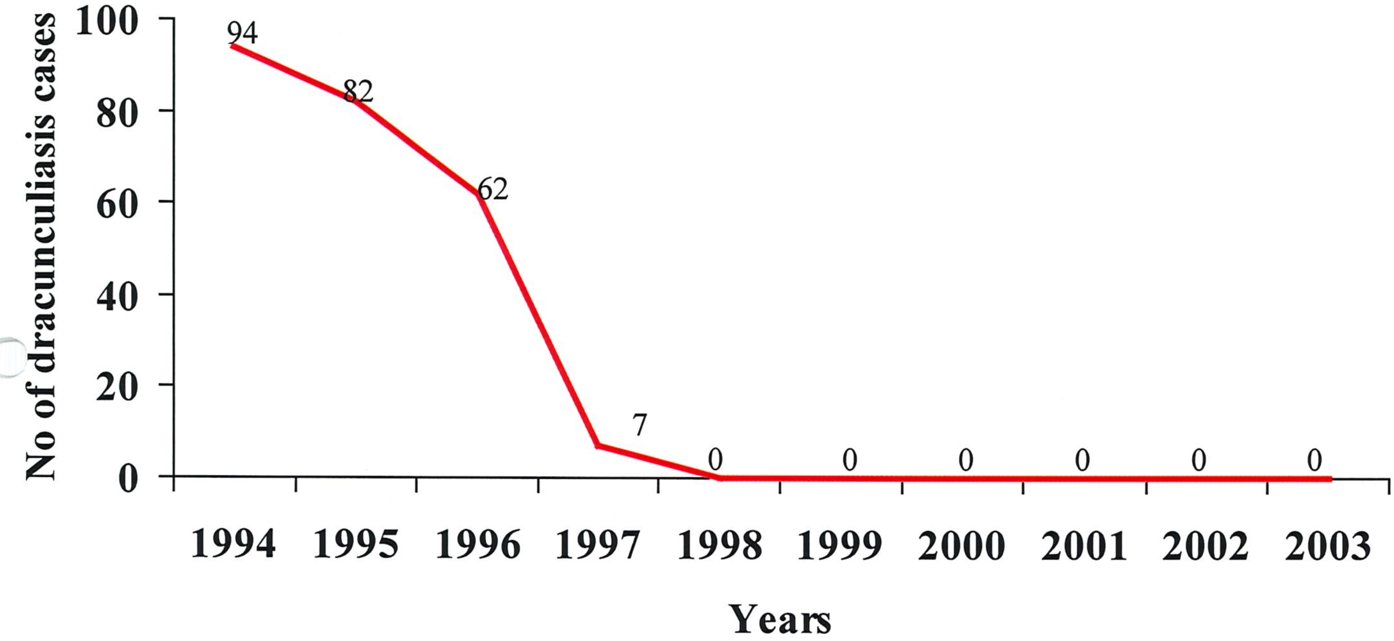


Table 1. Percentage of households in rural areas according to their water sources

No	Governorate	Pipe water	Well	Stream /spring	Closed pool	Open Pool	Drain	Dam	Not stated	Number Household	Total
1	Abyan	34.80	46.25	3.31	7.62	3.47	3.07	1.38	0.11	42,844	100
2	Al-Jawf	6.86	80.96	1.75	1.18	5.32	3.73	0.20	0.00	16,043	100
3	Mareb	17.73	67.38	3.85	2.65	6.18	1.52	0.60	0.07	19,701	100
4	Al-Mahwit	10.80	25.68	35.86	12.19	7.61	6.45	1.27	0.15	54,354	100
5	Al-Mahrah	28.30	43.32	5.04	2.17	14.73	5.59	0.84	0.02	5,580	100
6	Shabweh	47.53	29.97	3.89	2.92	11.54	2.67	1.18	0.30	40,715	100
7	Aden	20.52	41.05	7.73	1.67	24.51	4.53	0.00	0.00	5,566	100
8	Saadeh	8.81	56.45	5.95	7.90	14.31	6.14	0.29	0.14	60,097	100
9	Ibb	30.39	31.70	23.10	5.85	2.56	5.58	0.79	0.04	233,558	100
10	Lahj	20.28	67.93	3.92	2.02	2.05	1.93	1.80	0.07	83,022	100
11	Al-Hodeidah	34.41	55.82	1.63	2.49	3.15	2.23	0.26	0.02	184,785	100
12	Sana'a City	na	na	na	na	na	na	na	na	Na	Na
13	Hadramowt	70.29	6.13	5.31	1.40	11.74	3.63	1.50	0.01	56,392	100
14	Dhamar	20.37	33.75	23.61	4.48	12.25	4.42	1.09	0.03	140,671	100
15	Al-Bayda	36.03	55.50	2.15	1.52	3.44	1.29	0.03	0.03	48,138	100
16	Taiz	19.91	57.28	9.73	8.63	1.77	2.27	0.36	0.05	267,137	100
17	Hajjah	8.07	56.38	14.77	3.70	8.30	8.02	0.71	0.04	158,659	100
Total											

Sources: The Central Bureau of Statistics, Sana'a 1994, Yemen

Table 2. Dracunculiasis cases according to governorates per year (1994-1998)

Governorate	1994	1995	1996	1997	1998	Total
Amran	23	5	0	0	0	28
Dhmar	65	76	61	6	0	208
Taiz	0	1	0	0	0	1
Ibb	6	0	1	1	0	8
Total	94	82	62	7	0	245

Table 3. Dracunculiasis by District, Sub-district, Village and year									
Governorate	**District**	**Sub-district**	**V. No.**	**Village**	**1994**	**1995**	**1996**	**1997**	**1998**
Amran	Al Sudah	Bani Mawhab	1	Al- Muhadwar	0	0	0	0	0
(ex Sana'a)			2	Al Najed	8	0	0	0	0
			3	Al Gool	0	1	0	0	0
			4	Al Mashaarah	2	0	0	0	0
			5	Al Jewar	1	0	0	0	0
			6	Al Damineh	1	0	0	0	0
			7	Shaghab	6	2	0	0	0
				Al Mowsem	3	2	0	0	0
				Sheb Khudair	2	0	0	0	0
Dhamar	Wesab Al Safel	Bani Husam	8	Hodeiddah & Kadiha	26	21	8	0	0
			9	Mokhaiberat al Hawaz	22	13	2	0	0
			10	Dim Al Abbasi	4	5	0	0	0
			11	Al Rahah	5	0	2	0	0
			12	Al Lakmah	2	0	0	0	0
			13	Hathroor	0	1	0	0	
			14	Al Moghni	1	0	0	0	0
			15	Al Aadi	1	0	0	0	0
			16	Al Bahairah	0	5	3	2	0
			17	Al Kathia	1	1	0	0	0
			18	Al Faqwah	0	1	0	0	0
			19	Al Haljoum	1	0	0	0	0
		Rubu Al Magharem		Al Barooh	0	1	0	0	0
		Bani Shunif		Al - Manakh	0	1	0	0	0
		Bani Omar		Al - Sharaf	0	1	0	0	0
			20	Kroorad	2	1	0	0	0
		Al Ajraf	21	Al Waqar al Asfal	0	0	0	0	0
			22	Jaashan	0	0	1	2	0
		Wadi Al Khashab	23	Al Hasab	0	23	45	1	0
			24	Al Rahen	0	0	0	0	0
			25	Al Jarat	0	0	0	0	0
			26	Haquibah	0	0	0	0	0
			27	Al Jaroob	0	0	0	0	0
			28	Shaoaifal	0	0	0	0	0
			29	Al Haij	0	1	0	0	
			30	Zarjah	0	0	0	0	0
			31	Al Moshan	0	0	0	0	0
			32	Al Barh	0	0	0	0	0
				Al Hadiya	0	0	0	1	0
				Al-Sharj	0	1	0	0	0
Taiz	Saber Al Mawadem	Al Dhabab	33	Al Mensahah	0	1	0	0	0
Ibb	Fara al Udain	Al Maseel	34	Al Orairieh	4	0	0	0	0
			35	Al Hajlamah	1	0	1	0	0
			36	Al Methianah	1	0	0	0	0
			37	Qobaibah	0	0	0	1	0
		Total			**94**	**82**	**62**	**7**	**0**

Table 4. Amount of rewards given for informing on a dracunculiasis case per different year

The year	The amount of the reward	To whom to pay	The finding
September 1993	3000YR	Only to the person who notify the first case from any district.	The first officially documented case was detected by the reward (3 rewards were paid)
January 2001	30,000 YR	15,000 YR to the HW and 15,000 to the patient (for all cases)	Only rumors
January 2002	100,000YR	50,000 YR to the HW 50,000 YR to the patient (for all cases)	Only rumors

Table 5. Rumor cases according to their governorates, 1999 NID

No	Governorate	No of Districts	No of Sub-district	No. of Villages	No of cases
1	Sadah	3	4	26	269
2	Sana'a City	8	NA	NA	23
3	Hudaideh	2	3	1+?	8
4	Hadramout	2	2	2	6
5	Taiz	1	1	2	6
6	Lahj	1	1	1	5
7	Al-Jawf	1	1	1	3
8	Aden	2	2	-	2
9	Dhamar	1	1	1	2
10	Ibb	2	2	2	2
11	Hajah	2	2	2	2
12	Al-Baydha	1	1	1	1
13	Mareb	1	1	1	?
14	Sana'a Governorate	1	1	1	1
Total		28	22	41	330

Table 6. Rumor cases during 1999 NID

No	Quest. No	Governorate	District	Sub-district	Village	No of cases	Local Name	Interviewers
1	180	Mareb	Madghel	Al-Arqah	Al-Arqah	?		Ahmed Muhsen Medraj
2	1816	Dhamar	Wesab Al-Safel	Meshrafa	W. Rema	2		Hadiah Abdo Sulaiman
3	1923	Al-Baydha	Rada'a	Al-Muklah	Al-Muklah	1		Salem Al-Eysa
4	2217	Sana'a City	Sana'a City	Al-Thaniah	-	1		Waleed Al-Samet
5	2244			Al-Thaletha	-	?		Adnan Said Al-Ahabi
6	2348			Al-Rabeah	-	1		Ahhmed Abd Al-Awtheri
7	2359				-	11		A'eshah Abdullah
8	2361				-	1		
9	2407			Al-Raeisi C	-	1		Bulqees Hasan Ghaleb
10	2486			Al-Thamina	-	2		Jamal M. Al Ezi
11	2578			Al-Asherah	-	3		Abdul-Kareem Khawlani
12	2622			Al-Wadi	-	?		Ahmed Al-Humaidi
13	2661			Al-Tibi 1	-	2		Abdulqader Akhfash
14	2662				-	1		
15	2859	Aden	Al-Mansourah	Al-Wahda Sk	-	1		Afaf Ahmed Hussain
16	2872		Al-Buraiqah	Al-Buraiqah	-	1		Ali Hussain Al-Nabc'ai
17	3719	Hadramout	Amad	Al-Na'air	Al-Na'air	5		Salem Mohamed Binjasar
18	3797		Shebam	Shebam	Mushah	1		Sahl Rabei Quror
19	4181	Al-Jawf	Al-Ghail	Al-Salamat	Al-Salamat	3		Said Mohamed Aal-Najar
20	4538	Lahj	Al-Mutharba	Al-Suqia	Al-Suqia	1		Dr Abdul Naser Aiash
21	4539					1		
22	4540					1		
23	4541					1		
24	4552					1		
25	5083	Al-Hodaideh	Buraa	Beladaitarf	Al-Shmah	1		Mohamed Saghair Altayar
26	52245		Hodaidah	Al-rbah	?	1		Saad sulaiman
27	5246				?	2		
28	5247				?	1		
29	4983	Sadah	Razeh	Al-Hamliah	Bani Safwan	1		Abdallah Ahmad Taher
30	5647		Sadah	Al-Talh	Al-Qrashi	10		Jamilah Ali Za'id
31	5648				Al-Saifi	30		
32	5649				Khwian	3		
33	5650				Ahma Altalh	1		
34	5651				Al-Talh	6		
35	5652				Al-Rkhsah	5		
36	5653				Al-talh	4		
37	5654				Al-Safariah	3		
38	5656				Ahma AlTalh	14		
39	5657				Al-Talh	2		
40	5658				Al-Taif	5		
41	5659				Raimah	5		
42	5660				Al-Algahm	2		
43	5662				Al-awsah	6		
44	5663				Razeh	1		
45	5664				Al-Algahm	7		
46	5666				Al-Talh	1		
47	5667				Al-Murdan	1		
48	5707		Sahar	Bani Muath	Sufian	5		Hafedhah Mu –awdh
49	5708					1		

50	5709					10		
51	5710				Al-Magash	50		
52	5711				Al-Aleraqi	1		
53	5712				Al-Aleraqi	2		
54	5713				Al-Hbrah	3		
55	5715				Al-Qaili	1		
56	5716				Al-Barakat	4		
57	5717			Al-Masgha		3		
58	5718			Bani Muath	Bani Muath	8		
59	5719					8		
60	5721				Al-Barakat	2		
61	5723					3		
62	5725				Sawdan	50		
63	5726					3		
64	5727				Al-Aldhabian	3		
65	5728				Al-Alsabri	3		
66	5729				Al-Alsrbi	2		
67		Ibb	Al-Udain	Al-Nakhla	Abdelqader	1		?
68			Jeblah	Al-Dahthan	?	1		?
69		Hajah	Al-Mahabsha	Al-Mahabsha	Qazia	1		?
70				Abs	?	1		?
71		Taiz	Al-Mawaset	Al-Dahah	Al-Dahah	5		?
72					Al-Kadan	1		?
73		Al-Hodeidah	Hodaeidah	Ghulail	?	2		?
74				Al-rebah	?	1		?
75		Sana'a Governorate	Banimater	Al-haqab	?	1		?
Total								

Table 7. Rumours of dracunculiasis investigated by the NGWEP in 2001.

No	Village	District	Governorate	Name	Age (Year)	Sex	Site of emergence	Diagnosis	Date
1	Al-Mehras	Wesab Al-Safel	Dhamar	Hasnaa Ahmed Zaied	35	F	Hand[1]	GW ?	18.02. 2001
2	Al-Mehras	Wesab Al-Safel	Dhamar	Abdoul Raqeeb Abdoullah	12	M	Leg[2]	GW ?	18.02.2001
3	Al-Mehras	Wesab Al-Safel	Dhamar	Nabila Mohamed Hazal	8	F	Hand[3]	GW ?	18.02.2001
4	Ali Solaiman		Hodeideh	Nizar Mobarek Fateeni	1	M		LF	24.02.2001
5	Ali Solaiman		Hodeideh	Fatemeh Kolaib Abdoullah	3	F		LF	24.02.2001
6	Ali Solaiman		Hodeideh	Saeed Kolaib Abdoullah	9	M		LF	24.02.2001
7	Ali Solaiman		Hodeideh	Ayesh Josh Kolaib	8	M		LF	24.02.2001
8	Ali Solaiman		Hodeideh	Salwa Ghamami	7	F		LF	24.02.2001
9	Ali Solaiman		Hodeideh	Ghadeh Abdoullah Hosain	3	F		LF	24.02.2001
10	Ali Solaiman		Hodeideh	Rabeaa Ghamami Ahmed	5	M		LF	24.02.2001
11	Ali Solaiman		Hodeideh	Naseem Salem Ayesh	4	M		LF	24.02.2001
12	Hodeideh	?	Hodeideh	Ali Mohamed Babanawi[4]	60	M	Leg	?	14.03.2001
13	Hodeideh	Hodeideh	Hodeideh	Abdoullah Saleh Ahmed Al-Buraaee[5]	75	M	Leg	?	17.03.2001
14	Karbahah	Tor Al-Bahah	Lahj	Fatemah Ali Mohamed	45	F	Leg	LF	20.12.2000
[illegible]	Al-Aned	Al-Madharebeh	Lahj	Abdullah Hassan Al-Hamedi	30	M	Leg	Cutaneous disease	25.01.2001
16	Bani Hajjaj	Sodah	Amran	?	13	M	?	Myiasis	?. 01.2001

[1] Worm emerged from the middle finger (right hand)
[2] In left leg, the worm emerged by itself but was cut off.
[3] Worm emerged from the middle finger (right hand). It was cut off when it was pulled out.
[4] Patient was resident in Al-Hodeideh but during agricultural activities traveled to his village near Bajel where he drank open water sources. He noticed worm six month earlier.
[5] The patient was resident in Al-Hodeideh but he usually travel to Al-Buraa one week each year. He notice emergence of worm one week earlier.