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WHO WORKING GROUP MEETING ON ANTHRAX CONTROL AND RESEARCH, WITH SPECIAL REFERENCE TO NATIONAL PROGRAMME DEVELOPMENT IN AFRICA

Mongu, Zambia, 22-28 September 1992

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INTRODUCTION

The meeting commenced with a welcome speech by Mr M. Imbula, Acting Permanent Secretary to the Western Province of Zambia. Dr T. Fujikura, Veterinary Public Health, Division of Communicable Diseases, WHO, welcomed the participants (ANNEX I) on behalf of the Director-General and opened the meeting. He explained its purpose and scope, stressing the importance of national anthrax control programmes in Africa in view of the recent increasing prevalence of the disease in both animal and human populations:

- to review anthrax epidemiology in Africa and the other regions of the world;

- to discuss technical details of anthrax diagnosis, vaccine production and immunization in animals, aspects of food safety, disinfection and decontamination, treatment of human cases, health systems, intersectoral cooperation in diagnostic services, surveillance and reporting systems in order to promote comprehensive national control programmes;

- to discuss actions to be taken when an emergency occurs and the related national/local control programmes applicable to Africa;

- to discuss the public health implications of anthrax in Africa;

- to review the importance of wildlife anthrax in Africa;

- to elaborate plans of work for 1993-1995 and to set up international cooperation to control anthrax in Africa.

Dr Turnbull was elected as Chairman, Dr Böhm as Vice-Chairman, and Dr Muyoyeta served as Rapporteur.

1. REVIEW OF WHO-COORDINATED WORKING GROUP ACTIVITIES AND INTERNATIONAL COOPERATION

WHO has been promoting activities on anthrax control and research since its inception in 1948. In the last few decades, a number of countries, particularly in Europe, have reduced morbidity and mortality due to anthrax in both humans and livestock to negligible levels through international cooperation and support. However, many countries are still endemic today for anthrax in both human and animal populations, including wildlife, and the disease has a great public health, environmental, and socioeconomic impact in Africa and Asia.

In view of the above, the Veterinary Public Health unit of WHO called upon experts working in anthrax control and formed a working group for anthrax control and research comprising four sub-groups: (1) epidemiology and information exchange, (2) disinfection and decontamination, (3) vaccines and vaccine developments, and (4) consultative group for problems in developing countries. In the course of its activities, the group elaborated in 1987 "A guide to the diagnosis, treatment, and prevention of anthrax", (document WHO/Zoon./87.167) and met at a WHO Consultation on Anthrax Control and Research, Geneva, in November 1990 (document WHO/CDS/VPH/91.98). The group has been active in extending expert advice and services to interested countries in surveillance, diagnosis, vaccine production and control,

immunization campaigns, disinfection and decontamination, carcass disposal, intersectoral cooperation, and provision of reference and research materials. A number of missions have already taken place to Africa and Asia, and several other missions are planned. Members of the group were now meeting in Mongu, Zambia, to review and discuss the status of anthrax in Africa in order to further strengthen international cooperation in Africa through the working group's activities as described in this report.

2. REVIEW OF ANTHRAX EPIDEMIOLOGY AND CONTROL IN SOME AFRICAN COUNTRIES

2.1 Zambia

Anthrax vaccination campaigns used to be compulsory in this country; however, the campaigns ceased some years ago due to success in controlling the disease in livestock. A large-scale outbreak in game animals in Luanguwa National Park then occurred in 1987 of which the enzootic origin could not be clearly identified. Circumstantial evidence pointed to the enzootic being associated with severe drought for several years running during which more animals were concentrated in limited watering places. Since anthrax cases in animals, wildlife as well as humans continued to occur sporadically in Zambia, a vaccination campaign was again initiated although its coverage was limited to endemic areas at the time of outbreaks. Quarantine and restriction of animal movement from/to endemic areas were also re-introduced.

There was a direct relationship between outbreaks in 1989-1991 with previous outbreaks in the plains and plain edges. These were characterized by sudden occurrences of multicentric foci of infection with many sudden animal deaths not preceded by any observed illness. Many such outbreaks occurred in the country from 1989-1992: in 1989 (2 outbreaks), 1990 (20), 1991 (25), and 1992 (2 as at May), and were linked to unusually high rain falls with flooding. Where vaccination campaigns were carried out and high coverage achieved, deaths in animals ceased two weeks after the vaccination. However, anthrax deaths continue now in these areas because of the continuous inflow and outflow of cattle.

The Western Province has a cattle population of 556 000. The animals are raised in a sedentary and/or transhumance type of management. The animal density is 10 per Km^2 and constitutes the main economic background of the Province. Since 1970, there have been 1 to 3 anthrax enzootic outbreaks per year. Vaccination coverage in this Province is less than 50%.

Regulations on cattle movement control between districts in this Province are very strict in principle, but difficult to implement or control where other routes than main roads are taken. The traditional management system, cattle exchange, sending gifts, etc., and herding arrangements make it difficult to control interdistrict movement of livestock and products. Jackals and hyaenas may also bring about some movement of carcasses and hides.

It is a social custom for people to skin, butcher and eat animals that die unexpectedly in Zambia, although village people do understand that "sudden death" animals may have had a serious transmissible illness such as anthrax. This situation leads to delay in notifying the veterinary office responsible for anthrax control. Burying and/or burning of carcasses require

extra labour, and in many districts there is a lack of sufficient wood for incineration of carcasses. Disinfection and decontamination are impractical in many of the affected regions at present.

Other problems in controlling anthrax occur as a result of: (1) lack of cooperation over vaccination by farmers; (2) delays in diagnosis due to the fact that regional laboratories lack facilities for confirming the diagnosis of anthrax so that specimens have to be sent the long distance to the Central Veterinary Research Institute (CVRI) in Lusaka; and (3) funding problems for vaccination and diagnosis programmes.

In the Western Province, attention to the possibility of anthrax is drawn in three ways: (1) the cattle owner opens the carcass and notes an enlarged spleen; (2) the occurrence of human cases resulting from handling or consuming meat from animals having died of anthrax; and (3) detection by specimen examination in the laboratory (at present this can only be done at the CVRI, Lusaka).

During the meeting the participants had an opportunity to visit endemic areas in the Kalabo district, some 60 km from Mongu, accompanied by national and local staff, to observe some of the endemic situations mentioned in this report and have direct contact with patients/village people who had suffered from anthrax transmitted by contaminated meat or through their direct involvement in skinning, cutting and other activities with regard to animals dead from unknown causes. Further information is given in Annex II.

A research programme was recently initiated at the CVRI, Lusaka, to carry out a serological survey on cattle, humans and dogs in the endemic Western Province using enzyme immunoassay (EIA) with a cell-free protective antigen. Technology transfer of anthrax vaccine production and control has also been initiated, with the support of WHO, FAO and other international agencies.

2.2 Tanzania

At the last (1984) census, livestock populations in Tanzania were 13 million (M) cattle, 6 M goats, 3 M sheep, 2 M horses, 14 M poultry and 200 000 donkeys. Tanzania also has the world's largest number of wild animals. Wild and domestic animals co-exist and wild animals play a significant role in transmitting anthrax to domestic animals. Sporadic anthrax occurrences are seen in most parts of the country, but basically the disease is enzootic in pastoral areas. From 1981-1990, some 97 585 cattle died of anthrax, representing 2.3% of all cattle deaths in this period.

The major reason for the enzootic state in pastoral areas is improper disposal of carcasses and the consequent persisting environmental contamination. Diagnosis is made on the spot by observation of clinical manifestations such as high temperature (42°C), sudden death, or a carcass oozing blood from the orifices and which does not stiffen. Regulations require that such carcasses are not opened and that blood smears from the tip of ears are prepared and stained with Giemsa or methylene blue. Field staff readily recognize anthrax cases on these criteria and only a few cases are referred for further laboratory investigation.

Quarantine, supervised disposal of carcasses, and ring vaccination with routine vaccination campaigns have proved quite effective control methods in livestock.

For disposal of carcasses, Tanzanian legislation prescribes burying the carcasses 2 m deep in the ground with quicklime; disinfection of contact areas with formalin (30%), and caustic soda (40%); watering points are chlorinated. Alternatively, the carcasses and materials must be incinerated. These regulations are often not implemented properly, hence the perpetuation of the disease in enzootic areas. In such areas, routine animal vaccination is necessary to control anthrax.

Anthrax vaccine has been produced in the Vaccine Production Institute in Dar es Salaam since 1984. However, the Institute has suffered from problems of unreliable electricity supply, shortage of raw materials, reagents, seed cultures, bottles and packing materials, and lack of funds for field trials of the vaccine. Research activities at the Institute have been concerned with development of a combined anthrax/black quarter vaccine.

In wildlife, quite marked anthrax outbreaks have been experienced in the Manyara and Tarangie National Park (Arusha district) during drought years. The heavy concentration of wildlife in/around watering points render these points important sources of infection. Biting flies may contribute to the transmission of anthrax. In wild animals, prevention and control measures are similar to those for livestock, i.e. (1) proper disposal by incineration or burying of carcasses at least 2 m deep in the ground with quicklime, and (2) chlorination of watering points. However, these measures are difficult to implement with wild animals. Quarantine, vaccination, and detection/disposal of carcasses before they are opened up by scavengers can help to minimize contamination.

2.3 Kenya

In Kenya, anthrax is classified as a notifiable and emergency disease and is covered by legislation to ensure the proper disposal of carcasses, quarantine of the affected area, and emergency vaccination. The disease occurs sporadically throughout the country and is more common in unusually wet years. The Central Veterinary Laboratory, Kabete, and regional/district laboratories are active in diagnosis and control of anthrax, cases of which tend to be reported only when humans are affected due to eating meat from anthrax-infected carcasses. This occurs more commonly in pastoral districts in the north, and to a lesser extent in the central districts. In the pastoral northern districts the disease is common in cattle and camels and some endemics have also been seen in humans. As well as being a common custom of the peoples in these areas to eat the meat from sudden-death animals, the remains are not properly disposed of and are therefore spread about to other places by wild animals. In the central agricultural parts of Kenya, outbreaks are sporadic (<10 per year) and may only affect one or two animals at a time. In the coastal regions, for many years reports of cases have been few and far between.

Annual vaccination with combined anthrax/black quarter vaccine is practised, with very large numbers of vaccine doses administered (703 549 in 1990; 483 067 in 1991). Other measures for controlling anthrax include:

- regulations on the proper disposal of carcasses;

- prohibition of selling meat from an animal that has died of undiagnosed cause;

- quarantine of an affected area while vaccination is carried out and until three months after the last reported case;

- implementation of proper disinfection and decontamination procedures for contaminated areas and materials; and

- public education campaigns by public health and veterinary staff aimed at educating people not to eat un-inspected meat.

2.4 South Africa

In South Africa anthrax was first described by a historian/traveller in 1838 and first confirmed scientifically in 1876, although B. anthracis isolated from bone diggings in the Kruger National Park and dating back more than 200 years indicated that the disease had been around for a long time. Incidence of the disease increased markedly in the early years of this century, reaching a peak in 1923 when an estimated 30 000 to 60 000 animals died of anthrax (Fig.1).

Legislation to control anthrax was issued in 1911 and the Government decided to provide free vaccination to all livestock owners in 1923. Annual vaccination of cattle remained compulsory, with consequent decline of anthrax outbreaks in cattle from about 1000 a year to <3 a year (Fig.1), cases also declining in humans (Fig.2), until the Government-provided vaccination services for the livestock population ceased at the end of 1987. Since then the number of vaccinations has declined dramatically (Fig.3).

Anthrax in livestock in South Africa rarely progresses beyond the primary cases, being rapidly brought to a halt by effective control measures as follows:

- upon confirmation of diagnosis the area or farm is placed under quarantine which is enforced by Government veterinary staff. Quarantine is lifted three weeks after vaccination or three weeks after the last anthrax case diagnosed, whichever is the later;

- all cattle on the farm and in neighbouring areas are vaccinated by the Department of Animal Health;

- chemotherapy (antibiotics such as a combination of penicillin and dehydrostreptomycin) is permissible but must be followed by vaccination 10-14 days afterwards. Treatment with antibiotics is not allowed 10 days before or after vaccination;

- infected animals are isolated and destroyed under the supervision of an authorized officer;

- anthrax carcasses are not allowed to be opened and must be incinerated or buried with liberal amounts of slaked lime;

- disinfection of the premises is effected with a 5% solution of formaldehyde or disinfection according to the WHO Guidelines (WHO/Zoon./87.163).

Diagnosis is confirmed by means of blood smears examined by a state veterinarian or at one of 14 regional laboratories. Tissue samples are sent to the Veterinary Institute at Onderstepoort for confirmation by culture.

The live spore (Sterne strain) vaccine is manufactured at the Institute in Ondestepoort, and costs 0.30 rand (US$ 0.10) per dose. A marked decline in vaccine sales since 1988/1989 years reflects a complacent attitude by farmers following long periods of freedom from anthrax outbreaks and an inability to enforce the law on vaccination.

In the case of wildlife, 52 species have been found to be susceptible to anthrax in the Kruger National Park including kudu, nyala, and roan which are highly vulnerable (Table 1). Adult animals are evidently more vulnerable than young or sub-adults. Scavengers such as vultures and hyaenas play a major role in disseminating anthrax spores. Blowflies feed off body fluids from opened carcasses, then deposit infective faecal and vomit droplets on vegetation which is then eaten by browsers such as kudu (Fig.4). Outbreaks typically take place towards the end of winter to the beginning of summer, before the first major rains occur (Fig.5). Factors influencing the outbreaks in wild animals in the three national parks of South Africa are: (1) concentration of the animals; (2) over-utilization of vegetation; (3) stagnation and concentration of water resources; and (4) nutritional stress.

Standard control measures applied to livestock in South Africa cannot be applied in wildlife so that in the event of an outbreak of anthrax in wildlife, vaccination is carried out using disposable darts fired from a helicopter. This method has been very successful in the Kruger Park and neighbouring game ranching areas. Apart from immunization, control in wildlife rests on incinerating carcasses, when found, preventing water-holes from getting infected via vultures, etc., veld burning practices, and preventing large accumulations of game through culling procedures.

3. ELABORATION OF NATIONAL ANTHRAX CONTROL AND RESEARCH PROGRAMMES IN AFRICA

3.1 Surveillance and data collection

For anthrax control to be achieved, surveillance and data collection procedures need to be improved. This means that all suspected clinical cases should be confirmed by reliable laboratory tests and all unexplained, sudden deaths in animals should be investigated.

Although anthrax remains a human and animal health problem in Africa, and the cause of significant economic losses, the true incidence and effect of the disease in many African countries is uncertain. This results from a failure to apply standard methodologies of surveillance and data collection. In many developed nations where severe action is taken to prevent the disease, anthrax has almost been eradicated. Correct surveillance and data collection requires:

(1) that all suspected clinical cases and unexplained deaths should be investigated and diagnosis confirmed by laboratory tests (i.e. appropriately stained blood smears, isolation of *B. anthracis*, pathogenicity, and where appropriate, virulence or serological tests);

(2) creation of field surveillance stations, headed by a qualified veterinary person who should be able to make necessary investigations and collect appropriate samples for confirmation. The stations should be supplied with sufficient glass slides and a good quality microscope for examination of smears collected from all animals dying unexpectedly. The

field station should be able to collect blood smears, animal and environmental specimens from the sites of animals suspected of being victims of anthrax and should submit these to a laboratory equipped to carry out confirmatory bacteriological and other tests;

(3) the formulation of a questionnaire. The field surveillance stations should have standard questionnaires to issue to all animal owners for completion during investigations.

In addition, in the event of major outbreaks, it may be appropriate to establish a task force composed of staff of local, central and academic veterinary, public health and, if relevant, wildlife services, to investigate the outbreak and make recommendations on action to be taken.

Serology is useful but, at present, the necessary antigen is not commercially available. Thus serological tests are confined to specialized centres and research projects rather than routine diagnosis.

3.2 Reporting and information support

It is estimated that anthrax is still not a notifiable disease in about 54% of African countries. Another factor contributing to inaccurate information is the frequent failure by field officers to recognize clinical cases and by regional laboratories to provide the necessary support tests. Poor intersectoral cooperation is yet another factor leading to inaccurate reporting.

Proper reporting and provision of information require that:

(1) field surveillance stations should keep records of all cases of anthrax and the officer in charge should prepare regular reports for submission to all relevant services;

(2) all suspected cases of anthrax should be confirmed by a laboratory to ensure quality reporting;

(3) livestock owners should be compelled by law to report all unexpected deaths;

(4) livestock owners who willingly report the disease should be given support in the form of free vaccination, disinfection and disposal of carcasses;

(5) in national parks and game management areas, all suspected cases should be reported to the field surveillance stations;

(6) a leaflet on the disease should be supplied to all field stations. It should briefly describe anthrax, animals likely to be affected, transmission, biology of the bacillus, symptoms, treatment, prevention, decontamination and disposal of carcasses.

3.3 Disposal of carcasses and subsequent disinfection and decontamination

Proper disposal of carcasses and subsequent disinfection and decontamination of infected places is done with a view to disrupt the epidemiological cycle of the disease. However, with respect to the disposal of carcasses, the problem sometimes arises that the disease is not recognized immediately and the carcass is incorrectly handled. Similarly, the lack of availability of appropriate disinfectants is often a problem in African countries. Those on the market at present have not proved effective against anthrax spores, and work should be encouraged to look into the possibilities of using locally available disinfectants.

The following approaches need to be considered:

(1) Physical (burning and burying). Burning, when correctly done, is the most reliable method of destroying spores. Burial entails the possibility of leaving long-term environmental contamination. However, burning requires large amounts of firewood which may not be available. Disposal needs to be supervised by veterinary officials or other appropriate persons such as members of surveillance teams or anthrax control task forces. Ideally, the effectiveness of the disposal procedure should be confirmed bacteriologically.

(2) Chemical. Before any locally-produced chemical can be recommended, the sporicidal value of these chemicals must be confirmed in laboratory tests.

Disinfectants must then be kept in reasonable quantities by all field surveillance stations and should be used only under the supervision of trained staff. Legislation should be formulated on the collection and disposal of carcasses and on the disinfection of contaminated premises.

The meat industry, including abattoirs and other animal product industries (hides and skins, wool and hair, bone meal, etc.) should maintain a sufficient quantity of disinfectant to disinfect their premises in the event of inadvertent anthrax cases.

Information leaflets on the disinfection and decontamination of anthrax contaminated premises should be readily available to farmers and surveillance teams.

3.4 Functions and role of diagnostic laboratories

For proper monitoring of anthrax, a laboratory should be able to:

- support an investigation and confirm all suspected cases of anthrax in the shortest possible time;

- develop procedures and instructions and provide the materials for field personnel in regard to collecting specimens and submitting them to the laboratory;

- perform the most appropriate laboratory tests. A flow diagram of the suggested procedure for isolation and identification of B. anthracis and confirmation of diagnosis is shown in Fig.6;

- communicate the findings to all groups concerned;

- develop and maintain the nationally required reporting system.

3.5 Production and supply of anthrax vaccine

For an anthrax vaccine to qualify for use, it must meet certain conditions and standards. Some of these are:

- the vaccine should be produced in accordance with acceptable international standards and agreed procedures, including potency, abnormal toxicity and other quality control tests in line with those given in the report of the WHO Expert Committee on Biological Standardization (WHO Technical Report Series No 361, 1967);

- the vaccine should be safe for all the target animal species;

- the vaccine should be efficacious and give at least 12 months' protection;

In addition,

- the vaccine must be readily available when required;

- field officers should have storage facilities for the vaccine;

- contingency stocks of the vaccine should be available, in the care of the national task force;

- research into an improved vaccine should be encouraged with the aim of producing one that is more easily administered and has longer lasting protection than current vaccines.

3.6 Food hygiene aspects, training and education

In Africa, many people have died of anthrax, often after consuming infected meat or handling infected carcasses. Avoidance of the problem depends on the following considerations:

- meat must be properly inspected before being distributed for consumption. This includes meat from animals culled in game parks;

- animals that die unexpectedly or the carcasses of animals "found dead from unknown cause" should not be butchered and distributed for human consumption;

- public awareness of the dangers of consuming such meat should be intensified through seminars, the media and posters;

- meat inspection regulations and training should be regularly reviewed;

- all meat processors should be equipped and trained to decontaminate and disinfect their premises in the event of an anthrax infected carcass entering the processing line.

Drying is a common method of meat preservation in Africa and in this form the meat can be readily transported over long distances and kept for a long time. However, this is a potential means of spreading anthrax spores if the meat is derived from an infected animal.

3.7 Task forces and intersectoral cooperation

Intersectoral cooperation is essential to effective control of anthrax. In developing countries where anthrax is still a great problem, the formation of task forces must be given high priority. Such task forces should be drawn from the following Ministries: Agriculture, Food and Fisheries; Health; Tourism (Wildlife); and Environment.

The operations of task forces must range from the outbreak level to national level. Within each interested ministry there should be an officer to attend to anthrax-related matters, including:

- surveillance and reporting/notification;

- public awareness;

- field facilities for diagnosis, carcass disposal, disinfection and decontamination, and vaccination, including ensuring that stocks of vaccine and disinfectants are held under appropriate conditions of storage;

- food hygiene aspects;

- quarantine.

3.8 Research requirements and programmes in Africa

The group agreed on the need for research in the following areas relating to control of anthrax under the conditions prevailing in Africa.

3.8.1 Epidemiological factors contributing to anthrax outbreaks in Africa

- mechanisms of infection through exposure to contaminated soil, water and other materials;

- mechanisms of anthrax infection in humans;

- transmission dynamics of anthrax amongst livestock, wild animals and humans;

- the effect of seasonal and climatic factors on anthrax occurrence, in particular the effect of drought in Africa;

- socioeconomic customs in African villages and the anthrax endemic state.

3.8.2 Operational research for task forces concerned with anthrax control in Africa

- collection of diagnostic materials and their transportation to diagnostic laboratories;

- applicable methods of carcass disposal under conditions prevailing in Africa;

- applicable methods of disinfection/decontamination of contaminated sites and areas in Africa;

- first-aid action to be taken for anthrax patients;

- intersectoral cooperation, including wildlife service sectors;

- cost/benefit analysis of anthrax control operations in Africa.

3.8.3 Anthrax vaccine development and vaccination campaigns

- vaccine production and control in Africa;

- vaccine efficacy and effectiveness as applied in Africa;

- stability, duration of immunity and safety of the vaccine;

- development of oral anthrax vaccine for animals.

3.8.4 Research in diagnostic methods in Africa

- development of simple, economical anthrax diagnostic methodology for Africa;

- development of serological methodology for surveillance and diagnosis;

- identification and antimicrobial sensitivity testing on B. anthracis isolated from clinical samples, environmental materials and food.

3.8.5 Operational research in animal slaughter hygiene

- biosafety aspects of animal slaughter;

- inspection of slaughtered animals with special attention to anthrax.

3.8.6 Other research areas

- Intersectoral cooperation, health systems and legislation for anthrax control in Africa;

- best methods of utilizing anthrax-contaminated pastures and lands for safe agricultural purposes;

- pathogenesis of anthrax to better understand risks in, for example, slaughterhouses.

4. INTERNATIONAL COOPERATION AND WORK PLANS FOR 1993-1995

The group agreed upon the following actions to be taken by participating countries under the auspices of working group cooperation:

(1) To facilitate prompt collection of epidemiological information upon the onset of an anthrax outbreak, a "broad sheet" (a small but comprehensive check-list on action to be taken by livestock owners in the event of an anthrax outbreak) should be designed and distributed in endemic countries. The livestock owner should be encouraged to follow the directions of the broad sheet to inform the nearest veterinary and/or public health offices so that further control contingencies can be set in motion.

(2) Moves should be made to ensure that diagnostic laboratories be equipped with simple, essential minimum facilities, equipment, and trained technical personnel. Microscope smear preparation and specimen collection kits should be available for distribution to local veterinary, public health or other appointed officers for prompt collection of diagnostic specimens.

(3) Laboratories producing anthrax vaccine in Africa should be identified together with their type of vaccine, capacity, standard, stability, safety and control of the production, as well as the price and amount of stock for possible distribution to outlying districts or export to other countries as necessary. Cold chain throughout the process of vaccine application also needs to be re-examined, together with vaccine efficacy and effectiveness. Availability of human anthrax vaccine for people in at-risk occupations should be established.

(4) More information should be collected on the costs of implementing task force control of anthrax, including the resources required for disinfection/decontamination, carcass disposal, meat inspection, transportation, public education, and any other activities required.

(5) Training courses for technical personnel at local/national levels, and educational campaigns for the general public in endemic areas, should be organized. For this purpose, guidelines for diagnosis, prevention and control, video films, posters, and diagnostic kits should be prepared and distributed in the selected model countries.

(6) The model country approach for improved anthrax surveillance, control and associated research, proposed at the working group's meeting in 1991 (document WHO/CDS/VPH/91.98), would be initiated with minimum further delay in Kenya, Tanzania and Zambia, together with other countries having shown marked interest in being involved. Also in line with the proposals contained in the 1991 report, the model countries would closely examine the best methods under their individual circumstances for conveying and imparting the necessary information and instruction at the various levels of infrastructure, from the farmer/owner through the veterinary services to the Ministry of Agriculture (or equivalent).

(7) To facilitate the earliest possible implementation of the above plans a training workshop on anthrax surveillance, diagnosis and control should be organized for technical personnel from countries in Africa. The FAO/WHO Collaborating Centre for Research and Training in Veterinary Public Health, at the Istituto Superiore di Sanità, Rome, has offered to set up such a course.

The OIE General Assembly, Paris, 1994, may provide the opportunity for a further meeting to discuss international cooperation for promoting anthrax control in endemic countries in Africa.

5. CONCLUSIONS AND RECOMMENDATIONS

Anthrax still remains endemic in many parts of Africa to date, despite the efforts of public health, veterinary, agriculture, environmental and social sectors to control the disease. Local socioeconomic circumstances and customs, together with the complexity of anthrax epidemiology in Africa (from extensive spread of contaminated areas and agricultural lands to the intermingling of livestock with wild animals) are also factors preventing the implementation of effective control programmes in Africa. It was felt that current science and technology could be applied to anthrax control, and that plans for international cooperation in support of national control programmes would be invaluable.

It was particularly fruitful to identify the problems and needs for further collaboration in controlling anthrax in Africa through visits to endemic areas in the Kalabo District, Western Province, Zambia. Working group activities will continue in line with work plans agreed upon in the meeting.

Recommendations

(1) Surveillance and reporting. It was agreed that the appropriate legislation requiring notification of anthrax was in place in most countries, but that the problem lay at the level of the farmer/owner reporting to the veterinary field officer or equivalent. It was therefore recommended that:

(a) the incentive for livestock owners to report anthrax should be the offer of free vaccination of the remainder of the herd following laboratory confirmation of the disease;

(b) a concerted effort should be made to insert into legislation a clause that hospitals and clinics should report cases of human anthrax to the regional/district veterinary officer and/or find other ways and methods of establishing/ensuring close cooperation between medical, veterinary and wildlife services.

In view of the frequent problem of distance between the sites of communities where a case or outbreak may occur and the nearest veterinary station, it was considered that it should be an accepted aim that every unexpected death among livestock should, through appropriate means, result automatically in a blood smear for examination at the first opportunity. The "appropriate means" might be a person of standing in each community who has been given adequate instruction.

(c) better monitoring by veterinary field staff of unexpected death would assist in improving anthrax surveillance;

(d) each participating country should choose an area for intensive study to determine the real incidence of and reasons for unexpected death in that area;

(e) the recommendation contained in the preliminary draft of WHO Anthrax Guidelines (document VPH/Anthrax/WP/92.4, section 9.1, page 34) on "establishment of national and regional anthrax watch teams" be accepted and implemented.

(2) Diagnostic laboratory support. Laboratory culture should be regarded as an essential back-up procedure for diagnosis and this should be made possible by provision of the appropriate equipment, materials and instructions at least at the district veterinary laboratory level. Research and development on prototype alternative "on the spot" test systems not requiring any expensive piece of equipment, such as a microscope, should be a priority.

Simple guidelines on clinical diagnosis of anthrax in animals and in humans should be elaborated to ensure optimal chances of correctly determining the incidence of anthrax in an area, even in the absence of diagnostic laboratory support.

(3) Disposal of carcasses, disinfection and decontamination. Research should be carried out in the participating (model) countries to determine the conditions under which a "rendering policy" might be established. The recommendation was in four parts:

(a) that participating countries be supplied with information on rendering plant design, construction and operating needs such as amount and type of fuel required;

(b) that these participating countries carry out a feasibility study on establishment of rendering plants, transportation thereto of carcasses and supply of the necessary fuel;

(c) some studies should be carried out to determine the efficacy of burning as a means of decontaminating the site of an anthrax carcass after the latter has been correctly (or incorrectly) removed from that site;

(d) research should be carried out into the design of a formal disinfection procedure applicable to the conditions pertaining in Africa.

(4) Vaccines and vaccinations. Follow-up investigative surveys on vaccinated animals should be carried out so as to examine:

(a) the possible effects on vaccine efficacy of variable production, storage and distribution conditions;

(b) sero-conversion rates in vaccinated animals;

(c) duration of vaccine-induced protection.

It was accepted that in Africa, as in Europe and north America, human vaccines should only be used for persons in at-risk occupations.

(5) Food hygiene aspects. Hygiene regulations appear to exist in most African countries, but problems appear to lie with implementation of these regulations, especially in rural areas. In general, inspection is only required for meat destined for sale. It was recommended that the new aim should be that all livestock carcasses destined for human consumption should be inspected.

A person at village level should be trained to inspect all livestock carcasses destined for human consumption. This person might be the same person as proposed in (1) above, appointed to take smears from the carcass of any animal dying unexpectedly.

Equivalent provision should be made for inspection of carcasses resulting from culling in wildlife and proposed for human consumption.

A way should be found to increase public awareness of this matter.

(6) Task forces and intersectoral cooperation. It was felt that poor communication and collaboration between veterinary and medical services constituted a major problem in relation to controlling anthrax. A way should be found to open channels of communication between these services on zoonotic diseases and to make it possible for them to share necessary facilities. It was suggested that one way of ensuring such improved communication would be to offer combined courses on various zoonoses. The need for intersectoral cooperation and communication was also stressed in relation to veterinary and wildlife staff.

The other area of intersectoral cooperation identified as needing improvement was the farmer/wildlife staff link. Model country personnel would also examine ways of improving this aspect wherever necessary.

Permanent national/district task forces, with every member clear as to his/her role, should be established so that mobilization is instant when needed. The district task force should include diagnostic capabilities and should have established plans of action in line with local conditions and circumstances. These plans should include instructions on the source and use of vaccine, disinfectants, etc.

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The group also thanks all the other officials and staff of the Ministry of Agriculture, Lusaka, involved in the meeting preparations, as well as the district veterinary officers in Mumbwa, Mongu and Kalabo, and Mrs Elizabeth Kasmumba at the Kalabo District Hospital, for their invaluable information about the anthrax outbreaks in the villages visited.

Table 1. Relative vulnerability of different wildlife species to anthrax during an epidemic in South Africa in 1991

SPECIES*	SCIENTIFIC NAME	AVAILABILITY		ANTHRAX DEATHS		RELATIVE VULNERABILITY (V)	% V	RANK
		NO.	% (A)	NO.	% (D)			
Greater kudu	*Tragelaphus strepsiceros*	1531	6.48	631	54.30	8.38	34.15	1
Nyala	*Tragelaphus angasii*	210	0.89	51	4.39	4.93	20.09	2
Waterbuck	*Kobus ellipsiprymnus*	486	2.06	67	5.77	2.80	11.41	3
Wild dog	*Lycaon pictus*	18	0.08	2	0.17	2.13	8.68	4
Lion	*Panthera leo*	49	0.21	5	0.43	2.05	8.35	5
Roan antelope	*Hippotragus equinus*	105	0.44	6	0.52	1.18	4.81	6
African buffalo	*Syncerus caffer*	6996	29.62	333	28.66	0.97	3.95	7
Steenbok	*Raphicerus campestris*	120	0.51	4	0.34	0.67	2.73	8
Eland	*Taurotragus oryx*	420	1.78	10	0.86	0.48	1.96	9
Hippopotamus	*Hippopotamus amphibius*	129	0.55	3	0.26	0.47	1.92	10
Sable antelope	*Hippotragus niger*	532	2.25	5	0.43	0.19	0.77	11
Elephant	*Loxodonta africana*	1327	5.62	7	0.60	0.11	0.45	12
Burchell's zebra	*Equus burchelli*	7464	31.61	17	1.46	0.05	0.20	13
Blue wildebeest	*Connochaetes taurinus*	2029	8.59	5	0.43	0.05	0.20	13
Warthog	*Phacochoerus aethiopicus*	393	1.66	1	0.09	0.05	0.20	13
Giraffe	*Giraffa camelopardalis*	1807	7.65	3	0.26	0.03	0.12	14
Bushbuck	*Tragelaphus scriptus*	*	-	8	0.69	-	-	-
Baboon	*Papio ursinus*	*	-	1	0.09	-	-	-
Common duiker	*Sylvicapra grimmia*	*	-	1	0.09	-	-	-
Blackbacked jackal	*Canis mesomelas*	*	-	1	0.09	-	-	-
Whitebacked vulture	*Gyps africanus*	*	-	1	0.09	-	-	-
		23616	100	1162	100	24.54	100	

* census results not available or unrepresentative of the true population

Fig.1. Line-graph of confirmed anthrax outbreaks in livestock in South Africa. Relevant historical events aimed at controlling the disease are superimposed on the graph

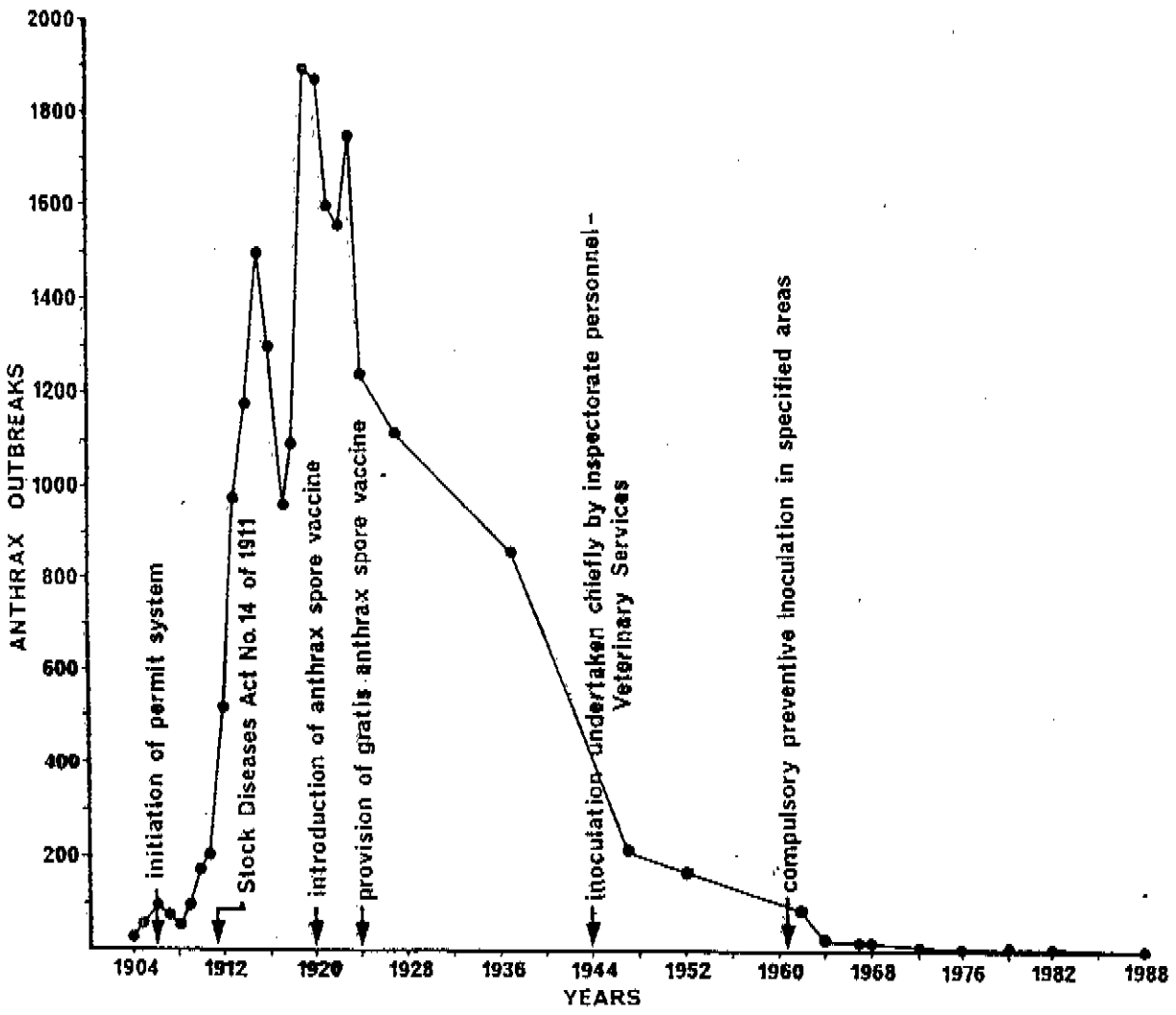


Fig.2. Incidence rate for human anthrax in South Africa

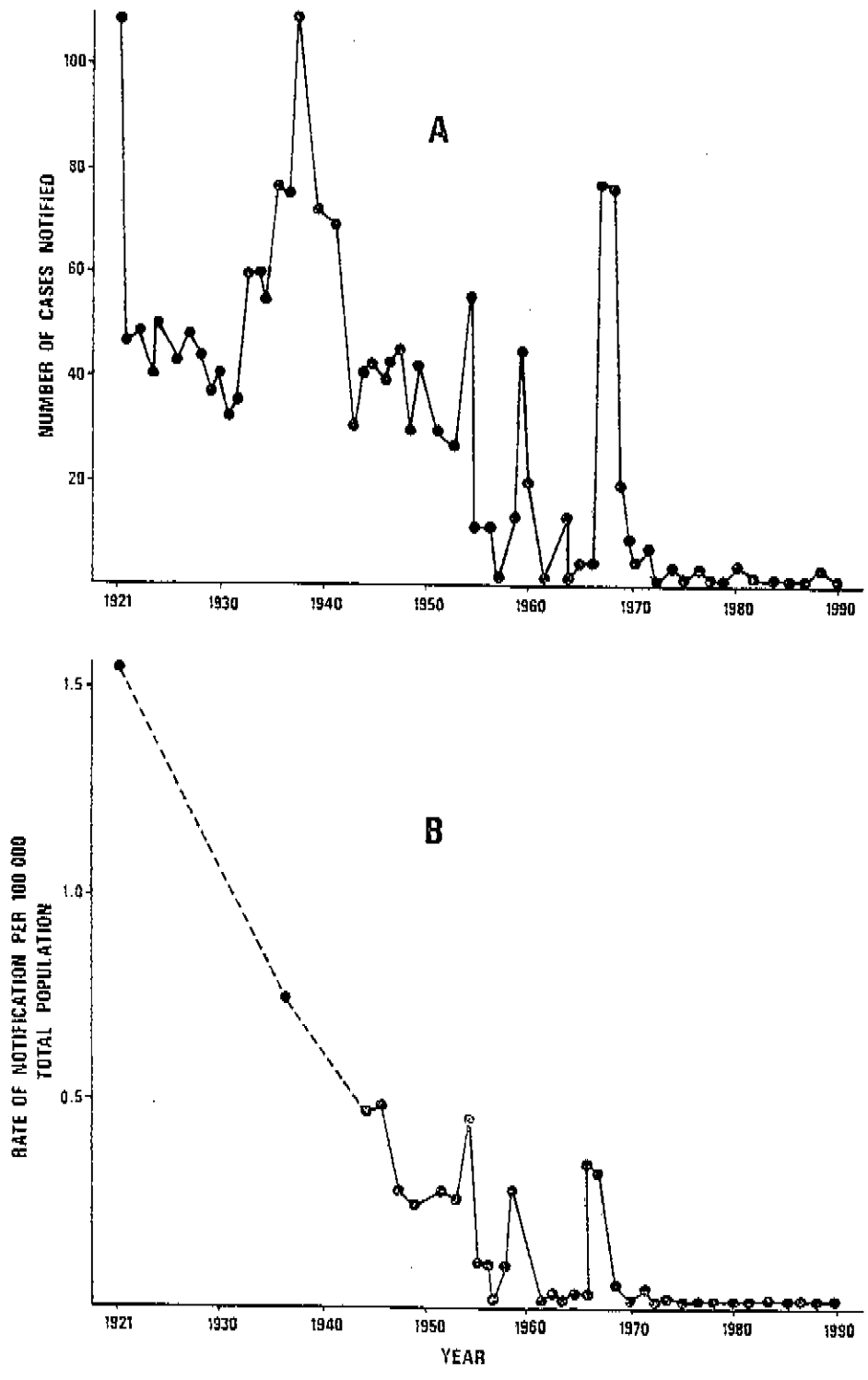


Fig.3. Anthrax cattle vaccinations in millions as performed in South Africa from 1984-1991. Dotted line indicates the time when vaccination passed from Government to owners

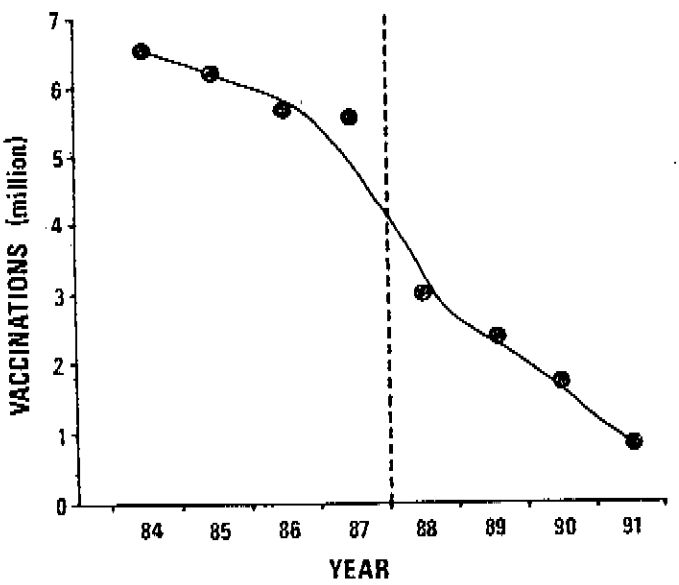


Fig.4. Anthrax transmission in wildlife in Kruger National Park

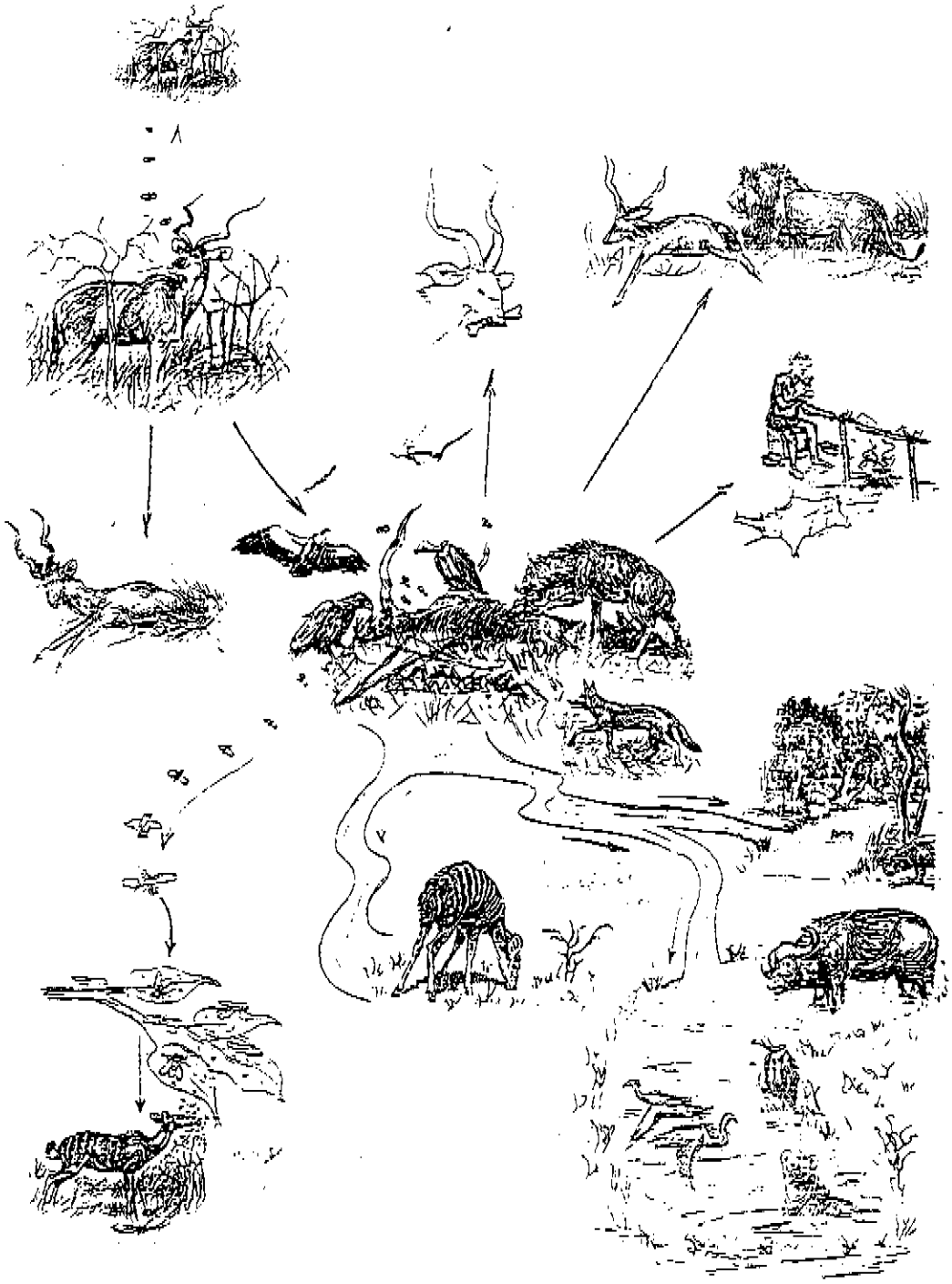


Fig.5. Number of new cases per 4-day interval during the 1990/1991 anthrax epidemics, with a seasonal cyclic variation, in the Kruger National Park

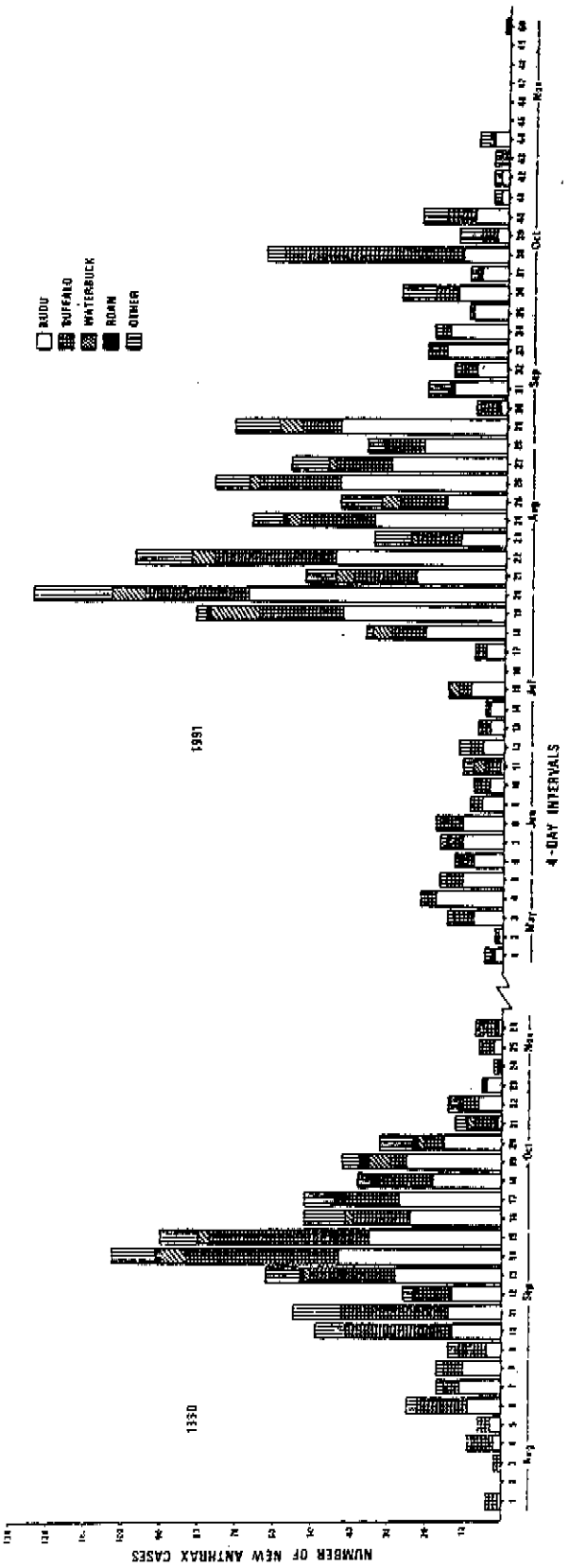
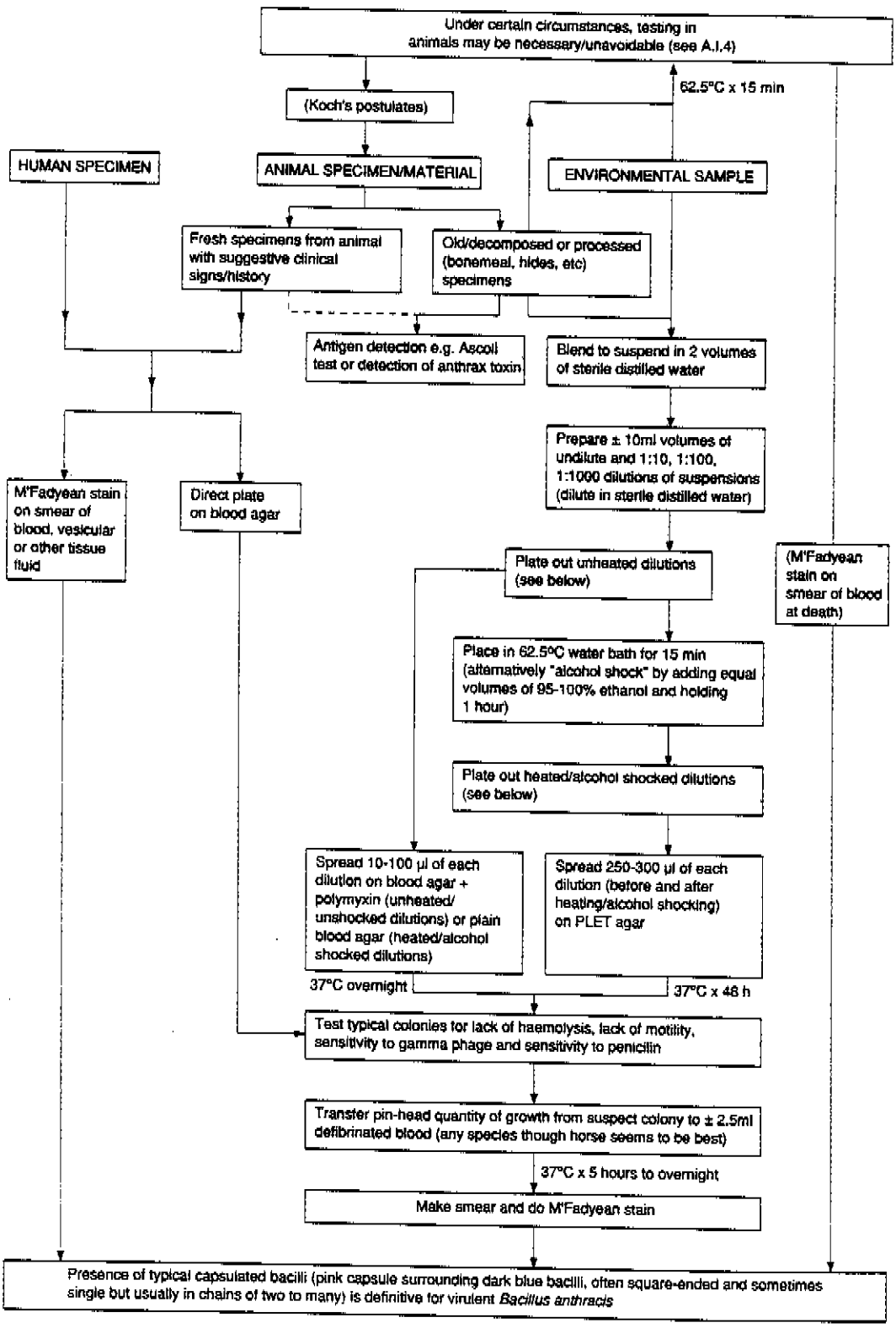


Fig.6. Flow-diagram of suggested procedure for isolation and identification of B. anthracis and confirmation of diagnosis



ANNEX I

LIST OF PARTICIPANTS

Dr Katinka de Balogh, Netherlands International Development Cooperation (at time of meeting, Lecturer Samora Machel School of Veterinary Medicine, University of Zambia, Lusaka, Zambia)

Dr G.C. Bbalo, Provincial Veterinary Officer, Western Province, P.O. Box 910034, Mongu, Zambia

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ANNEX II

RECORD OF STUDY TOUR TO ANTHRAX ENDEMIC AREAS IN THE KALABO DISTRICT, WESTERN PROVINCE, ZAMBIA

In conjunction with the WHO working group meeting on anthrax control and research, with special reference to national control programme development in Africa, held in Mongu, 22-28 September 1992, the group visited anthrax endemic areas in the Kalabo district, some 60 Km from Mongu, in close collaboration with district veterinary and public health officials.

On 22 September 1992, all the participants of the WHO working group meeting on anthrax in Mongu met in Lusaka to discuss the travel schedule and other arrangements for the meeting in Mongu, 600 Km away from Lusaka as well as the travel on to Kalabo (60 Km further on from Mongu with no proper road or bridges on the route) to visit native villages in endemic areas of the region. A chartered minibus was arranged for travelling to/from Mongu with VPH/WHO funds, with close assistance by the WHO Representative in Lusaka. Four other official vehicles (Land cruiser type) were provided by the Veterinary and Tsetse Control Services of the Ministry of Agriculture. An FAO expert in Lusaka also cooperated with the team with a similar type of official vehicle to travel to Mongu and Kalabo.

On 23 September, the team travelled to Mongu through Mumbwa and visited the District Veterinary Office in an anthrax endemic area. According to Dr J.L. Mweempwa, district veterinary officer, 10 cattle were found dead from anthrax in this district in November 1990; 179 cattle died in another area where 27 866 animals were vaccinated. In the same area, 13 human deaths, including 7 children, were recorded. These animal and human cases were confirmed in clinical and laboratory diagnosis. The human anthrax cases were contracted through consumption of contaminated meat and/or direct contact through skinning and/or cutting the carcasses. Since January 1990 an anthrax vaccination campaign in cattle has been continued with a cost per dose of 6.64 Kwacha (approx. 0.03 US$). It was mentioned, however, that anthrax outbreaks are still occurring sporadically in unvaccinated zebra, buffaloes, and other wild animals. The district officer emphasised that public meetings are useful for educating the general public in hygienic practices based on primary health care concepts at the village level.

On arrival in Mongu, the local television broadcast to the district that a WHO expert team had arrived at Mongu City for the meeting to assist anthrax endemic areas in this district.

On 24 and 25 September the WHO Working Group Meeting was held in a hotel meeting room in Mongu with several local observers (see detailed information attached to this report).

On 26 September, the team proceeded to Kalabo and visited the Skundo area, a village where a majority of the natives suffered from anthrax in November 1990. The village master lost his wife and two children from anthrax. Most of village people ate, they said, meat derived from their own cattle of which ten animals were found dead in a remote pasture without any remarkable symptoms except an enlarged spleen, and caused 11 deaths and many

others suffering from anthrax. The symptoms in the people were swelling of neck and chest, enlargement of local lymph nodes; skin lesions were traced, even at the time of the team's visit more than a year later in 4-5 village people who were mainly engaged in skinning and cutting of carcasses. Mrs E. Kasmumba, nursing officer at the Kalabo District Hospital who accompanied the team, mentioned some of the patients were sent to the district hospital in Kalabo and treated on average for only 2-3 days (some were 7 days) before returning to the village where they were more comfortable than staying at the hospital. These patients had come to the Kalabo hospital by themselves on foot and/or on stretchers with the assistance of family members from distances of at least 20 Km. In another village (Nactande), approx. 10 km on from Skundo village, 7 animals died in 1991 within a few days without any remarkable sign or symptoms although the village people engaged in skinning and cutting the carcasses found that the dead animals had enlarged spleens. Since the animals were not in the village but in a remote pasture, skinning and cutting of the carcases were done in the pasture and only the meat was brought from there to the village for consumption. An old male victim in the village who did not eat but engaged in skinning and cutting the carcases suffered from anthrax and developed skin lesions. The village people already knew such carcases should be buried and/or burned but they said that burning is extremely difficult due to lack of wood or other fuels. The village people are now quite cautious about consuming dead animals with enlarged spleens or any unknown/unidentified meat since they have experienced that such meat causes health problems such as swelling of neck and chest, skin lesions, high fever, requiring many days to recover and even causing death though in this village no death occurred because some of the severely ill people got to hospital for treatment, on stretchers or on foot. In this context, the working group had to re-consider the content of the meeting discussions on health care systems and meat inspection in far remote areas in Africa so as to improve health status of such village people with minimum local resources available. It would be most important to improve this area of study within the context of anthrax control and research in Africa. The working group thoroughly recognized the importance of this subject. On the occasion of the working group's visit to the villages in endemic areas, the village people requested the team for free provision of anthrax vaccines for animals as well as humans although the cost of animal vaccine is 6.6 Kwacha (approx. 0.03 US$) and chemically defined human vaccine is prohibitively costly to supply to endemic areas in Africa. The group urged development of human anthrax vaccine at a cost economically reasonable to endemic countries in Africa.

On 28 September the group met in the early morning to discuss various points raised from the trip to the villages in Kalabo District so as to review the meeting discussions in the light of the trip; revised meeting recommendations were adopted.

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