

## TREPONEMATOSIS ERADICATION, WITH SPECIAL REFERENCE TO YAWS ERADICATION IN HAITI \*

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### SYNOPSIS

This paper outlines the general administrative and therapeutic principles governing yaws eradication campaigns, with particular reference to the operational problems encountered in Haiti. The ways in which those problems were solved are described in the course of a relatively detailed account of the yaws eradication programme which began in that country in 1950 and which has now reached the end of the "mopping-up" phase. The author points out that lessons learnt in this mass treatment campaign can usefully be applied to eradication programmes against other diseases.

In December 1942, the treponemicidal action of the newly discovered antibiotic, penicillin, was, for the first time, reported by Mahoney, and this set the wheels in motion for one of the most concentrated attacks on syphilis. Step by step the conventional lines of treponematoses therapy were changing, and so we observe some years later that one single injection of penicillin is sufficient to cure syphilis and other treponematoses. In the meantime, better preparations of this antibiotic made possible a reappraisal of the conservative principles of treponematoses control. So many countries after the Second World War were facing a rise in their venereal disease rates that it became imperative to formulate a new philosophy of attack on the treponematoses.

The development of the idea of treponematoses eradication is undoubtedly associated with the days when the Pan American Sanitary Bureau became very active in promoting co-ordinated health action at the international level, and when the World Health Organization came to life. Against these facts as background, the yaws eradication programme in Haiti was established, organized, and is being carried on to a successful conclusion.

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## Yaws in Haiti

In Haiti, an independent country of the West Indies, occupying one-third of the island of Hispaniola, of about 10 000 square miles (25 900 km<sup>2</sup>) and 3.5 million people, yaws has existed for many years, and various health administrations have tried to cope with the problem, with different degrees of intensity. In 1949, it was known that—leading even malaria, tuberculosis, enteric diseases, and malnutrition—yaws was the major public health problem which had to be conquered before the country could undertake other health programmes essential for a vigorous economic plan. Precise figures, i.e., prevalence rates and ratios, detailed census figures, etc., would have been of comparative value, but were not available. However, according to all reliable sources, the prevalence of yaws in Haiti was between 40% and 60%, representing a serious epidemic menace. It is our considered opinion that the only other accomplishment to be reported today, had any costly surveys been conducted, would be the numerical element of statistical comparison between an unknown base figure and the progress to be reported in November 1955. Moreover, there were, at the time, certain published statements regarding the prevalence of yaws in Haiti. Strong<sup>4</sup> wrote: "In Haiti, it has been estimated that 80% of the rural population are infected, and during a number of years mass treatment was given annually to some four hundred thousand cases". McKinley<sup>2</sup> stated that "100,000 cases of framboesia had been reported, the majority from rural districts." During 1943, 48759 cases were reported to the health authorities, 32 195 in 1944, and 11 679 during the period January-July 1945. Duvalier,<sup>1</sup> in 1945, reported "that 97,299 patients attended one rural clinic in Haiti from March 1943 to March 1944".

## Administrative Considerations

### *Objective*

There can be but one objective in a yaws programme—eradication. By eradication of yaws we mean a complete disappearance of all infectious cases from a country and the non-appearance of any primary autochthonous case after the intensive campaign efforts have been terminated; in other words, the complete interruption of transmission. This objective can be attained if suitable techniques are put into effect, as will be described below. Although the differences between an eradication programme and a control programme may seem to be only of degree, if we examine them carefully we will observe the tremendous public health and economic importance of an eradication programme. These differences may be tabulated as follows:<sup>a</sup>

<sup>a</sup> This tabulation has been adapted from document No. 1 of the Co-ordinating Office for Malaria Eradication Programme, Pan American Sanitary Bureau.

<i>Elements</i>	<i>Control programme</i>	<i>Eradication programme</i>
1. Objective	To reduce morbidity.	To prevent the occurrence of any new cases of yaws.
2. Area of operations	Accessible zones, areas of yaws prevalence of high social, political and economic importance.	All the areas where cases occur.
3. Minimum quality of work	Good: reduction of number of cases.	Perfect: all infectious cases must be eliminated (which implies the treatment of contacts), and the chain of transmission must be stopped.
4. Duration of operations	Permanent.	Programme finishes when infectious yaws no longer exists. To be successful it must be an expanding programme to clean up all areas from which re-infection can occur.
5. Economic factors	Treatment measures applied in those areas where the cost is justified by the economic importance of the local area; expenditures must be continued indefinitely (recurrent service).	Treatment measures have to be applied in all areas and will rapidly reduce expenditures, representing a capital investment rather than a recurrent expense.
6. Case-finding	Important in all phases of the programme.	Important especially in the final stages of the programme.
7. Serological diagnosis	Important in all phases (and expensive).	Not important in mass phases.
8. Imported cases	Of relative interest.	Vital after mass treatment has stopped.
9. Epidemiological investigation of individual cases	Very expensive and seldom conducted.	Vital in spite of expense, especially in last phase of the programme; only measuring rod of eradication.
10. Administrative evaluation of the programme	Measurement of accomplishment (reduction in morbidity).	Measurement of what remains to be done.
11. Epidemiological evaluation	Reduction of serological rates.	Disappearance of primary autochthonous cases as proved by the yaws "intelligence service".

### *Extent of the problem*

It is important to recognize the several factors involved where yaws is a serious problem—such as the number of cases, the distribution of cases, the clinical characteristics, etc.—in order to be able to plan the measures and procedures applicable to a particular area or country.

In certain countries, the problem is minimal and, consequently, the number of staff and the extent of the area of operations can be correspondingly adjusted to those particular needs; in other countries, the yaws

cases only appear in certain tropical areas along the river banks and it would, of course, be futile to treat the entire population of the country. There are also areas with a high prevalence of non-infectious yaws cases without public health significance, which should be dealt with in yet different fashion. All these factors need to be carefully studied and evaluated before proceeding to establish a certain pattern, which may be right for one place but highly unsuitable for another.

### *Reconnaissance*

Once the extent of the problem has been more or less determined, it is of the utmost importance to visit all the country where the work is to proceed. Frequently one encounters a load of data at the central headquarters which are not corroborated by hard "shoe and sole" investigation.

The local customs, and grudges, should be recognized very early in order to adjust the administrative procedures of the programme to them.

### *Method of work*

In treponematoses campaigns there are four generally accepted methods of work:

- (1) from permanent dispensaries;
- (2) from ambulatory clinics;
- (3) from mobile (trailer-type) clinics; and
- (4) house-to-house work.

*Permanent dispensaries* are the oldest approach to the treatment problem but could not be used in Haiti because they are not suitable for rural areas, since they are very expensive to maintain and the peasants in Haiti would not readily attend them.

*Mobile clinics* were not satisfactory for yaws eradication in Haiti because the prevalence was too high to achieve a full coverage with this particular approach.

The *mobile (trailer-type) clinic* would have been too expensive for this mass campaign and would not have proved satisfactory in Haiti, where there are few highways.

The *house-to-house method* of work, which implies that *every single dwelling* must be visited and all persons must be examined and treated, is the method of choice. It is the only way to ensure that the objective of eradication will be attained; and in the final analysis it is more economic, since areas which have been completely covered will need only epidemiological spot surveys to check the appearance of any new case.

### *Training of personnel*

This is of vital importance to the success of any public health programme, but in eradication work, when only perfection can be accepted, it is of the greatest value to give adequate training to the personnel in the field and in the central headquarters. Once personnel have been selected and recruited, intensive training must be given, which should include the following subjects:

- (a) technique of intramuscular injection;
- (b) minimum technique of asepsis;
- (c) "rough" diagnosis of yaws;
- (d) health education;
- (e) driving a car and horseback riding;
- (f) general topography of the area;
- (g) map-reading;
- (h) preparation of reports.

In most countries highly trained personnel are not plentiful, and sub-professional personnel must be used in almost every stage of the operations, under continuous careful supervision.

Refresher courses in all the subjects listed above, as well as frequent visits by the field personnel to central headquarters for revision of established techniques and procedures, are necessary. Sub-professional personnel of supervisory calibre should also be trained in order to prepare them for their more complex and exacting tasks.

### *Personnel and finance*

Normally, one person at the central headquarters should be made responsible for personnel and finance. The complexity of the personnel and financial procedures should be reduced to the minimum compatible with efficiency in the field; however, a close control must always be exercised to avoid loss of money, lack of discipline, and bad public relations. All personnel must be fully aware of the personnel and financial policies which will enable them to follow these procedures without error. This is particularly important for those working far from the central headquarters.

### *Supply and transport*

This is another vital element in the planning and operation of a yaws eradication programme. Certain basic principles may be mentioned:

- (a) early preparation of a complete list of supplies;
- (b) selection of supplies, equipment, and transportation suitable for the areas of operations;

(c) establishment of a central warehouse with adequate stock cataloguing;

(d) periodic inventory checks;

(e) establishment of regional warehouses;

(f) central garage with a reliable mechanical service;

(g) adequate control systems for the utilization of fuel and lubricants; and

(h) establishment of a supply-line with adequate checks, avoiding any breakdown along the way.

Supplies and transport equipment are expendable but extremely difficult and sometimes impossible to replace in less developed countries.

### *Mapping, marking, and statistics*

The work of the treatment inspectors in the field largely depends on a full knowledge of the routes, location of villages, and location of houses. If every house of a country is to be covered, it is necessary to adopt suitable means of pin-pointing them. A cartographical section must be organized at headquarters to do the initial work, but the chief inspector should be responsible for the accuracy of the subsidiary maps and for their duplication and distribution to all treatment inspectors.

Each house will have to be marked and numbered for its identification later on by the chief inspectors and other supervisory personnel. A great deal can be learnt from other eradication programmes, such as the *Aedes aegypti* campaign.

Statistics cannot be improved once they have been collected erroneously by the operational unit. Consequently, continuous checks must be made on the accuracy of data obtained by treatment inspectors, chief inspectors, liaison inspectors, and general inspectors.

It is also important, as described below, that the record data be sent to central headquarters on fixed dates without fail, so that full and comprehensive statistical reports can be prepared.

### *Reports*

It has been stated that anything worth doing routinely is worth routine reporting and, consequently, field reports, as far as practicable, should reflect the daily happenings, which in this particular case are: name of locality visited; number of houses visited; number of houses found closed; number of persons present in the house; number of persons absent; number of persons treated as cases; number of persons treated as contacts; and amount of penicillin used. Substantially, this is the basic information which should be reported daily, and then compiled weekly and monthly, so that

at the central level there is always a clear picture of what is going on, and where and how the operations are progressing.

Reports are not usually sufficiently used as planning and operational tools, but a careful study of field reports should enable the directors of a campaign to detect any failures, imperfections in the work, and misrepresentation of facts. Corrective action should follow this report analysis.

Reports must be compiled in such a way that they can be easily compared from one period to the next; they should be modified as soon as conditions in the field warrant any changes, in order to reflect what is happening.

### *Supervision*

In any eradication campaign, whether it be against *Aedes aegypti*, malaria, or yaws, close supervision at every level of operations is essential.

One of the differences between control and eradication is that the minimum quality of work acceptable may be good in the former but must be perfect in the latter. In eradication work there are no half-way accomplishments: the campaign is either a 100% success or a failure. Therefore, a pyramidal type of organization is necessary, so that a group of treatment inspectors (who represent the minimum administrative unit) should be supervised by a chief inspector; three, and no more than five, chief inspectors should be supervised by a general inspector; a group of the latter will be supervised by the general chief inspector, who in turn will be supervised by the medical officer in charge of field operations. This implies that every person has a definite area of responsibility.

It is important to convey to supervisory personnel the idea of guidance, advice, and example, rather than the idea, frequent in certain areas, that supervision means inspection and penalties if the work is not satisfactory.

### *Logistics*

Once all the administrative factors have been considered, the field operation must be so organized that the equipment and supplies, the personnel, and the patients should, without fail, meet at a particular dwelling at a given time. In other words, the entire administration of a yaws eradication programme must be geared to the systematic coverage of every house in a community, and all persons—cases or contacts—must be examined and treated.

If any deviation from the procedures regarding personnel, transport, and other equipment is allowed, then not all the houses and persons will be covered and the work will fall short of the objective. The final result of these deviations will be delays in the achievement of the coverage of houses and communities, failures to meet the time-tables for a country,

and, at times, the necessity for a complete re-coverage of a particular community which was not 100% treated. For these particular purposes liaison inspectors primarily in charge of feeding the supply-line must be employed to avoid any breakdowns along the way. There can be no compromise in this.

### *Evaluation*

In a yaws eradication programme there are certain ways of measuring the progress of the campaign and of determining its end. The epidemiological investigation of individual cases is vital in the last phase of the mass campaign, when there are so few cases occurring that it must be known where they occur in order to establish focal coverage by special treatment squads.

The epidemiological intelligence service of a yaws campaign is primarily concerned with checking all new cases in order to determine whether they are reinfections, imported cases, or autochthonous cases which were missed during the intensive mass coverage. The epidemiological intelligence service should be organized on a permanent basis until the campaign ends, under the direction of a physician fully acquainted with the darkfield examination technique and who will have at his disposal a group of inspectors to visit houses on a random basis, in order to ascertain, epidemiologically and clinically, whether the cases are primary or imported.

### **Therapeutic Considerations**

It has been fully demonstrated that penicillin is the therapeutic agent of choice for the treponematoses. Although a few years ago there was justification for pilot studies in order to determine the minimum dose of penicillin for the treatment of infectious yaws, today there is evidence that 600 000 units of procaine penicillin G in oil with 2% aluminium monostearate (PAM) are sufficient to render non-infectious a case of infectious yaws. Hume & Facio have reported the detailed results of the Babinet study in Haiti after over 24 months of clinical and bacteriological follow-up (see page 1057). They conclude that very satisfactory results can be obtained in the treatment of infectious yaws with 600 000 units of PAM in a single intramuscular injection.

In most programmes it has been found that a dose half that employed for cases is satisfactory for the treatment of contacts. It should also be stated that it is of paramount importance to treat all household contacts in order to cover all those persons who may not show symptoms because they are incubating the disease or because they are in the latent stage.



## Yaws Eradication Programme in Haiti

### *Background*

Early in 1949 a representative of the Government of Haiti proposed to the Director of the Pan American Sanitary Bureau (PASB) that a co-operative enterprise be undertaken to eradicate yaws from the country, as the only practicable measure to solve the major public health problem of the Republic. The Pan American Sanitary Bureau presented this proposal for the consideration of the United Nations Children's Fund (UNICEF) in February 1949. Before the programme began, WHO became responsible for the technical approval of UNICEF-aided health programmes and almost simultaneously the Pan American Sanitary Bureau began to serve also as the WHO Regional Office for the Americas. The Pan American Sanitary Bureau, WHO and UNICEF accepted the Haitian proposal, with a single objective in mind: the eradication of yaws from Haiti.

The Government's contribution of US \$196 000 per year was jointly assisted by WHO, PASB and UNICEF. Field operations began on 20 July 1950.

### *Training of personnel*

Early in 1950, after the appointment of two technical consultants, sub-professional personnel were selected and given intensive training in all the subjects set forth on page 901 above.

The inspectors employed had a primary school education, and were able to drive cars and ride on horseback. At the end of the training, they were all able to recognize superficial lesions of yaws and give intramuscular injections.

### *Pilot therapeutic study*

At the beginning of the project certain unpublished studies in Guatemala showed that a small amount of aqueous penicillin was sufficient to render an infectious case of syphilis non-infectious, and, consequently, a dose of 600 000 units of penicillin was selected for the treatment of yaws. To check the validity of these studies, a therapeutic pilot centre was established in Baintet (in the Department of the West of Haiti). The results of the Baintet study have been very conclusive and are reported on page 1057. During the early part of the campaign a certain number of people received what has since been called "unsatisfactory" penicillin. Those persons treated with "unsatisfactory" penicillin were later re-treated with a satisfactory penicillin preparation.

*Ambulatory clinic phase*

Unfortunately, the house-to-house treatment recommended was not done initially, but the ambulatory clinic method was organized. Daily clinics were held, locality by locality, to which everyone was advised to go for penicillin injections. The ambulatory clinic method was used from 20 July 1950 until 26 October 1951 and approximately 600 000 persons, mostly in the southern area of Haiti, were treated.

*The house-to-house approach*<sup>3</sup>

During the middle of 1951, the writer visited Haiti and studied more than half a million records, finding that the population coverage of the treated communities was very far from 100%. In fact, using the 1950 census figures, it became clear that in certain areas no more than 15%-25% of the population had been treated. A pilot demonstration of the house-to-house method was set up in the Miragoane area.

A small community of 5000 people was divided into three areas, each under the responsibility of a treatment inspector. Each area was surveyed, the houses were pin-pointed on special maps, and each inspector proceeded to cover his area systematically until everyone had been treated.

Knapsacks were provided in order to make it possible to carry sufficient supplies for a day's work. Attention was paid to the treatment of those persons who were not found during the first visit, and the inspector could not leave his area until everyone had been treated. The whole experiment took approximately three weeks and the results (91.9% coverage) were found satisfactory, especially since the work was carried out with staff inexperienced in the method. When the house-to-house technique became widespread the results proved to be even more satisfactory than in the demonstration, although the inspectors were not under the immediate supervision of medical officers. Nevertheless, after 27 October 1951, the house-to-house method was made routine with excellent results, and coverages of 95%-100% became common. Almost three million persons have been treated.

*Epidemiological spot surveys*

As the house-to-house work continued, it became evident that a certain number of areas were being cleaned up and, because of the movements of people, certain areas were showing primary cases which, in this particular instance, could be classified as being imported from another community. Also, it was found that a certain number of persons were cured and had been reinfected following contact or exposure to infectious cases. It then became necessary to establish a yaws epidemiological intelligence service

whose duty it was to survey and examine, following a random selection, all houses and persons living in a previously selected area. These areas were primarily chosen because of apparently deficient coverage. The inspector of the epidemiological intelligence service visited every dwelling located within a certain radius and any person who, after questioning and superficial examination, showed any signs of skin lesions was taken to the physician for a careful darkfield and physical examination. This epidemiological service continues to operate in Haiti, but fewer and fewer cases are being found, and of late the surveys in most areas show no infectious cases and only a few late non-infectious cases. Thus in "spot" surveys carried out in 1954-55 after mass treatment with PAM, among 91 624 persons surveyed a total of 518 cases were found—a prevalence of 0.57%—of which 139 were infectious cases—a prevalence of 0.15%. Table I gives further results of "spot" surveys.

#### *"Mopping-up" phase*

By December 1954, all the population of Haiti (3 503 564 persons) had been treated, and the epidemiological service was reporting very few cases. Consequently, it was found necessary to change the organization of the operations in such a way that the emphasis was no longer on treatment but on the epidemiological investigation of every case, with focal treatment whenever necessary. This was made possible by zoning the entire country, with each inspector personally responsible for the population in a definite geographical area. The inspector visits all the houses in his particular area, following established itineraries, and investigates possible cases. If a case is found, he, his household contacts, and people living in the houses nearby are all treated.

It is too early yet to report the results of this new system, but here again the success of this type of work depends on the close supervision of personnel at all levels.

#### *Surveillance*

In the near future, the "mopping-up" operation will end, and at that time it will become necessary to do one of two things: the yaws inspectors, who are the best sub-professional trained people in public health in Haiti, could continue the search for cases, combining this search with some other public health programme, such as vaccination against smallpox; or the inspectors could be transferred to local health services which could take care of any outbreak, as represented by one single case of yaws, which could appear following importation. Such a case would be dealt with as if it were one of smallpox or any other quarantinable disease, excluding isolation, since penicillin therapy rapidly makes an infectious case non-infectious.

**TABLE I. RESULTS OF "SPOT" SURVEYS UNDERTAKEN IN 1954-55 FOLLOWING MASS TREATMENT OF YAWS WITH PAM IN HAITI**

Department	Population	Treatment coverage (%)	Time between treatment and survey (months)	Number of persons examined at survey	Population examined (%)	Number of cases (infectious and non-infectious)	Prevalence of cases (%)
Département du Sud	740 171	62.5*	30	38 775	5.2	307	0.8
Bainet & Côtes de Fer	91 099	8.3**	12	9 207	10.1	44	0.5
Département du Nord	540 196	96.5	26	17 004	3.1	55	0.3
Ile de La Gonâve	26 910	99.0	16	2 878	10.7	23	0.8
Saint Marc	43 128	97.2	18	4 493	10.4	14	0.3
Hinche	36 524	95.1	36	4 004	11.0	30	0.7
Verretes & La Chapelle	43 281	98.5	19	4 025	9.3	6	0.15
Département du Nord-Ouest	52 496	97.6	27	5 061	9.6	15	0.3
Département de l'Ouest	56 926	99.1	28	6 177	10.9	24	0.4
Total	1 630 731		(average) 23.5	91 624	5.6	518	0.57

\* Before the survey, this zone had been treated by the daily clinics method, whereby the inspectors established mobile clinics which the population was requested to attend. After the survey was carried out, certain areas of the Département du Sud were re-treated by intensive mass treatment given in a house-to-house "sweep".

\*\* A special yaws clinic was established in the Bainet & Côtes de Fer area from 17 February 1951 to 13 June 1953, during which time 35 497 yaws patients were treated. In July 1953, this area was covered by the house-to-house method and only cases and obvious contacts were treated.

### *Eradication*

After the "mopping-up" phase is concluded and surveillance has been started, it will be possible to state that yaws eradication has probably been accomplished if no autochthonous cases occur during a one-year period, since most infectious relapses will present themselves during the first twelve months after treatment.

### **Evaluation of Administrative and Operational Elements**

The various administrative and operational elements which have been reviewed in general and specifically for the programme in Haiti have undoubtedly taught a lesson during the last five years. This lesson can be applied in the same country to other eradication programmes, such as those against malaria and *Aedes aegypti*, but certain important factors stand out.

One of the most important is the question of adequately assessing the elements which combine to make a yaws problem, so that suitable techniques can be devised in the field to achieve the objective of eradication. From the very beginning, the house-to-house method was the only way to cover the entire population of Haiti, which was undergoing a real yaws epidemic. The careful and proper use of sub-professional personnel is important for other health programmes. While it is true that general public health programmes of acceptable quality cannot be carried out by sub-professional personnel, the situation is different in the case of campaigns with a single aim where such personnel carry out a single routine procedure under careful supervision. This is particularly important in less developed countries, where highly trained personnel are not easily obtained and, if public health programmes of all kinds are to wait until more highly trained personnel are available, many years will go by before the most pressing public health problems can be tackled.

The key to eradication is close supervision but, even so, eradication is never easy and simple.<sup>3</sup> It demands money, time, authority, and, in the tropics, sweat. The lessons learned in Haiti can be applied elsewhere in the Caribbean, in South America, and in other areas of the world, if suitable adjustments for special situations are made.

### **RÉSUMÉ**

Le pian était le principal problème de santé publique en Haïti et il était indispensable de le résoudre avant d'entreprendre toute autre activité sanitaire. La prévalence était, selon les estimations de 40% à 60%. L'éradication était la seule solution efficace. Une campagne antipianique a été entreprise en 1950 par le gouvernement, avec la collaboration du Bureau sanitaire panaméricain qui fait fonction de Bureau régional de l'OMS pour les Amériques, de l'OMS et du FISE. Du personnel para-médical a été formé dans ce but.

Durant la première année, le traitement a été assuré par le centre thérapeutique pilote de Baint et par des dispensaires ambulants qui circulaient de localité en localité, les habitants étant invités à s'y présenter pour être soignés. En une dizaine de mois, 600 000 personnes ont été traitées de cette façon. Cette méthode n'a pas suffi cependant à assurer le traitement de l'ensemble de la population et ce sont les visites des équipes de maison en maison, entreprises depuis octobre 1951, qui ont permis de traiter la totalité de la population.

En décembre 1954, les quelque 3,5 millions d'habitants de Haïti avaient été traités par le PAM (600 000 unités) et l'on ne signalait plus que des cas sporadiques de pian. L'organisation de la lutte fut modifiée en conséquence et l'effort porta dès lors principalement sur l'épidémiologie des cas nouveaux et le traitement des éventuels foyers d'infection. Le pays a été divisé, à cet effet, en circonscriptions; un inspecteur, qui devait faire les contrôles maison par maison, était responsable de chacune d'elles.

A l'avenir, la surveillance sera assurée de deux façons: les inspecteurs affectés à d'autres activités sanitaires, telles que la vaccination antivariolique, signaleront l'apparition éventuelle de nouveaux cas de pian, ou bien, incorporés à des services sanitaires locaux, ils seront à même de déceler immédiatement les cas nouveaux et de les traiter.

Les expériences faites au cours de cette campagne antipianique pourront être utiles lorsqu'il s'agira de prévoir l'éradication d'une maladie ou d'un vecteur dans des conditions analogues à celles de Haïti.

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