

## THE CONTROL OF RABIES IN MALAYA THROUGH COMPULSORY MASS VACCINATION OF DOGS\*†

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### SYNOPSIS

A fulminating extension of rabies—which has been enzootic in northern Malaya since 1924—occurred in Kuala Lumpur in April 1952. The outbreak was suppressed by the compulsory mass vaccination of dogs, stringent legislation, and intensive stray-dog destruction. Similar measures are being employed in the current campaign, the aim of which is the complete eradication of the disease.

From an average annual incidence of 112 confirmed canine cases prior to 1952—when a total of 198 cases was reported—the incidence fell to 15 cases (all in unvaccinated dogs) for the period January–November 1953, during the last 5½ months of which no case in either animals or man was reported. It is considered that the extensive publicity campaign and strict enforcement of the control measures have contributed measurably to the present improved position.

Statistics relating to confirmed cases in dogs previously vaccinated with (a) phenolized 20% brain-tissue suspension vaccine (buffalo origin) and (b) chicken-embryo vaccine (Flury strain) are quoted and their probable significance in favour of the latter under Malayan conditions is discussed. The hypothesis that the development of rabies may, in many instances, have been blocked by the vaccine is advanced.

The plan for a pan-Federation compulsory vaccination campaign in 1954, to consolidate the 1952-3 improvements, is outlined.

Records of the incidence of canine rabies in Malaya are available only from the year 1924 onwards, earlier ones having been lost during the second World War. Since the rabies diagnostic service was discontinued by the occupying force from 1942 to 1945 no records for those years, or for 1941, are available. Clinical canine cases were, however, observed during this period in several parts of the country.

Malaya (i.e., the Federation of Malaya and Singapore island) is 50,000 square miles (129,500 km<sup>2</sup>) in area, 80% of which is covered by dense

\* Additional information for the months of October and November 1953 was received from the author while this paper was in press. This information has been included in the text, but not in the figures. — Ed.

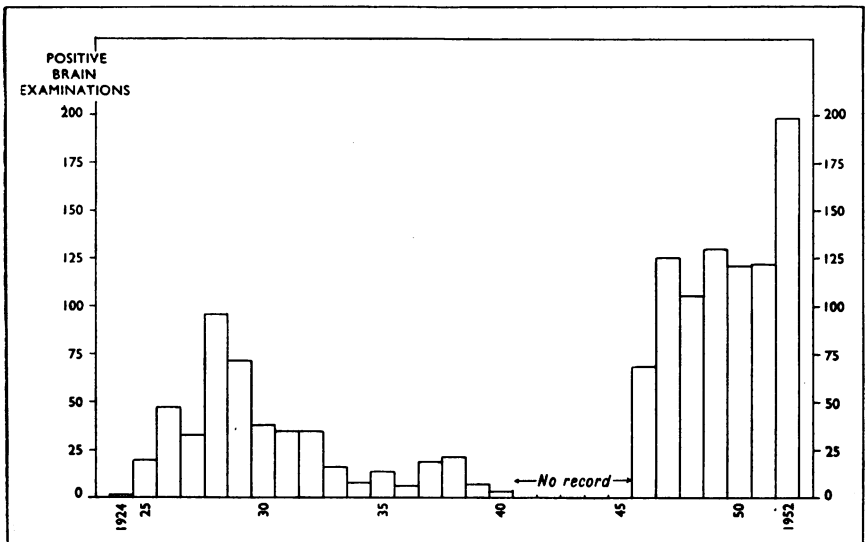
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tropical jungle. The remaining 20% is populated by six million people of various nationalities. Malaya is bordered to the north by Thailand, a country which, being Buddhist, is opposed to the deliberate destruction of animal life. There has been a high incidence of rabies in Thailand for many years and, so far as is known, no concentrated attempt has ever been made there at controlling it. The northern States of Malaya have, therefore, constantly been open to the introduction of the disease across the border and have, in fact, been the principal foci of rabies in the country for many years.

### The Dog as Vector

95% of all laboratory-confirmed cases of rabies in animals since 1924 have been in dogs. The dog is thus the principal, if not the sole, vector of rabies in Malaya. (Jackals, wolves, foxes, and vampire bats do not occur.) The annual totals of known positive cases of canine rabies, excluding clinical cases, are shown in fig. 1.

**FIG. 1. ANNUAL TOTALS OF KNOWN POSITIVE CANINE-RABIES CASES \* DURING THE PERIOD 1924-52**



\* Excluding clinical cases

### Annual Incidence

The incidence of the disease rose markedly in late 1945 simultaneously with the reoccupation of the country by Allied Forces, many of whom had come from India and had brought their dogs with them. The civil administration did not resume its pre-war functions until about mid-1946. For the

years 1946-51 inclusive the average number of confirmed canine cases was 112 per year (see fig. 4) : the 1952 total was 198.

**The Kuala Lumpur Outbreak, 1952**

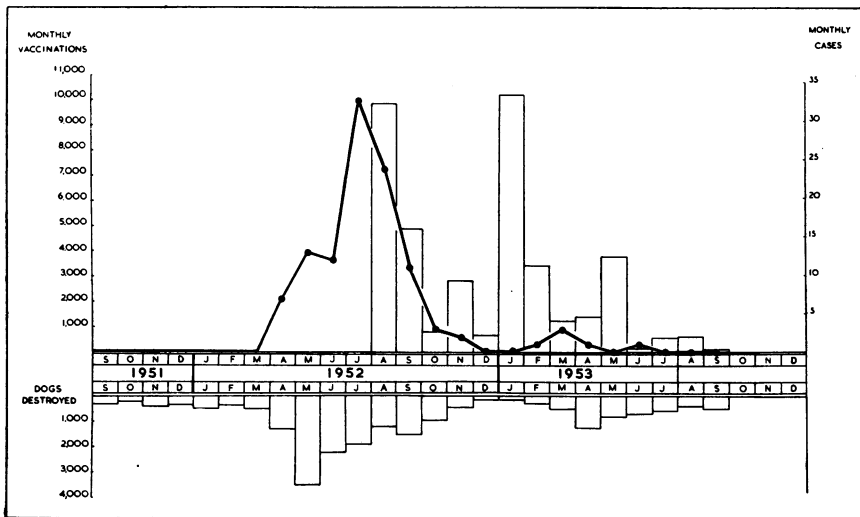
In April 1952 a fulminating outbreak, constituting a serious extension of the disease, occurred in the Federal capital of Kuala Lumpur (population 250,000) situated in the State of Selangor, 80 miles (approximately 130 km) south of the nearest known infected locality at that time. It was decided to introduce compulsory mass vaccination of dogs.

Although several compulsory vaccination schemes on limited scales had been operated between 1932 and 1947 and had, in general, produced gratifying local results, it was realized that, to approach complete eradication, a more concerted attack, backed by more-stringent legislation, would be required.

**Compulsory Mass Vaccination, 1952-3**

The 1952-3 compulsory mass vaccination campaign was planned in two phases. During phase I attempts were to be made to reduce incidence and

**FIG. 2. COMPULSORY VACCINATION CAMPAIGN IN SELANGOR STATE, 1952-3 \***

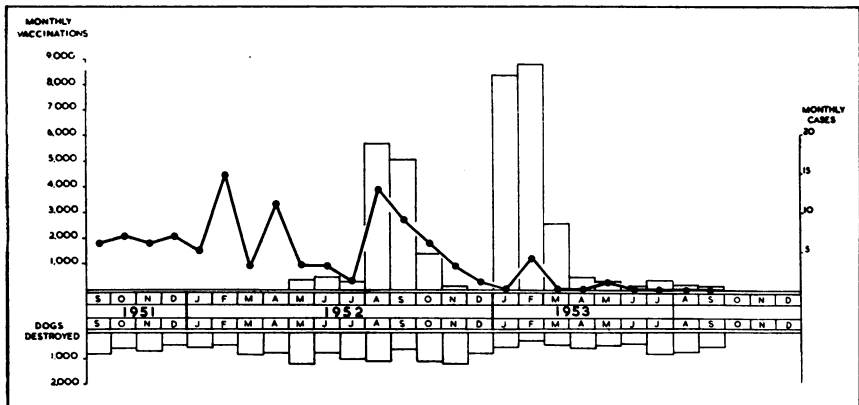


\* In 1952, 18,000 dogs were vaccinated with chicken-embryo vaccine (Flury strain). In 1953, 21,000 dogs were vaccinated ; of these, it is estimated that 15,000 had been previously vaccinated with chicken-embryo vaccine during the period August-December 1952.

The thick black line records the monthly incidence of proved positive cases. Owing to the pressure on laboratory and field staff during the epizootic, many clinical cases in stray dogs destroyed by dog-shooting teams were not submitted for laboratory confirmation. These cases have not been included in the records.

The open histograms above the base-line show the monthly vaccination totals ; those below show the monthly totals of dogs destroyed.

FIG. 3. COMPULSORY VACCINATION CAMPAIGN IN PERAK STATE, 1952-3\*



\* In 1952, 12,000 dogs were vaccinated with phenolized 20% brain-tissue suspension vaccine (buffalo origin). In 1953, 21,000 dogs were vaccinated with chicken-embryo vaccine (Flury strain); of these, it is estimated that 10,000 had been previously vaccinated with chicken-embryo vaccine during the period August-December 1952.

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spread in the most seriously infected areas, in preparation for the intensive programme, with eradication as the target, planned for phase II. Phase I commenced in the first week of August 1952 and phase II in the first week of January 1953.

#### *Phase I. August-December 1952*

(a) The aim was to control the Kuala Lumpur outbreak and prevent further spread to the south, and at the same time to vaccinate in four selected areas in Perak, the State with the worst post-war record of rabies.

(b) Chicken-embryo vaccine (Flury strain) was used in Kuala Lumpur. The incidence of rabies was rising alarmingly at the time vaccination commenced, in spite of intensive day and night dog-shooting. By the end of December 18,000 dogs had been vaccinated (an estimated 90% of the dog population) and 5,400 destroyed.

(c) Phenolized 20% brain-tissue suspension vaccine (buffalo origin) was used in the four Perak areas. By the end of December, 12,000 dogs had been vaccinated and 4,900 destroyed. (An additional 1,100 had been voluntarily vaccinated during the three months preceding the compulsory scheme.)

(d) There was a marked drop in incidence in each instance during phase I (see fig. 2 and 3).

*Phase II : 1953*

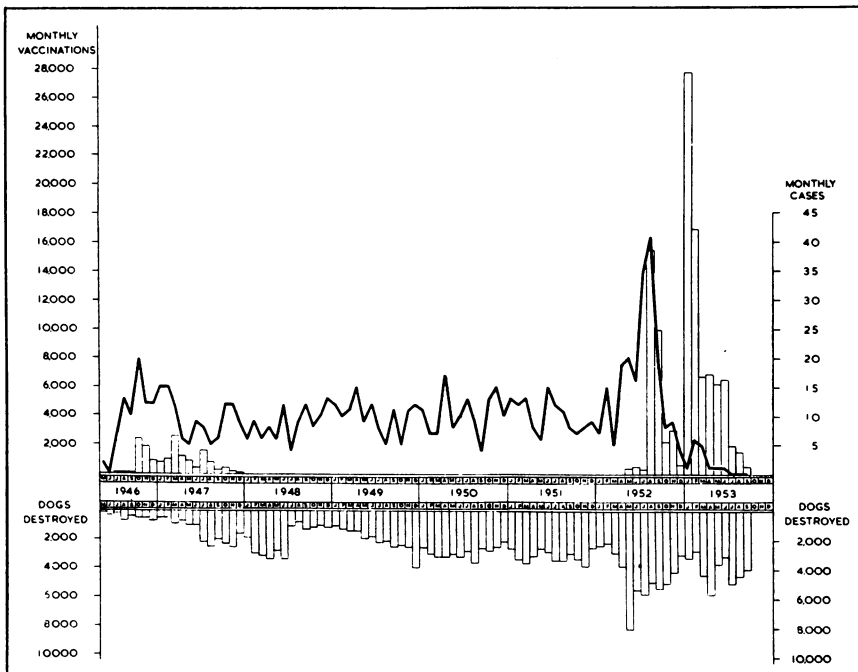
(a) The aim was to vaccinate all dogs over four months of age in every rabies-infected State in the Federation within a period of 2½ months, irrespective of whether a dog had been previously vaccinated in 1952. 50,500 dogs were vaccinated during this period and 10,300 destroyed.

(b) Chicken-embryo vaccine only was used throughout this phase.

(c) At the time of writing (November 1953) 73,100 dogs—estimated as being at least 80% of the dog population involved—have been vaccinated in infected States and in certain belts adjoining them and 44,500 destroyed in the Federation as a whole.

The results of the compulsory mass vaccination campaign from August 1952 to September 1953 are shown in fig. 4. The monthly incidence of rabies is plotted from April 1946 to September 1953.

**FIG. 4. INCIDENCE OF CANINE RABIES IN RELATION TO DOGS VACCINATED AND TO DOGS DESTROYED DURING THE PERIOD APRIL 1946 - SEPTEMBER 1953**



The thick black line records the monthly incidence of proved positive cases. Owing to the pressure on laboratory and field staff during the epizootic, many clinical cases in stray dogs destroyed by dog-shooting teams were not submitted for laboratory confirmation. These cases have not been included in the records.

The open histograms above the base-line show the monthly vaccination totals ; those below show the monthly totals of dogs destroyed.

### Publicity

Each phase was preceded by intensive publicity in the Press, on the radio, through mobile broadcasting vans, and by cinema slides, handbills, and posters. Since the Malayan population comprises four principal races—Malay, Chinese, Indian, and European—propaganda had to be disseminated in each of the four languages.

### Legislation

Since it was desirable to vaccinate dogs at as early an age as possible it was decided in July 1952, after consultation with the manufacturers of the vaccine and with WHO Rabies Consultants, to order that all dogs over four months of age be produced for vaccination. Dogs younger than this had to be adequately restrained : if this was not done they were destroyed.

Legislation was accordingly introduced to enforce the vaccination in infected States of all dogs over four months of age within the first 2-2½ months of each phase, with attendant penalties for owners who failed to comply. Much evasion took place until, to counter it, authority was obtained for certain specified persons to search private houses between sunrise and sunset for unvaccinated dogs. These powers were exercised with the utmost discretion. Although they were applied in very few instances their demonstration had a most marked effect on the subsequent production of dogs, as was shown by the fact that nearly three times the number of dogs (18,000) had been vaccinated in Kuala Lumpur by the end of 1952 than had been licensed (6,400) at the beginning of the outbreak, in spite of 5,400 having been destroyed in the interim.

### Vaccination Teams

During the first two months of each phase, fully-equipped static centres were established in the larger towns and operated from 8 a.m. until 6.30 p.m. in order to cater for all classes of owners, particularly those who could attend only before or after office and factory working-hours.

Mobile vaccinating teams toured all outlying areas of each infected State, working to a well-publicized schedule. Two or three days after a mobile team had completed its visit to an area, a team of dog-shooters moved in and destroyed all dogs encountered not wearing the distinctive vaccination tag. (These tags are serially numbered, are of a bright colour, and are sufficiently large to be readily visible from a distance by day and, with the aid of a torch, by night.)

A fee of two Malayan dollars <sup>a</sup> had been charged for vaccination in

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<sup>a</sup> 1 Malayan dollar = 2s. 4d. (sterling) = US \$0.33.

1952 but in 1953 licensing and vaccination were combined into a single operation and a composite fee of five Malayan dollars levied.

The vaccination of dogs as they attain four months of age continues as a routine and the destruction of unvaccinated dogs is being maintained at a high intensity.

### Results up to November 1953

No recorded case of rabies in dogs, in other animals, or in human beings had occurred after the middle of June 1953 up to the time of writing (November 1953). Diagnostic services, reporting facilities, and communications are good in Malaya, so that the authorities feel confident that the improved position is a correct picture of the combined impact of vaccination and dog destruction on the incidence of rabies in the Federation.

### Singapore Outbreak, 1953

A small outbreak involving two known canine cases occurred in May 1953 in Singapore island (separate, administratively, from the Federation). The origin of the infection is unknown, but a smuggled dog is the most probable cause. Compulsory vaccination, on a limited scale only, was introduced. The reasons for such limitation on an island only 200 square miles (518 km<sup>2</sup>) in extent are not clear.

### Rabies in Vaccinated Dogs

(a) In the 1946 and 1947 limited compulsory vaccination schemes (15,500 dogs) and in the August-December 1952 scheme operated in Perak (12,000 dogs), a single dose of phenolized 20% brain-tissue suspension vaccine (buffalo origin) was used. In this total of 27,500 vaccinated dogs, rabies was subsequently confirmed in 24 cases as follows :

<i>Number of dogs</i>	<i>Week after vaccination</i>
9	1st
1	2nd
1	3rd
4	4th
1	6th
1	11th
1	12th
2	15th
1	19th
2	23rd
1	35th

(b) During the period August 1952-November 1953, a total of 114,000 dogs received chicken-embryo vaccine in the Federation of Malaya and

Singapore. In this total rabies was subsequently confirmed in eight cases as follows :

<i>Number of dogs</i>	<i>Week after vaccination</i>
1	1st
2	2nd
5	3rd

In comparing these records certain points must be borne in mind.

In those areas where brain-tissue vaccine was used the exposure risk of dogs to rabies had been relatively high. Where chicken-embryo vaccine was used it can be said that at least the same degree of exposure risk had existed for not less than 60,000 of the 114,000 dogs later vaccinated, the balance comprising those vaccinated in certain belts as a precautionary measure only and those vaccinated in the later stages of the 1952 and 1953 campaigns when the risk of exposure was greatly reduced.

Again, the rabies-consciousness of the general public was undoubtedly much higher in 1952-3 than in 1946-7, so that it is not improbable that more cases of rabies in vaccinated dogs were undetected in 1946-7 than in 1952-3 notwithstanding the fact that, of dogs exposed to approximately the same degree of risk, more than twice the number (circa 60,000) were vaccinated in 1952-3 than in 1946-7 (27,500).

To generalize from these records would be unjustified. It does, however, seem apparent that under Malayan conditions—some of which assist a mass vaccination operation but many others hamper it—chicken-embryo vaccine brought about a more rapid improvement in the general picture, with a seemingly longer period of freedom from recrudescence during which consolidation measures could be developed, than had been achieved or had been possible with brain-tissue vaccine.

### **Modified Legislation Made Possible**

The success of the measures adopted during the 1952 and 1953 compulsory vaccination campaigns have made it possible to modify the veterinary sanitary laws governing the admission of dogs into the Federation from rabies-infected countries, and the movement of dogs between rabies-infected and rabies-free States within the Federation. These modifications are, briefly, that

(1) dogs from rabies-infected countries may enter the Federation provided they are vaccinated with chicken-embryo vaccine and ear-tattooed immediately on arrival, and are quarantined for 30 days subsequently;

(2) dogs from rabies-infected areas within the Federation may move to rabies-free ones—

(a) under the conditions stated in (1), or



(b) after having spent 90 days, subsequent to vaccination with chicken-embryo vaccine and ear-tattooing but without quarantining, in the State in which they were vaccinated.

These amendments are based principally on the fact that only eight dogs, out of a total of 114,000 vaccinated with chicken-embryo vaccine in 1952-3 in the Federation and Singapore, have been reported as having died of rabies subsequently. All were adult dogs, all showed Negri bodies on post-mortem examination, and all died less than 20 days after vaccination. It is not unlikely that these were cases incubating the disease at the time of vaccination.

### Interference—Antibody Production Hypothesis

The hypothesis that an interference phenomenon or antibody production may have blocked the development of rabies in some dogs in the early incubative stage is advanced. The following observations on the Kuala Lumpur records for 1952 are offered in support of this hypothesis :

(1) Of the eight cases mentioned above, seven occurred in Kuala Lumpur during a 5½ weeks' period in August-September, vaccination having commenced on 4 August. No case in a vaccinated dog was reported in Kuala Lumpur after September: the last canine case in the town was reported in October 1952.

(2) There had been 33 confirmed canine cases in the town in July and a further 24 occurred in August. The many clinical cases, which were destroyed but not submitted for confirmatory examination, are not included in these totals.

(3) On field evidence it is difficult to accept that only 7 of the 18,000 dogs vaccinated in Kuala Lumpur from August to December were incubating rabies at the time of vaccination. The effects of bites inflicted by the 65 confirmed canine cases in the period April-July would be reflected, to some degree, in the number of positive cases reported in the period August-October. Yet, these 7 cases all occurred in the 5½ weeks' period and no case in a vaccinated dog was detected subsequently, although 31 cases in *unvaccinated* dogs were confirmed in the period August-October.

Unless it can be assumed that a critical stage of development of rabies exists, beyond which the presence of antibody production or the interference phenomenon could have no effect, but before which they could, it is not easy to explain these results. On the hypothesis advanced, the seven cases could have been beyond the critical stage and therefore beyond hope. On the other hand, in infections before that stage the interference phenomenon, or antibody production, may have operated to block the infection. It is, of course, possible that all other dogs bitten by rabid dogs were accounted

for in the 31 cases of rabies in unvaccinated dogs and in the 1,689 dogs destroyed in the period August-December, but field experience suggests that the likelihood of this being so is small. If this is accepted, then the possibility remains that, in many instances, development of the disease was blocked by the vaccine.

### **Human Rabies**

The total of recorded human deaths from rabies in Malaya from 1946 to 1952 is only 25. This low total is probably due to the close liaison existing between the veterinary and medical departments, good reporting routine, wide publicity of the action to be taken when dog-bites occur, and the excellent transport and communications systems in the country, which enable early treatment to be given in all reported cases of exposure. Post-mortem examinations are performed where possible, but in certain cases of suspected rabies racial or religious objections to a post-mortem have overridden other considerations.

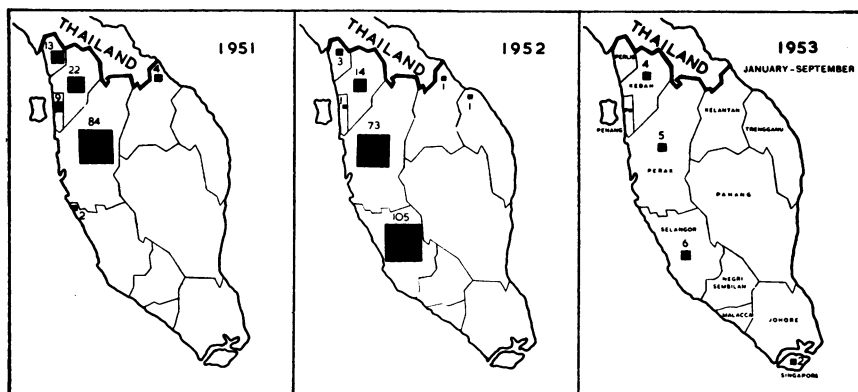
A measure of the extent to which prophylactic treatment has been given to humans bitten by rabid or suspected rabid dogs is, however, afforded by the quantity of vaccine issued from the Institute for Medical Research in Kuala Lumpur. These issues correspond broadly with the annual incidence of canine rabies and varied from sufficient vaccine for 180 full courses of treatment in a year of low incidence, e.g., 1935, to sufficient for 2,600 full courses in 1952, the year of greatest incidence.

### **1954 Vaccination Plan**

Fig. 5 shows diagrammatically the reduction in intensity and distribution of the disease in Malaya for the past three years. (The 1953 diagram is correct up to the time of preparation, i.e., September.)

In order to consolidate the present improved position, the compulsory vaccination of all dogs in the Federation will come into force on 1 January 1954, including those areas already dealt with in 1952 and 1953. It is estimated that about 120,000 dogs will be vaccinated with chicken-embryo vaccine during 1954, and that about 100,000 dogs will have been vaccinated by the middle of March. Further, the minimum age for compulsory vaccination will be reduced to three months. This would tend to eliminate any cryptic pockets of the disease among dogs which may, unknown to the authorities, still exist and would also, after a short interval, make it possible to revoke the restrictions on the movement of dogs in the Federation. If the improvement recorded in 1952-3 is maintained during 1954 it may be possible in subsequent years to limit compulsory vaccination to the northern strips only of those States having a common border with Thailand.

**FIG. 5. DISTRIBUTION OF CANINE RABIES IN THE FEDERATION OF MALAYA AND SINGAPORE, 1951-3**



Although immunity induced by chicken-embryo vaccine is stated to hold for over three years the Malayan authorities are faced with peculiar difficulties in taking full advantage of this fact. If compulsory vaccination were to be operated every fourth year it would mean that, in order to maintain the dog population at a level where 70% are immunized, a very considerable amount of dog destruction would be necessary. The factors responsible for the stray-dog problem in Malaya may never be eliminated, so that the rate of destruction would need to exceed the normal birth-rate if the 70% level were not to be compromised. This would be very expensive in manpower. The alternative appears to be to continue with annual compulsory vaccination and stray-dog destruction until such time as the evidence is overwhelming that eradication has been achieved. From then on it should be necessary only to (1) maintain a belt, not less than 30 miles (approximately 50 km) wide, along the Malayan side of the Malaya-Thailand border in which dog vaccination would be compulsory, (2) ensure a strict vaccination and quarantine routine at the ports of entry into Malaya, and (3) maintain the stray-dog population at a manageable level. Of these, (1) is of paramount importance and can be achieved with mobile vaccinating and dog-destruction patrols touring the area constantly; (2) is already in operation and presents no difficulties; and (3) could be achieved by periodical "dog-destruction weeks" over and above the normal routine destruction programmes.

#### ACKNOWLEDGEMENT

Grateful acknowledgement is made to WHO for its technical aid, help, and advice during the early stages of the campaign. At all times its assistance was prompt and unstinting.

## RÉSUMÉ

La rage, qui est enzootique dans le nord de la Malaisie depuis 1924, prit l'allure d'une épidémie foudroyante à Kuala Lumpur en avril 1952. L'épidémie fut arrêtée grâce à des mesures rigoureuses : vaccination systématique des chiens, destruction des chiens errants, renforcement de la législation. La campagne antirabique actuellement en cours, qui vise à la suppression de la maladie, applique des méthodes similaires et fait une large place à la propagande auprès du public.

La fréquence annuelle moyenne de la rage canine qui était de 112 cas jusqu'en 1952, s'éleva cette année-là à 198 cas, pour s'abaisser à 12 cas (tous des chiens non vaccinés) durant la période de janvier à novembre 1953.

L'auteur analyse les données relatives aux cas de rage survenus parmi les chiens vaccinés : 24 cas sur 27.500 vaccinés en 1946-47 et 8 cas sur 113.400 vaccinés en 1952-53. Comparant le vaccin phéniqué (20 % de suspension cérébrale) provenant du buffle, au vaccin avianisé souche Flury, il constate une certaine supériorité de ce dernier, dans les conditions régnant en Malaisie. D'autre part, l'auteur avance l'hypothèse selon laquelle le vaccin pourrait bloquer le développement de l'infection déjà en incubation, à condition qu'elle soit encore en-deçà du point critique, à partir duquel la production d'anticorps ou l'interférence du vaccin sont sans effet.

Seuls 25 cas de rage humaine ont été signalés de 1946 à 1952. La vaccination préventive chez l'homme a varié selon l'intensité de l'infection canine. L'Institut de recherches médicales de Kuala Lumpur a préparé du vaccin pour 180 traitements complets en 1935, année de faible incidence et pour 2.600 traitements en 1952, année de fréquence maximale.

La vaccination des chiens dès l'âge de 3 mois est obligatoire sur tout le territoire de la Fédération de Malaisie depuis janvier 1954. L'auteur indique quelques solutions pour résoudre les problèmes d'application qui se posent aux autorités responsables des programmes à long terme visant à la suppression de la rage.

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