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HEALTH ORGANISATION

MALARIA COMMISSION

Note by the Secretary of the Malaria Commission

At its meeting in October 1937 the Reporting Committee of the Malaria Commission decided to draw the attention of Health Administrations to the urgent necessity for carrying out research on the subject of great malaria pandemics, not only during the epidemic but also prior to its outbreak.

In this connection Lieut. Colonel C.M. NICOL, Director of Public Health of the Punjab, has communicated a Report on  
THE METHOD OF FORECASTING THE PROBABLE INCIDENCE OF MALARIA IN THE PUNJAB

accompanied by a Memorandum on

ANTI-MALARIA MEASURES IN THE PUNJAB

sent to District and Municipal medical officers of Health in the Punjab.

The texts are reproduced below.

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The object is to forecast the probable incidence of malaria during the autumn of each year: it is in the autumn that malaria occurs in epidemic form in the Punjab.

The method is based on the theory that the incidence of autumnal malaria in the Punjab is influenced by a disturbance of equilibrium between the quantum of infection and of immunity in the population of an area. An effort is made to estimate the quantum of infection and of immunity.

An estimate of immunity in the population is made, based on the following factors:-

- (i) the presence or absence of enlarged spleen amongst children aged 2 - 10,
- (ii) the state of nutrition of the population as calculated from the availability of staple articles of diet in any year.

The quantum of infection is estimated by a consideration of factors which are known to influence atmospheric humidity and thereby the breeding of mosquitoes, their longevity and their power of transmitting the malarial

parasite. Atmospheric humidity cannot be directly measured except at 10 Meteorological Stations in the Punjab. A high degree of correlation, however, exists between atmospheric humidity and rainfall during the months of July and August, and the rainfall data for these two months are made use of as an approximate measure of atmospheric humidity.

Rainfall during July and August has been found to be closely correlated with the mortality from febrile illnesses in general in October, November and December. The coefficient of correlation between July-August rainfall and "fever" deaths during the last three months of the year has been calculated for each district of the Punjab: it is as low as +0.083 in some districts and as high as +0.735 in others and even a negative correlation may exist in some cases.

In practice, the actual July-August rainfall for a particular year is compared with the mean rainfall over a period of some 20 years.

Excessive July-August rainfall compared with the mean - other factors being equal - suggests the likelihood of a heavier incidence of malaria than usual during the last three months of the year.

Rainfall evenly distributed over July and August is more favourable to the development of malaria than a heavy downpour towards the end of August which may even wash away and destroy mosquito larvae.

The occurrence of floods during July and August, whether due to local rainfall or to inundation from rivers or storm water channels, has the same effect locally as heavy rainfall.

As regards immunity, it has been observed that intense epidemic outbreaks of malaria do not occur in localities in which the spleen rate is absolutely or relatively high as compared with the previous five years. Other things being equal, the intensity of malaria in the last three months of a year varies inversely to the spleen-rate during the month of June. If the June spleen-rate be high (over 50 per cent) either permanently or as a result of recent malaria, even an excess of rainfall in July and August is not likely to determine severe malaria in the last three months of the year, and vice versa.

The spleen census of children is taken in representative areas in each district of the Province during the month of June. The census is taken in June because at that time of the year spleen-rates are likely to be at their lowest for the year.

The availability of staple food-stuffs in any particular year is a rough index of what the state of nutrition of a community generally will be for that year. It is assumed that when food is scarce, individuals will be less well-nourished and, in consequence, less resistant to infection.

When immunity and infection have been estimated on the basis indicated above, these two factors are correlated with the estimated liability of each district to visitations of epidemic malaria. The coefficient of variability of

fevers is taken to indicate this liability and this "epidemic potential factor" has been calculated for each district in the Province.

The incidence of malaria is likely to be high during the last three months of a year when:

- (i) The July and August rainfall is in excess of the mean;
- (ii) floods occur;
- (iii) the June spleen-rate is low;
- (iv) food is scarce; and
- (v) the coefficient of variability of fevers in an area is high.

The method of forecasting outlined above was elaborated by Colonel C.A. Gill, I.M.S., in whose book "The Genesis of Epidemics" (page 186-191) a full account is given of the principles underlying the method.

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Memorandum on anti-malaria measures in the Punjab sent by the Director of Public Health to all District and Municipal Medical Officers of Health in the Punjab.

Lahore, March 18th, 1937.

The extent to which malaria is a cause of ill health and death throughout the Punjab, even in non-epidemic years, is known: there are in the neighbourhood of 130,000 deaths from this disease in an average year. The devastating effect of an epidemic was clearly demonstrated in 1908 in which year there were something like 350,000 deaths from malaria. An outbreak of similar magnitude may occur again without warning.

Anti-malaria measures have never been undertaken to an extent in any way commensurate with the detrimental effect of malaria. In some districts familiarity with this disease has even led to inactivity when local bodies have been faced with the apparently prohibitive cost of effective routine measures. It is, however, quite within the financial capacity of District Boards to establish and maintain at least the nucleus of an anti-malaria organisation sufficient for the execution of much useful routine work and capable of expansion, to meet requirements should the disease assume epidemic proportions.

To assist local authorities in the formation of primary anti-malaria units in districts\* where the need is greatest, it has been found possible to provide a limited amount of equipment and material: this will allow of routine anti-malaria measures being undertaken in selected

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\* 1) Lahore, 2) Gujranwala, 3) Gujrat, 4) Sialkot,  
5) Sheikhpura, 6) Montgomery, 7) Muzaffargarh,  
8) D.G. Khan.

areas of these districts during the coming season. Work should, however, be undertaken in every district irrespective of whether equipment and material have been supplied by the Department or not; a comparatively small sum of money will suffice for a beginning.

In addition, the Department has in stock a reserve of quinine which will be distributed to districts when there is definite evidence that local authorities themselves cannot provide this drug in sufficient quantity to meet requirements.

For effective anti-malaria work certain conditions must be fulfilled:-

- (1) Personnel must be ear-marked definitely for anti-malaria work and adequately trained in the duties which they will have to perform. This means selecting intelligent individuals and instructing them in the rudiments of mosquito control, the careful and proper use of apparatus and the economic application of oil and other larvicides.
- (2) The elaboration of a proper organisation for quinine distribution, the haphazard giving of quinine to anyone who comes asking for it is utterly futile and simply results in waste and misappropriation. The really ill people in villages, who are unable to leave their beds, are notoriously neglected. Arrangements must be made for the administration of quinine to individual sick people in village houses by trustworthy agents. Children in particular must receive adequate treatment. What the agency for distribution is to be must be decided by local authorities themselves. It is suggested that Boy Scout and Junior Red Cross organisations may be in a position to nominate suitable individuals for voluntary work of this kind.

Unless these two conditions are fulfilled it will not be possible to permit the use of the apparatus and material now provided; these will be transferred to districts in which it has been found possible to make proper arrangements for their use. No grants of quinine will be made to any district in which I am not satisfied that the organisation for distribution is efficient.

The control of malaria does not begin and end with the activities indicated above: these are merely supplementary to what must be regarded as the fundamental work against malaria, viz. species-sanitation based on the continued study of the bionomics of the anophelines which are prevalent in particular areas. Recent articles in the medical press have shown what can be done by knowledge, ingenuity, and commonsense in making the habitual breeding places of particular species uninviting to the mosquito. A sunlight loving mosquito can be eliminated from its marshy breeding places by the introduction of vegetation giving rise to shade; the cutting down of vegetation may give similar results in the case of mosquitoes which seek shade: species which flourish in clear water can be eliminated by rendering water turbid by the application of such worthless material as domestic sweepings to breeding places. For successful work of this description an accurate knowledge of the bionomics of the mosquitoes in a particular

area is necessary. This knowledge (if you do not already possess it in respect of your district) you must acquire, by patiently investigating possible breeding grounds, collecting specimens of larvae and sending the adults when bred out for identification to the Epidemiological Bureau. Systematic catching of adult mosquitoes should also be undertaken for identification purposes and for dissection and the determination of infectivity rates.

What is required is that each Medical Officer of Health should, in a very practical sense, be the Malaria Officer for the district he controls. This will entail considerable extra work. I am satisfied that time can be found for this work if the will to do it exists and other duties are properly arranged and promptly undertaken. It may take years to collect data, but each individual observation, if accurate, is of the greatest value. The aggregate of data slowly and steadily recorded will in time form the basis on which sound economical work can be established.

The bi-annual spleen census will give an indication of the localities in each district where investigations should be commenced and work undertaken.

In carrying out anti-malaria work you will frequently have occasion to consult with and advise district officers belonging to other departments. Your duty in this connection is to help in a practical manner not merely to criticize and suggest impossibilities or propose measures which may dislocate the work of others. It is not likely that you will persuade anyone to have an irrigation channel left dry for one day a week, for instance, unless you can show that mosquitoes are actually breeding there and explain the reasons for the procedure you recommend.

Both District and Municipal Medical Officers of Health must co-operate not only with each other but with Railway and Military Medical Officers who are undertaking anti-malaria work in their own areas. I know from personal experience that much excellent work done in Cantonments is nullified and its good effect on neighbouring civil areas reduced to a minimum because of lack of co-operation. If your area borders on Cantonments you should meet the Military A.M. Officer early in the season and discuss with him how your work and his can best be arranged so as to secure continuity without overlapping and a maximum of protection for both communities with the least possible expenditure.

You have been issued with copies of the following bulletins of the Malaria Survey of India:-

1. Health Bulletin No.14 "How to do a Malaria Survey".
2. - do - 13 "Instructions for collecting and forwarding mosquitoes".
3. - do - 10 "Synoptic table for the identification of the Anopheline mosquitoes of India".
4. - do - 11 "Anti-mosquito measures".

These you must read and make use of to the fullest extent.

Barraud's boxes for the transportation of live adult mosquitoes caught in natural surroundings and intended for dissection at the Epidemiological Bureau may be obtained on application to the Epidemiologist to Government.

The attached table gives in outline the most important facts regarding the five known malaria-carrying mosquitoes of the Punjab. You must make yourself familiar with all these species of anophelines. The more you study them the more our knowledge of them will be expanded. It is most important that you should ascertain to what extent the broad characteristics stated in the table are modified by the local conditions obtaining in your district, and the relative importance locally of each of these mosquitoes as a carrier.

It is possible that you may meet with difficulties, technical and otherwise, when you begin this work. I shall make arrangements for an officer from the Epidemiological Bureau to visit you as soon as possible and discuss any matter connected with anti-malaria work on which you may care to consult him. Some of you have had a special course of instruction on Malariology at Karnal and will not require advice of the kind contemplated.

Assistant Directors of Public Health will be responsible for ensuring that the instructions contained in this letter are carried out and will actively assist District Medical Officers of Health in the organisation of the work.

During my monsoon tours I shall see the work you have done.

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TABLE SHOWING BREEDING PLACES, SEASONAL DISTRIBUTION AND METHODS OF CONTROL OF ANOPHELINE SPECIES KNOWN TO BE CARRIERS OF MALARIA IN THE PUNJAB.

Species.	Breeding places.	Seasonal distribution.	Control.	Remarks.
1.A. <u>Culicifacies</u> .	<ol style="list-style-type: none"> <li>1. Clear water in weedy pools shadowed by trees.</li> <li>2. Along grassy banks in water slowly flowing through tufts of grass in irrigation channels.</li> <li>3. In pools in beds of streams and irrigation channels.</li> <li>4. Along grassy edges of back waters of large rivers.</li> </ol>	<ol style="list-style-type: none"> <li>1. Throughout the year except during December and January.</li> <li>2. Increases markedly during monsoon.</li> </ol>	<ol style="list-style-type: none"> <li>1. Removal of grass and vegetables from swamps, irrigation channels.</li> <li>2. Filling up of pools in their beds.</li> <li>3. Periodical drying up of small channels.</li> <li>4. Diking.</li> </ol>	<p>Most important natural carrier of malaria adapts itself to a wide variety of conditions and is particularly associated with out-breaks of epidemic malaria.</p>
2.A. <u>Fluviatilis</u> (A. <u>listoni</u> .)	<ol style="list-style-type: none"> <li>1. Clean water of slowly running streams or stagnant water with grassy edges, exposed to sun light or only partial shade.</li> <li>2. In dry weather along the edges of slowly running rivers.</li> <li>3. During Monsoons in clear grassy streams and seepage of irrigation channels.</li> </ol>	<p>Present throughout the year but decreases from May to September.</p>	<ol style="list-style-type: none"> <li>1. Shading of streams or swamps by hedges or swampy vegetation thick enough to eliminate the growth of grass.</li> <li>2. Filling up of depressions.</li> <li>3. Periodical drying up of channels.</li> <li>4. Diking.</li> </ol>	<p>An important natural carrier of malaria.</p>

Species.	Breeding places.	Seasonal distribution.	Control.	Remarks.
<u>S. A. Steph- ensi.</u>	<p>1. Breeds habitually in wells and cisterns in towns.</p> <p>2. In rural areas breeds in swamps and riverside pools.</p> <p>3. Prefers fresh water constantly renewed.</p>	<p>In rural areas breeds in large number from March to June. Disappears almost completely at the outset of monsoon.</p>	<p>1. Wells should be covered and water drawn by pumps.</p> <p>2. Periodical emptying by tanks and other ornamental waters.</p> <p>3. Oiling of tanks and cisterns and petrolisation of wells.</p>	<p>An important carrier of malaria particularly in towns.</p>
<p>4. <u>A. annu- laris.</u></p> <p>(<u>A. fuli- ginosus</u>)</p>	<p>Same as <u>A. culicifacies.</u></p>	<p>Perennial with a decrease in the extreme heat of April, May and June.</p>	<p>Same as <u>A. culicifacies.</u></p>	<p>Although found infected in nature it is not generally considered an effective carrier of malaria.</p>
<p>5. <u>A. palli- dus.</u></p>	<p>Prefers clean cool stagnant water containing aquatic vegetations.</p>	<p>From October to February.</p>	<p>1. Removal of vegetation.</p> <p>2. Oiling.</p>	<p>Occurs sparsely in the Punjab. Doubtful carrier of malaria.</p>

The above information is taken mainly from an article in the Indian Medical Gazette of December, 1936 by G.C. Ramsay and G. Macdonald.