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HEALTH ORGANISATION.

MALARIA COMMISSION.

The Secretary of the Malaria Commission has the honour to communicate the attached note by Lieut. Colonel G. Covell, member of the Commission for India, on

"METHODS OF FORECASTING AND MITIGATING MALARIA EPIDEMICS IN INDIA".

As the result of his study of the great regional (or fulminant) malaria epidemic which visited the Punjab in 1908, Christophers (1911) described a method by which such epidemics might be predicted with some degree of accuracy.

From an analysis of the statistics relating to meteorological conditions and mortality, he had observed that an epidemic was most likely to occur in a year of heavy monsoon rainfall following upon a year in which the rainfall had been deficient. No epidemic had ever occurred in a year when monsoon rainfall was deficient, although a year of heavy rainfall was not necessarily associated with epidemic conditions.

He found that there was a high degree of correlation between a series of values representing averages for the yearly monsoon rainfall and a series representing fever deaths in the months of October and November. A higher correlation was obtained by multiplying the rainfall average by a figure representing food prices, and the highest correlation of all was reached by multiplying this value (rainfall x prices) by a coefficient obtained by dividing each year's average rainfall by the average rainfall of the previous year. Christophers showed that by this method one could predict the probability of epidemic conditions and also measure the probable intensity before the actual epidemic conditions supervened.

As the result of studies carried out in the Punjab during the period 1913-1923, Gill expanded Christophers' method with a view to rendering it possible not only to forecast the occurrence of epidemics, but to predict their geographical distribution and relative severity. His method of forecasting malaria epidemics, based on the view that such epidemics are the outcome of a loss of equilibrium between infection and immunity, has been used in the Punjab for a number of years, and has achieved a considerable degree of accuracy.

The forecasting data comprise the four following factors:-

1. The humidity or rainfall factor, of which the July-August rainfall of 192 rainfall recording stations is the index. The rainfall figures are used because humidity figures are only recorded at ten meteorological stations in the Punjab, and it has been shown by statistical analysis that atmospheric humidity is highly correlated with rainfall in this province during the pre-epidemic period (July to August).

2. The spleen rate factor, which is provided by the figures relating to the spleen rate recorded in June amongst school children in 286 representative localities over a period of years. The significance attached to this factor is dependent on the observation that epidemics of malaria of appreciable intensity never occur in localities where the spleen rate, as compared with the preceding two or three years, is absolutely and relatively higher.

3. The economic factor, represented by the average price of food grains during the preceding two years. The significance of this factor is dependent on the induction derived from statistical analysis that, though famine and lesser degrees of stress are incapable of determining an epidemic of malaria, they exercise an appreciable influence upon its intensity when other factors are favourable.

4. The "epidemic potential" factor, of which the coefficient of variability of "fever" mortality during the years 1868-1921 is the index. It is obtained by multiplying the standard deviation of fevers during the month of October by 100 and by dividing the product by the number of observations (55 years). It indicates the relative liability of each district to epidemic visitations. No epidemic is expected to occur, however favourable the other factors may be, in any district with an extremely low coefficient of variability of fevers.

All the data except those referring to humidity can be assembled several months before the onset of the malaria season, but owing to the fact that the highly significant rainfall data cannot be obtained before the end of August, it is not possible to prepare a forecast until the 1st of September. It is rarely possible to obtain complete data before September 12th, and it is therefore usual to issue a preliminary forecast on September 14th.

There is no known method in this country of preventing the occurrence of an epidemic, but the preparation of a forecast enables the health authorities to take steps to mitigate it. Such steps include the provision of adequate supplies of quinine and cinchona febrifuge in the threatened areas, the despatch of extra medical staff and travelling dispensaries, preparation to increase hospital accommodation by the conversion of schools and other buildings, and additions to the nursing and medical staff by the enlistment of lay helpers.

Successful preliminary results have been obtained in the Delhi area during the past two years by destroying adult mosquitoes by spraying dwellings with pyrethrum insecticide. This method has been found effective in dealing with epidemics of malaria in South Africa, and the agricultural authorities in India are experimenting with a view to finding out whether a suitable species of pyrethrum can be grown in India on a large scale. Should it be found possible to produce a cheap and efficient extract in this country, it will be extensively used in attempts to combat malaria epidemics.

It is perhaps superfluous to add that the prosecution of all possible anti-malaria measures during inter-epidemic periods is held to be of great importance in mitigating the severity of malaria epidemics.

BIBLIOGRAPHY.

- Christophers, S.R. (1911) Malaria in the Punjab. Sci. Mems. Off. Med. & San. Dept. Govt. Ind. No. 46.
- Idem (1911) Epidemic Malaria of the Punjab with a note on a method of predicting epidemic years. Paludism, 2, pp. 17-26.
- Gill, C.A. (1923) The Prediction of Malaria Epidemics with special reference to an actual forecast in 1921. Ind. Jour. Med. Res. 10, 4, pp. 1136-1143.
- Idem (1923) Malaria in the Punjab: the malaria forecast for the year 1922. Ibid., 11, 2, pp. 661-666.
- Idem (1924) Malaria in the Punjab: the epidemic forecast for the year 1923. Ibid., 12, 1, pp. 185-193.
- Idem (1927) The forecasting of epidemic malaria, with special reference to the malaria forecast for the year 1926. Ibid., 15, 1, pp. 265-276.
- Idem (1928). The Genesis of Epidemics. Baillière, Tindall and Cox, London, pp. 186-202.
- Covell, G. and Baily, J.D. (1932) The Study of a Regional Epidemic of Malaria in Northern Sind. Rec. Mal. Surv. Ind. 3, 2, pp. 279-322.
- Idem (1936) Further observations on a Regional Epidemic of Malaria in Northern Sind. Ibid., 6, 3, pp. 411-437.

Kasauli, dated
January 18th, 1938.