

# Epidemiological Appraisal of Malaria Morbidity and Mortality in Five Southern States

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Most authorities believe that, until recently, there generally has been underreporting rather than overreporting of malaria. Dr. Justin M. Andrews, Deputy Officer in Charge of the Communicable Disease Center, has been convinced, since his experience in Georgia in the late 1930's, that where reported malaria is investigated, it tends to disappear.\*

In 1946 CDC undertook plans for the eradication of malaria. Reported malaria was one of the important criteria by which the efficacy of the eradication program might be measured. In order to determine the relative accuracy of malaria reporting as an indication of the degree of control being achieved, a program of the epidemiological appraisal of malaria morbidity and mortality was initiated. Originally it was intended that confirmed reports would be used to select the areas in which malaria eradication resources would be concentrated.

The data gathered during the appraisal of reported malaria were used indirectly to ascertain the relative accuracy of CDC's entire communicable disease reporting system. The investigations tended primarily to discourage the spurious reporting of malaria but also confirmed some unreported cases and incorporated them into the vital statistics of the States. The investigations stimulated diagnosticians to utilize thick blood films to confirm clinically reported cases.

Cases of malaria are usually reported weekly by the diagnosing physician to the local health department, which in turn tabulates and forwards these records to the State health department. After being recompiled, the totals are telegraphed

to the Public Health Service in Washington. In order to appraise the validity of malaria reporting, it was necessary to obtain the basic epidemiological data from the physician and patient. Since the legal responsibilities of the reporting system are vested in the States, this appraisal program was administered by the State health departments, utilizing principally Communicable Disease Center personnel detailed to the States.

Personnel was available for assignment to only five of the more malarious States. Medical or nurse officers of the Public Health Service assisted State epidemiologists in carrying out this program. In the summer of 1947, a medical officer was assigned to each of the States of Arkansas, Alabama, Georgia, and Mississippi, and a nurse each to South Carolina and Mississippi.

During the latter half of 1947, the States investigated the largest groups of reports which characteristically stemmed from a small number of physicians in a few counties. Fevers of undetermined origin and other ill-defined clinical entities were found ascribed to malaria. The multi-disease card reporting system which did not identify or locate the patients was considered responsible for the vast majority of spurious reports. In Mississippi the institution of a system giving the disease, name of patient, and address eliminated the greater part of the statistics not founded on sound clinical or laboratory criteria.

In both 1947 and 1948, blood surveys were carried out in those counties reporting large numbers of cases. No positive smears were found. Not only were groups of officially reported cases

\*Andrews, Justin M. *General Considerations in Planning Malaria Control; Symposium on Human Malaria. Publication of American Association for the Advancement of Science, Number 15, 1941.*



investigated but also rumors suggesting malaria.

In January 1948, the appraisal of individual reports was begun in three States. This was done objectively by utilizing a special appraisal form produced with the cooperation of all participating States. Where possible, the reviewer traced the report through the county health department to the diagnosing physician and ultimately to the patient. Attempts were made to obtain the name, address, age, sex, and race of the patient. The case was dated both by report and onset. The source and date of the original attack were noted where known. The reporting physician was interviewed or his records reviewed to determine the method of diagnosis--whether by history, clinical impression, or laboratory means. Wherever available, the blood smears made by the diagnostician were reviewed by the appraiser or referred to the State health department or Public Health Service malaria laboratories for confirmation. Where the physician complained that the public health laboratories would never report his slides positive, he was encouraged to send his positive slides to the school of his graduation for use in teaching. With the consent of the physician, a blood specimen was obtained from the patient.

The quality of the technical standards of the laboratory examination was appraised as ACCEPTABLE, ERRONEOUS, or UNDETERMINED. In a small number of instances, the patient was re-examined clinically by the diagnostician or with his concurrence. Where a differential diagnosis was indicated, the physician was encouraged to use the facilities of the State or other specialized public health laboratories. Thus the appraisals were made by history, clinical examination, and laboratory means.

During 1948 the appraised cases were classified as POSITIVE, DOUBTFUL or IMPROBABLE. Under the POSITIVE category were included all cases with laboratory confirmation by technical standards acceptable to the State health department as well as those presumptively positive cases with consistent clinical histories, clinical findings, and therapeutic response. Under the IMPROBABLE category were included cases which lacked laboratory confirmation, which did not present consistent histories and clinical findings, or which suggested some

disease other than malaria. Under the DOUBTFUL category were included all cases the appraiser could assign to neither the POSITIVE nor IMPROBABLE categories, usually because of incomplete data.

Although the aforescribed classification removed the IMPROBABLE and DOUBTFUL reports from too serious epidemiological consideration, the POSITIVE category was too inclusive. During 1949 this category was separated into a POSITIVE category, to include only reports confirmed by laboratory standards acceptable to the State health department, and into a PRESUMPTIVE category, to include those cases with clinical diagnoses considered valid by the appraiser.

The above methods of appraisal were used to investigate the individual reported cases except where medical relations, incomplete data, or other factors contraindicated or modified the procedures. Where these appraisal procedures revealed the need, special blood surveys were conducted to sample parasitemia in the population. In September 1948, the emphasis of appraisal was shifted in South Carolina from large groups of reports to individual cases. Not until September 1949 did Arkansas initiate individual case appraisals. Prior to that time, they supplemented the laboratory facilities of the reporting physicians, held parasitologic seminars for physicians and their technicians, and performed blood surveys with mobile laboratories to evaluate the larger groups of reports. No positive films have been found by the Arkansas State Hygienic Laboratory among at least 2,000 slides during the course of this study.

The results of the program during the first few months in the fall of 1947 were hardly demonstrable except in the counties accounting for the majority of cases. In Alabama 754 cases were reported from one county and 408 from another. These cases constituted over two-thirds of those reported for the entire State. None were confirmed by examining the smears taken by the physicians. Supplemental blood surveys were negative. Therefore, the State decided to withdraw from its official reports all cases except for an estimated 40 for the first county and 20 for the other. In Arkansas, 368 cases were reported from a sin-



gle county. These could not be confirmed; but as a result of investigation, reports practically ceased.

Table 1 shows an analysis of the 1,042 cases which were individually appraised from the 4,815 cases reported in these States of Alabama, Georgia, Mississippi, and South Carolina from which individual appraisal forms were received up to October 1, 1949. The appraised cases represent 22 percent of those officially reported. Of 1,042 cases appraised, 180 were in the POSITIVE category, which for the purposes of this summary included only diagnoses confirmed by blood films examined under laboratory standards acceptable to the State health departments; 225 were PRESUMPTIVE and 637 were DOUBTFUL or IMPROBABLE.

TABLE 1

Appraisals of Reported Malaria  
January 1948 to September 1949, Inclusive

Reported Malaria			Appraisal of diagnosis			
State	Reports	Appraised	Positive*	Presumptive	Doubtful	Improbable
Ala.	429	196	42	105	35	14
Ga.	158	153	65	10	29	49
Miss.	170	145	55	24	28	38
S. C.	4,058	548	18	86	256	188
<b>Total</b>	<b>4,815</b>	<b>1,042</b>	<b>180</b>	<b>225</b>	<b>348</b>	<b>289</b>

\*Confirmed by laboratories approved by State health department.

The methods used in the appraisal of the 1,042 reports were: history alone 770, history and laboratory 165, and laboratory alone 40.

The parasites from blood films confirmed the 180 cases of which 143 were *Plasmodium vivax*, 5 were *P. malariae*, 3 were *P. falciparum*, and species undetermined in 29. Of those same 180

confirmed cases, 115 were believed to have originated outside the United States, and only 59 from within this country (origin of 6 undetermined).

Under the conditions of diminishing endemicity of malaria in this country from 1947 through 1949, the epidemiological follow-up of reported cases is believed to have reduced spurious reporting more than it increased the reporting of undetected or unreported malaria. It is possible that physicians have been discouraged from reporting their clinical diagnoses of malaria. Nevertheless, it is also believed that the epidemiological appraisal program has reduced morbidity reporting to a level reflecting more nearly the actual incidence of malaria. Where spurious reporting has been reduced, greater emphasis should be given to finding nonclinical infections and unreported cases.

The future emphasis of the malaria appraisal program will be concentrated on the more extensive epidemiological investigation in the vicinity of all positive cases, to determine the circumstances of transmission, the extent of the residual focus of infection, and the reasons for survival of the infection. Also, where clinically suspected malaria cannot be confirmed, special laboratory and communicable disease consultant services should be rendered to the reporting physicians to establish the true etiology of the disease.

#### CONCLUSIONS

(1) Two years' epidemiological studies of malaria have further supported the concept that where reported malaria is investigated, it tends to disappear.

(2) Most of the cases reported to the State health departments lacked consistent clinical history or laboratory proof of infection. Few of these could be confirmed by case follow-up.

(3) During 21 months of investigations in 4 States, only 59 reports were confirmed by laboratory standards acceptable to the State health departments and were believed to have had their origin within the United States. Some of these might be scientifically questioned.

(4) Epidemiological appraisal is essential in directing economically the final phases of the malaria eradication program.