Malaria in the World Today

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What concern have we Americans—living in an essentially malaria-free country—with the world-wide effort to eradicate the disease? A very immediate concern, warns this speaker, who makes it clear that even by our generous annual appropriations we are not, as a nation, doing enough. This paper is a fine antidote for complacency.

The United States is no longer malarious and we are now concerned with the malaria of other countries. World-wide malaria eradication is a slogan much in the news. But such great emphasis has been laid on the word "eradication" and so successful have we been at home and in selected areas abroad that the present magnitude and difficulties of the problem may be underestimated. Some have concluded that for malariology the sun has set, that additional malaria research would be redundant, and that malariologists are in oversupply. Such conclusions, unfortunately, are premature. There is, in fact, a shortage of qualified malariologists, there is urgent need for basic research in malariology, and the sun is still hot and high in the skies. We are certainly not here today to conduct a post-mortem!

World Malaria Incidence

Adding the best available data it seems that throughout the world in 1955 about 1,070,000,000 persons, or 40 per cent of the world's population, lived in areas still or recently malarious. Reports indicate that during the year approximately 375 millions were under what might be called routine protection against the disease. Control measures varied from completely effective malaria eradication to ineffectual quinine distribution. Probably no fewer than 695 million persons in 1955 were still without the benefit of routine malaria control. On the basis of past conditions in malarious countries, such as India, and allowing for cases occurring in so-called "protected" areas, it seems reasonable to estimate that during 1955 there were some 200 million cases of clinical malaria and over two million malaria deaths throughout the world.[1]

These calculations have not been plucked from a hat and they are not derived from previous world estimates, which have varied from 250 to 350 million malaria cases annually. The present assessment is based on a country-by-country study, fortified by personal experience, by communication with malariologists all over the world, and by checking with qualified officials of WHO, ICA, and the Division of International Health of the Public Health Service. Only in the case of the USSR and Communist China was it impossible to obtain current information bearing on the data.

Naturally, world incidence statistics for all diseases are inaccurate. Reports of malaria, published officially, sometimes vary widely for the same area and year. Much malaria is never recorded and many cases of other fevers are returned as malaria. Then, too, such statistics are out of date by the time they are compiled. But, very likely, the estimate of 200 million cases of clinical malaria throughout the world in 1955 is not wide of the mark. We must remember that malaria eradication in Asia has hardly begun and that in tropical Africa there are formidable technical obstacles now under study but not yet

surmounted. We are convinced that malaria today is still one of the leaders among the diseases that afflict mankind.

Nevertheless, there has been impressive progress. Malaria today is under an attack so widespread and so determined that one can safely predict a rapid fall in incidence and an end to its world supremacy. Already this disease has been eradicted from wide areas and it is at low levels in several once highly malarious countries.

Malaria Eradication

Undoubtedly, malaria eradication is big news today! Since 1945 nation-wide projects, based principally on residual spraying with DDT, BHC, or Dieldrin, have been widely tested and found to be administratively, technically, and financially practicable in many places. The evidence is so convincing that the WHO, at its Eighth Assembly in 1955, recommended nation-wide malaria eradication as a goal more logical than that of annually recurring old-line malaria control. Eradication is preferable because it sets a definite end point, because it is cheaper in the long run, and because the phenomenon of Anopheles tolerance to residual toxicants indicates that the choice is either eradicating malaria or indefinitely enduring a disease transmitted by increasingly resistant vectors.

Malaria eradiction implies both the complete interruption of transmission and the elimination of the reservoir of parasites by a campaign limited in time and carried out so thoroughly that at its end there will be no resumption of transmission.

Malaria eradication programs have four phases: preparatory, attack, consolidation, and maintenance. The preparatory phase includes initial survey, planning, and preliminary operations. It generally lasts from several months to a year. The phase of attack begins as soon as the preparatory phase ends and continues with total spraying coverage until malaria transmission has ceased and the parasite reservoir has been nearly emptied. It has generally been found that most falciparum and vivax infections will have died out in two and one-half to three years of interrupted transmission and this is usually the minimum duration of the attack phase. A few, not readily apparent, foci of residual malaria will generally remain at the end of the attack phase.

The phase of consolidation begins as the active attack on the insect ends. During this phase residual pockets of transmission must be found and eradicated and the parasites remaining in man eliminated. Surveillance must be active, complete, and routine over the entire area. Case finding and the use of antimalaria drugs have first importance. This essential and rather difficult phase of consolidation ends when during three years of active surveillance no locally contracted infections have occurred. Because malaria morbidity is so low during this key phase in an eradication project, it is sometimes difficult to obtain the necessary financial support from either governmental or international sources to carry the work through to completion.

The final phase of maintenance begins when malaria has been eradicated from an area and it will last as long as malaria exists anywhere in the world. But maintenance is not difficult or expensive, because it is carried out by regular health departments which add malaria to the list of exotic diseases against which they are always on guard. In most large countries time schedules will vary in different areas. some of the

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This paper was presented before the Division of International Health, Public Health Service, at the Eighty-Fourth Annual Meeting of the American Public Health Association, Atlantic City, N. J., November 15, 1956.

latter coming to the maintenance phase sooner than others.

Modern control operations against preventable maladies are often aimed only in a nebulous way at the complete removal of a disease from the community involved. Not until about a decade ago did the concept of widespread malaria eradication become acceptable as a practical idea. For there are large differences between the requirements of malaria control and those of malaria eradication. That these strict requirements for malaria eradication are not beyond attainment is clear from results already recorded in several nation-wide malaria eradication projects, three of which will be mentioned.

Venezuela

Venezuela was first to capitalize on the combination of a sound epidemiologic understanding of local malaria and a full appreciation of the possibilities inherent in DDT. Under the guidance of Dr. Arnoldo Gabaldon there was formulated in 1945 the earliest national project that from its inception was designed to eradicate malaria from an entire country by DDT residual spraying. DDT was already in limited use by civilian authorities in 1945, but no other national scheme up to that time had set "total malaria elimination" as its goal. In Venezuela, where malaria was once the foremost health problem, the disease has now been eradicated from areas totaling 304,000 square kilometers, with a population of two and one-half millions. There are still a few foci of endemicity and the chief vector, A. darlingi, which had all but disappeared by 1954, reappeared in some localized areas in 1955, but the disease is on the way out. It now does so little harm that lay officials are inclined to think that the campaign is over. This belief, of course, is dangerous while residual foci remain.

Italy

Another good example is that of Italy where there were more than 400,000 cases of malaria in 1945. Today, malaria eradication on the mainland and in Sicily and Sardinia is almost complete. No malaria deaths have been recorded since 1948. The total numbers of primary infections were nine in 1953, six in 1954, and only five in 1955. During the summer of 1956 a small malaria fire, involving 10–12 persons, broke out in Sicily, analogous to one that occurred in California a few years ago. The outbreak was quickly and effectively dealt with, and it illustrated once more the fact that, after malaria has been eradicated, it is relatively easy to stamp out occasional sporadic cases.

The eradication project in Italy was begun in 1946 by the late Professor Missiroli, and it is a notable monument to his genius and to the skill of Italian malariologists. No larviciding at all for malaria control has been done in Sicily or on the Italian mainland since 1946. In Sardinia there was a special experiment in 1946–1950 to find out if vector eradication would be feasible and more satisfactory than vector control. But the transmitting mosquito, A. labranchiae, was not extirpated in spite of intensive efforts that included both larvicides and adulticides. Malaria, however, was eradicated. The per capita cost was four times greater in Sardinia than on the mainland, where it was 50 cents per year, with equally good results.

Ceylon

A third example is that of Ceylon which was intensely malarious for centuries. No other disease did so much damage to its economy. Malaria rates were as high as 574 per 1,000 population as recently as 1940.

In Ceylon DDT was first tried in 1945 and proved to be so successful

against the single vector, A. culicifacies, that a scheme was prepared for the spraying of all dwellings in malarious areas once every six weeks. This project was implemented in 1946 and by the end of 1947 all endemic areas had been thus protected for a full year. Results were so good that in 1950 the goal of malaria eradication was set. Under the late Dr. Rajendram and now directed by Dr. Gunaratna the scheme has had great success. In 1951 it was possible to stop spraying in one area. Then, in each succeeding year, the spraying was withdrawn from more and more communities until, in 1955 and 1956, only jungly areas being cleared for agricultural use were routinely sprayed.

In 1951 when the first spraying unit was withdrawn, and progressively since then, an expanding system of surveillance has been organized. There are now 98 Vigilance Units and Subunits routinely employed. All fever cases are investigated. Persons whose blood smears reveal parasites are treated with Camoquin plus primaquine. Spraying is resumed if indicated.

The cost of the malaria eradication project in Ceylon in 1955 was only seven and a third United States cents per capita. Prior to the present scheme, malaria control costs were much higher, e.g., 72 cents per capita in 1938. Malaria morbidity rates have fallen from the 1940 level of 574 per 1,000 population to a low of 0.35 per 1,000 in 1956.

Present World Status of Eradication Projects

Based on a personal communication from the chief of the Malaria Section of the World Health Organization, officially designated nation-wide malaria eradication projects as of October, 1956, were as follows:

Countries in the Preparatory Phase of Malaria Eradication Projects—Bolivia, Cambodia, Colombia, Israel, Jamaica, Jordan, and Trinidad.

Countries in an Early Attack Phase—Afghanistan, Albania, Brazil, British Honduras, Bulgaria, Burma, Dominican Republic, Ecuador, Granada, Guatemala, Haiti, Honduras, Iran, Iraq, Mexico, Nicaragua, Panama, Paraguay, Philippines, St. Lucia, Syria, Turkey, and Yugoslavia.

Countries in which the Attack Phase Is Well Advanced—Antigua, Argentina, British Guiana, Ceylon, El Salvador, Greece, La Reunion, Lebanon, Panama Canal Zone, Roumania, Swaziland, Taiwan, Thailand, Tobago, and Venezuela.

Countries in Consolidation Phase with Eradication Practically Complete—Barbados, Corsica, Chile, Cyprus, French Guiana, Italy, Mauritius, Puerto Rico, and the United States.

Resistance

The development of anopheline resistance to residual insecticides has aroused considerable apprehension among malariologists, although there is general agreement that malaria eradication projects, energetically administered, can be completed successfully in spite of this new handicap. If, however, the concept of eradication were abandoned, there is reason to believe that long-continued malaria control by the use of residual toxicants would not be possible in many areas because the vectors would become resistant. The subject of resistance requires much more study. For instance, the physiology of Dieldrin resistance is an almost complete mystery. Another lacuna is the fact that we know practically nothing about the effect of using mixtures of insecticides. We still have to move in the dark when a vector begins to be less susceptible to DDT or to Dieldrin.

In the early years of this century we were primarily interested in taxonomy

and distribution of anophelines and the discovery of vectors. Then, up to the period of World War II, the ecology of larvae assumed major importance and was widely studied. We have now come to a time when we must direct more attention to the physiology of adult vectors, to anopheline genetics, and biometrics. Not only are there immediately pressing research problems, but experience would indicate that other basic and, at present, unforeseeable questions will arise. There is a vital need for forward planning of the scientific aspects of world-wide malaria eradication, especially as regards entomologic research.

International Cooperation

The 1956 malaria budget of the World Health Organization was about $309,000, and this was spent to provide world-wide coordination of malaria programs and to make available technical advice and a few field demonstrations. To the World Health Organization should go great credit for its leadership in the amazing acceleration in world-wide malaria control and eradication since 1947. The Malaria Section, under the skilled guidance of Dr. Pampana, and the five WHO Regional Offices, have stimulated nation-wide projects, demonstrated the feasibility of residual spraying in many areas, provided fellowships and training courses, organized regional malaria conferences, and fostered basic research.

The WHO has set up a Malaria Eradication Special Account to which have been invited contributions from governments, nongovernmental organizations, and private sources. Moneys from this account may be spent in direct aid to national eradication projects. It is hoped that considerable sums will be forthcoming to enable WHO to expand its support of the world-wide campaign.

The Pan American Sanitary Bureau with its own funds, and also as the American Regional Office of WHO, has had a dynamic role in pushing forward the attack on malaria in the Americas, and it is now coordinating a hemisphere-wide eradication scheme. In 1956 and in 1957 its malaria budgets were $100,000. The 1957 budget will be augmented by a special contribution of $1.5 million from the United States government.

The United Nations Children's Fund (UNICEF) since 1947 has spent some $16.2 millions for national malaria control and eradication projects in 53 countries and territories, realizing clearly the importance of this disease to infants and children. The 1955 malaria budget was about $3.7 millions and in 1956 UNICEF allocated some $6.6 millions for malaria projects. The expected figure for 1957 is about $9.2 millions. This money is not used for personnel but for insecticides, equipment, and transport expended with the technical help of WHO.

The United States has had a vital part in the world-wide attack on malaria. In 1955, in addition to its contributions of $3.35 millions to WHO, $6.645 millions to UNICEF, and $1.32 millions to PASB, the United States, through ICA, spent some $8.8 millions for malaria control and eradication projects in 19 countries. In 1956 ICA allocated $14 millions for malaria eradication throughout the world. These funds are being spent with a sharp focus on local problems and a tremendous impact on malaria. The Division of International Health of the PHS has had a major part in many policy decisions and in providing trained personnel for ICA projects. This division has been a powerful factor in recent world-wide victories over malaria.

Of course, very large sums are being spent by national governments for malaria eradication, the total undoubtedly exceeding that of the international moneys allocated.

Importance of Malaria to the United States

A century ago in the southeastern United States and in the central valleys malaria was as frequent as common colds are today. In many communities almost no one escaped this disease, which was referred to simply as "the fever." Competent observers in those days saw little possibility of reducing the malaria burden. As recently as the second decade of the present century there were years when almost 800,000 cases of malaria were recorded in a group of 11 southern states. Even in my own experience I have seen two cases of blackwater fever in a single season in a county in Georgia where falciparum malaria was common.

Today we are so close to complete eradication of malaria within our borders that we tend to minimize the importance of this disease to our national economy. Out of sight, out of mind! Because malaria ranks low in our morbidity tables, the disease has been given correspondingly low priority in allocating public medical research funds. Yet, very likely, malaria research is as good an investment for us today as it ever has been. Already mentioned are the millions of dollars we are spending for malaria control overseas and which we believe return profits in making and keeping friends and in protecting sources of vital imports.

We should not forget that the United States draws about 60 per cent of its imports from, and sends some 40 per cent of its exports to, countries where malaria is still prevalent. Malaria control among laborers who produce the imports requires, on the average, at least 5 per cent of annual production budgets. This constitutes a malaria tax of more than a third of a billion dollars paid annually by the United States on its imports. As to exports, the total value of business lost to exporters because of poverty directly due to malaria cannot be estimated, but it is certainly enormous. For these reasons, few question the wisdom of the allocations made by ICA for overseas malaria control and many would like to see them increased.

On the other hand, because it is less obvious, doubt has been expressed about the need today in the United States for a greater emphasis on malaria research. To many it seems clear, however, that such research might well cheapen the cost of control, point the way through the baffling maze of insect resistance, make malaria eradication in tropical Africa practicable, and put a stronger foundation under the world-wide drive to eradicate the disease.

During the period of World War II the United States was preeminent in fundamental malaria research. The concept of world-wide malaria eradication offered us an unprecedented opportunity to maintain our leadership. But during the past 10 years, while the global attack on malaria has been accelerating, we have lost research leadership in this field and have been dropping rapidly toward the rear. Although we are wisely investing millions of taxpayers' dollars in overseas malaria control, we are allocating only pennies to malaria research. Surely it would be to our advantage to protect our investment by giving much more support to vitally needed concomitant malaria research without which, it seems reasonable to predict, world-wide malaria eradication will be impossible.

Summary

World malaria incidence has fallen by the tens of millions in the past few years under the impact of modern residual toxicants applied on a nation-wide scale in many countries, with the leadership and the technical and financial aid of WHO, PASB, UNICEF, ICA, and progressive national health departments.

The progress has been so great that world-wide malaria eradication seems a practical goal. But we are in the midst of a stern battle and not at its end. Probably 200,000,000 cases of clinical malaria occurred in the world in 1955 with two million deaths. There is need for greater international monetary and technical assistance, for more trained malariologists, and particularly for more malaria research.

We face a "golden moment" that, skillfully used, may lead to a tremendous public health victory. The difficulties are enormous, but so are the potential resources of money and technologic skills. Malaria eradication is possible.

In concluding, may I express the hope and confidence that public and private agencies in the malaria-free United States will greatly increase their support of basic malaria research and will redouble their support of overseas malaria eradication for the welfare of mankind throughout the world.

REEFRENCE

1. Russell, Paul F. World-Wide Malaria Distribution, Prevalence, and Control. Am. J. Trop. Med. & Hyg. 5:937–965, 1956.

A Ten-Year Report on the Zoonoses

"Animal Disease and Human Health" is the subject of a joint conference of The New York Academy of Sciences and the Public Health Service's Communicable Disease Center to be held at the Barbizon-Plaza Hotel, New York City, May 2–4. Here will be a 10-year progress report on diseases of lower animals that are transmissible to man, or diseases caused by animal parasites. Among these are psittacosis, brucellosis, cat scratch fever, rabies, anthrax, and encephalitis. Also to be discussed are animal diseases from the standpoint of possible relationship to similar conditions in man. An example is pulmonary adenomatosis, which decimates sheep flocks in many parts of the world, and has several factors in common with lung cancer in human beings.

The conference is designed for physicians, veterinarians, nurses, virologists, and others in the biologic sciences. There is no fee. Further information from Eunice Thomas Miner, Executive Director, New York Academy of Sciences, 2 East 63rd St., New York 21.