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The World Health Organization's changing goals and expectations concerning malaria, 1948-2019

As mudanças nos objetivos e expectativas da Organização Mundial da Saúde com relação à malária, 1948-2019

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Abstract

From its inception, in 1948, the World Health Organization made control of malaria a high priority. Early successes led many to believe that eradication was possible, although there were serious doubts concerning the continent of Africa. As evidence mounted that eradicating malaria was not a simple matter, the malaria eradication programme was downgraded to a unit in 1980. Revived interest in malaria followed the Roll Back Malaria Initiative adopted in 1998. This article presents an historical account of the globally changing ideas on control and elimination of the disease and argues that insufficient attention was paid to strengthening health services and specialized human resources.

Keywords: malaria; World Health Organization; international health; Cold War; Roll Back Malaria.

Resumo

Desde sua origem, em 1948, a Organização Mundial da Saúde priorizou o controle da malária. Os primeiros êxitos induziram à crença na viabilidade da erradicação, apesar de sérias dúvidas quanto ao continente africano. À medida que se somavam comprovações de que a erradicação da malária não seria simples, o projeto com essa finalidade foi rebaixado a uma unidade em 1980. O reavivamento do interesse na malária ocorreu após a iniciativa Roll Back Malaria, criada em 1998. Este artigo apresenta um panorama histórico das mudanças nas ideias, em âmbito global, ligadas ao controle e à eliminação da doença e defende a tese de que a atenção dada ao fortalecimento dos serviços de saúde e a recursos humanos especializados foi insuficiente.

Palavras-chave: malária; Organização Mundial da Saúde (OMS); saúde internacional; Guerra Fria; Roll Back Malaria.

As readers will discover, the relationship between malaria and the main multilateral agency, the World Health Organization (WHO), has a very complex history involving strong personalities who often disagreed with each other, as well as great uncertainty concerning the prospects for achieving malaria eradication, especially in Africa. The paper begins with a brief review of pre-Second World War efforts undertaken by the Rockefeller Foundation (RF) and the League of Nations Health Organization (LNHO). Three sections follow: the first covers 1948-1969, which itself is divided into two parts to discuss Africa separately from the rest of the world, and then one section covering 1969-1992, and the last one which brings us to the present day. No effort has been made to describe the technical challenges faced by malaria programs, such as the need to change drugs as well as insecticides due to growing resistance. At the end I present some considerations on the contemporary malaria eradication goal promoted by some international organizations. The main argument of this article is that insufficient or inconsistent attention was paid by WHO to reinforcement of permanent health services and to the experienced and lay personnel who were crucial to malaria control.

Pre-Second World War approaches to malaria control

Prior to Ronald Ross's discovery of the role played by mosquitoes in transmitting the malaria parasite in 1897, the only sure method available to reduce the burden of malaria was the use of quinine, although the association of malaria with certain nefarious ground and wind conditions had led some towns and areas in Europe to continue attempting to control malaria by various environmental means with occasional satisfactory results. It is important to mention that although Ross, a British medical doctor who was working in India, demonstrated the role of mosquitoes in the transmission of bird malaria, it was the Italian malariologist Giovanni Grassi who in the 1890s demonstrated the role of mosquitoes in the transmission of human malaria.

The work of Ross and Grassi opened up two new points of attack: (1) reduction of mosquito numbers through larval destruction, and (2) reduction/elimination of contacts between man and *Anopheles*, the key mosquito transmitter of malaria. While Ross was inclined towards a direct attack on the mosquito, Italian malariologists led Grassi and others to explore all possibilities during the early decades of the twentieth century, with varying degrees of success. However, neither Lewis Hackett nor Paul Russell, both very prominent Rockefeller Foundation malarialogists during the 1930s and 1940s, acknowledged the early Italian experience in their historical accounts concerning malaria. Hackett (1937, p.30) reduced the Italian experience to one of distributing quinine, a time-honored resource with a "history of three hundred years of constant defeat." It is important to note that when he wrote this, he had over ten years of experience in Italy's Central Malaria Experiment Station in Rome, supported by the RF. Russell (1955, p.135), in his book *Man's mastery of malaria,* summarized and dismissed Italy's efforts in one sentence: "By 1910, after very determined attempts to use this method of drug prophylaxis, it had to be admitted that it was not without serious defects."

Others soon joined Ross and the Italians in the battle against malaria, notably the American military doctor William Gorgas, who, after eliminating the *Aedes* mosquito that

transmitted yellow fever in Havana after the Spanish-American War in the early twentieth century, moved to the Panama Canal construction site, where he again achieved success against yellow fever from 1904 to 1914, but his efforts to control malaria were less successful despite using a variety of anti-breeding techniques. While malaria did not disappear from the Panama Zone that ended under American control, there was a steady decrease in malaria cases and deaths over a ten-year period. Gorgas felt that the reduction would have been faster and reached lower levels had the engineers and Commission members "fully cooperated with instead of just tolerating him" (Litsios, 2001, p.374).

Work by other physicians was important for the international control campaigns. For example, the Scottish tropical physician Malcolm Watson, who had joined the British-controlled Malayan Medical Service in 1900, achieved outstanding results in very specific plantation conditions in Malaya. In the 1910s, the Dutch doctor Nicolas H. Swellengrebel demonstrated in the Dutch colonial possession of Sumatra (an island in western Indonesia) the possibility of species sanitation, i.e. altering the natural environment in such a way as to destroy the breeding of malaria-carrying anophelines. Nevertheless, whatever dream Ross and other early malariologists may have had that anti-vector work would eradicate malaria proved to be of very short duration, if it ever really had a lasting impact at all. Even Gorgas and Watson, who were achieving remarkable results in economically important colonial and postcolonial areas, and whose budgets were orders of magnitude greater because of support from the USA and UK than what could be expected to be available "normally" from other colonial possessions or independent developing countries, never eliminated malaria permanently.

A Pan African Health Conference organized by the LNHO held in Johannesburg in 1935 stressed the need for a broad approach to health, especially in rural areas, which rested on economic advancement. Concerning malaria, it noted that additional research on African malaria was needed but emphasized the need to raise the economic status of the vast bulk of the population of Africa as a whole. According to the report, there was no hope of successfully applying the results of medical research on a continent-wide scale without social reforms (LNHO, 1936).

Russell's efforts in the 1930s in the Philippines, a colonial possession of the USA at the time, led him to conclude that as far as the rural areas in the tropics were concerned, the problem of malaria control was still unsolved. For him, none of the expensive methods that had been developed with some degree of success in the South of the USA could be afforded in developing countries. In his opinion, malariologists should design inexpensive but continuous programs that could be used over decades of time because there were no significant funds to pay for well-organized campaigns in the tropics (Russell, 1936, p.5).

Malaria was one of the major problems discussed during an important conference on rural hygiene organized by the LNHO in Bandoeng, Indonesia, in 1937. Russell chaired the malaria technical working group, whose recommendation focused on how to reduce costs for rural communities; it recommended that (a) the free distribution of quinine products be extended, (b) lay individuals and communities be enlisted in minor control methods, and (c) that cheaper methods of control that use time more than money be explored. Research was needed to obtain "a much more definite understanding of the relationship

between malaria, malnutrition, famine and poverty... as well as further elucidation of the factors concerned in malarial immunity." Practical mosquito nets for rural areas in the tropics also needed to be developed. The League also advised against any simplistic attempt to standardize antimalaria programs valid for all Far Eastern countries (LNHO, 1937, p.89). As this quote and section suggest, during the first half of the twentieth century experts did not have an effective method to control malaria, especially one effective for the developing world.

WHO, DDT and the launching of the global eradication campaign, 1946-1956

World War II dramatically altered the international health scene. It effectively stopped the work of the LNHO, and led to the creation of temporary international organizations specifically set up to address problems caused by the war. It also led to the establishment of the United Nations, followed by the establishment of a series of specialized organizations, including the WHO. The use of DDT during World War II demonstrated an effective method of controlling malaria in many areas, at costs considered "within the economic means of the people" (WHO, 30 June 1947, p.14). What remained to be demonstrated in the postwar years was whether or not developing countries were ready to develop medical organizations with sufficient political support and financial resources capable of exploiting the power of DDT. As Russell (1945, p.13) observed even before WHO was created, the greatest social obstacle to malaria prophylaxis was the absence of "suitable malaria control organizations."

The hope that malaria control would help increase agricultural production led the Economic and Social Council (ECOSOC) of the United Nations to ask WHO and FAO to study suitable measures to "bring about an increase in food production with an offer to support a mass attack on malaria in selected areas of food-producing countries" (WHO, June 1949, p.1). As a result, a joint FAO/WHO Working Party on Food Production and Malaria Control was established in 1949. However, after a few years the Working Party was dissolved. The successful control of malaria in Ceylon during the 1940s created the perception that a new social problem would be created in developing countries after malaria was controlled: population explosion. For Russell (1955, p.245), who shared this concern with the unintended consequences of public health progress, the only humanitarian solution for the population problem was to control fertility. However, his opinion was not shared by all directives of international organizations. For example, Brock Chisholm, WHO's director-general, was blocked from establishing an expert committee on health aspects of the population problem, a proposal he made to the 1952 World Health Assembly with the support of some developing countries. The proposal was opposed by the Roman Catholic countries and the Vatican, and was ultimately not approved by the agency's assembly. For Russell (14 May 1952), it was a demonstration that old "medieval prejudices" were still getting in the way of science and public health. It would be decades, however, before the issue of fertility control could even get onto the agendas of international health and development meetings. In the meantime, it was accepted that malaria control successfully contributed to an unknown "extra" growth in the world's population and reduced malaria to a level where further control of this disease hardly threatened to contribute to any

additional population growth at all. Therefore, overpopulation was not portrayed as a major development problem caused by malaria elimination.

Russell, in his 1955 text *Man's mastery of malaria*, proclaimed the "DDT era of malariology" and predicted a swift global victory over this ancient scourge. That same year, he challenged the World Health Assembly that took place in Mexico City with a dramatic statement: "Whatever WHO decided to do, a campaign for world-wide malaria eradication was already under way" (WHO, 1955, p.205). This was an allusion to the fact that Fred L. Soper, director of the Pan American Sanitary Bureau (later renamed the Pan American Health Organization, PAHO) and former officer of the Rockefeller Foundation, had already committed his agency to eradicating malaria in the Americas, with sizable financial resources from the US State Department. Soper's experience combating yellow fever and *Anopheles gambiae* in Brazil during the 1930s had convinced him that nearly all vector-borne diseases could be eradicated; he prided himself as having almost single-handedly resurrected the idea of eradication as a public health measure worthy of pursuit. Soper was also known for strict discipline. In Brazil in the 1930s, he measured the time it took for his team members to carry out everything they did in order to be better able to supervise them. He was especially devoted to his system of checks and cross-checks covering all activities, especially those carried out in the field by inspectors. An anecdote will reveal how much he cherished this authoritarian discipline: he fired an employee who was still alive after an explosion that had taken place in a large ammunition dump in the Rio de Janeiro area that he was supposed to be visiting at the time of the explosion. When Soper first learned of the explosion, he checked its location and determined which inspector was inspecting the arsenal at that time, at which point he sent condolences and a death benefit to the widow. The next day, the inspector in question reported to work, and was surprisingly fired for being alive (Soper recorded how the local press violently attacked him for dismissing this inspector) (Weller, 1979, p.182).

But it should be noted (as Packard and Gadelha argue) that in his efforts to eradicate *gambiae*, he made no attempt to understand the wider social and economic context in which malaria occurred. Moreover, these issues were clearly irrelevant for Soper (Packard, Gadelha, 1994, p.199). Perhaps more revealing of his philosophy was his advice to the government of Brazil in 1947 to end all projects devoted to the systematic treatment of people with antimalarial drug treatment of persons in endemic zones (Packard, Gadelha, 1994, p.204); he did not want available funds to be used to treat malaria instead of expanding the battle against *gambiae*. The statement opposed a tradition of using quinine, which could be traced back to the nineteenth century. Russell (27 Aug. 1947) did not completely agree with Soper, believing that physicians had an obligation to treat the sick, even though treatment alone would not control the disease.

Soper's ideas found more enthusiastic support from the new head of the World Health Organization and his close friend, the Brazilian Marcolino Gomes Candau. Soper hired Candau, a Brazilian malariologist, during Brazil's anti-gambiae campaign in the 1930s, and later was instrumental in Candau's graduate studies at John Hopkins University. Soper was even said to have played a vital part in getting Candau elected as the second director-general of WHO in 1953 (a position in which he remained until 1973). It is important to mention a

possible reason why Brock Chisholm decided not to seek a second term as director-general; according to Farley (2008, p.195), Chisholm's campaign for re-election was "dethroned" by malariologists, who campaigned on the promise of malaria eradication and elected fellow malariologist Candau in his place. That Chisholm did not have the support of malariologists is revealed by what they had to say when Chisholm was overheard saying that "one cultural anthropologist [the American Cora Du Bois] was worth one hundred malaria teams." When Russell learned of this remark, he wrote in his diary that Chisholm's comment was the sort that "one might expect from a psychiatrist planning a world health program." Russell (1950) also reported that C. Mani, the WHO regional director for the South-East Regional Office in New Delhi as well as a malariologist, did not like an anthropologist engaged in malaria operations. It is relevant to describe Du Bois's work. She was 43 years old when she joined WHO for one year to escape the "Red-baiting tactics of Joseph McCarthy" against the State Department, where she was working. She was willing to work with physicians, engineers and public health experts and reported almost weekly to Mani. But it appears that Mani did not interact with Du Bois, as there is no record of him having responded to any of her letters; his silence suggests he did not care for anthropological work in the malaria program. It would be interesting to learn what his reaction was when Du Bois (6 June 1950) suggested that malaria technical demonstration teams operating in India would do better by linking their work within the "framework of a broad development experiment." She obviously did not know that WHO's malaria control program epitomized what in time would be termed a "vertical" approach to disease control that praised technology and administration over sociomedical perspectives. It is important to note that even in the 1970s, the inclusion of a medical anthropologist in malaria control programs was considered "bizarre" (Bradley, 1999, p.13). Even though Du Bois was with the State Department, she did not mention US government concern with malaria eradication programs as tools of the larger war on communism (Farley, 2008, p.159). The "urgent" pressure to combat communism, together with hidden reluctance to pursue social reforms and the glorification of technology, encouraged malaria work to go "its own way" and granted these experts a degree of autonomy and leadership in international health (Litsios, 1997, p.272). Furthermore, as Packard (2007, p.146) has noted, Cold War politics prevented the linking of malaria control programs with broader efforts at social and economic development.

The WHO's rationale in launching an eradication campaign was based on several assumptions, the most important of which was that prolonged and inconsistent use of DDT could be expected to lead to mosquito resistance. Because resistance takes several years to appear, Candau advised striving to eradicate malaria in as short a time as possible, so that the spraying campaign could be terminated before resistance occurred (WHO, 17 Jan. 1955, p.1). The decision to eliminate the disease was made at the World Health Assembly of Mexico in 1955 mentioned above, and the theory of eradication was fully laid out a year later in the Sixth Expert Committee on Malaria. The report of the Committee called for the application of residual insecticides on a total coverage basis, which usually meant large areas of developing countries (WHO, 30 Nov. 1956, p.10). At this stage in WHO's history, malaria experts did not seem to be giving any thought to the possibility that their approach to eradication might not succeed.

Africa

Before the beginning of WHO's eradication campaign there was a concern with how the campaign could be implemented in Africa because of the scarcity of infrastructure resources, widespread poverty, medical personnel, and the history of colonialism. Some experts even questioned whether it was desirable to treat infection in individuals in Africa who had acquired immunity through early and continued exposure to malaria. D. Bagster Wilson (1938, p.32), an English malariologist whose work in Africa spanned thirty years including the 1930s, believed that no control measures should be taken on behalf of infants in hyper-endemic areas, as this would prevent the survivors from acquiring immunity, which he considered "so valuable an asset in later life." This was the traditional position of many tropical medicine doctors who assumed that natural immunity was key in keeping malaria low in endemic areas and showed a disregard for the mortality and morbidity this assumption produced, and for control of this disease among African children.

One early indication that this idea was dismissed by supporters of malaria eradication is Russell's comments on the presentation by Bagster Wilson at the Fourth International Congress on Tropical Medicine and Malaria, held in Washington DC in 1948. Russell (14 May 1948) noted in his diary that it was unbelievable that Bagster Wilson was still talking about the natural immunity of Africans and the potential damage of doing any control work in malaria because it would endanger the local people's resistance to malaria. In contrast, other British experts in the meeting shared Russell's ideas and supported eradication work in Africa. For example, George Macdonald, who developed a mathematical model that supported killing adult female anophelines as a means of interrupting malaria transmission, urged the Congress attendees to tackle eradication in Africa and Asia by creating artificial islands of eradication surrounded by residual DDT barrier zones, an idea that assumed these model areas would be the basis for more aggressive campaigns in the future and which has currency today, as discussed at the end of this article (Russell, 13 May 1948).

In spite of their differences, Russell and Bagster Wilson participated as experts in the Fourth Session of the Malaria Expert Committee, which took place in Kampala, Uganda in December 1950. The committee endorsed WHO's malaria policy of using demonstration teams, while at the same time recommending that these teams be engaged on a long-term basis and that in highly malarious areas these teams should not be burdened with other duties until malaria control was well established (WHO, 17 Jan. 1951, p.5). This recommendation was part of a continued call to keep malaria control separate from the health services, and partly explains why some of the malaria eradication units became self-sufficient. The committee ignored Bagster Wilson's prior concern with protecting the process of natural immunity in children by recommending to the governments responsible for administration in Africa that malaria be controlled by modern methods as soon as feasible, regardless of the original endemicity and without awaiting the outcome of further experiments (WHO, 17 Jan. 1951, p.29). A review paper by Russell (1952, p.119) published in 1952 indicated that antimalaria operations were already underway in Africa to various degrees.

The report reinforced the assumption of many supporters of malaria eradication at the time, namely that work had to be done in Africa, but progress was going to be slower

than in other developing areas of the world. Nevertheless, eradicators kept in mind that their goal had to be global. In 1959, Candau noted that there could be no real and definitive progress towards the goal of eradication in any one single country unless the conditions for success were established on a world basis. The problem of malaria must be solved everywhere, he said, otherwise the money would in fact be wasted (WHO, 1959, p.78). No malaria expert argued against this statement, probably because it was taken as a political truism that the campaign truly had to aim to eradicate malaria everywhere, if it was to make any sense. On the other hand, there was already awareness that nothing was really implemented to address the African continent as a whole. It was clear that the problems of logistics, access to technology, human resources, and political commitment were much more acute in Africa than in other areas of the world that embraced malaria eradication.

The WHO assistant director-general, Doctor Prince Mohan Kaul, who was responsible for presenting and defending the malaria program and budget, assured the delegates to the 1960 World Health Assembly gathered in Geneva that the prospects in Africa now looked much more hopeful (WHO, 1960, p.383). However, one year later he explained – with little explanation – that development of health services was a prerequisite for the execution, consolidation, and maintenance of an eradication program (WHO, 1961, p.192). The reason why he changed his mind was the lack of resources, given the fact that most African countries had not fully developed health services suitable for such a task, and the intermittent political commitment to devoting significant financial resources to building these services; he was indicating that for the WHO, eradication was not possible in Africa in the near future. African governments fully understood this problem, as noted by the Cameroonian delegate to the World Health Assembly of 1962: the pre-eradication phase would probably last for several years, and even when all the necessary political, economic, and infrastructural conditions for eradication existed, it could not be undertaken until neighboring countries reached the same stage (WHO, 1962, p.168). Other delegates to the assembly voiced similar complaints in subsequent assemblies. Moreover, for some Africans this was part of a global health asymmetry; according to the Guinean delegate to the WHO Health Assembly of 1964, there was no uniform progress because of an "unequal distribution of operations" and resources, and a growing disparity between the different regions of the world with regard to malaria eradication (WHO, 1964, p.166).

Soper, who had retired from PAHO in January 1959 but remained close to the malaria eradication campaigns (shortly after his retirement he embarked on tours in Africa and Southeast Asia to assess malaria programs for the Rockefeller Foundation and US bilateral aid, and during the 1960s he was a malaria advisor to international health organizations), accused the WHO malaria program of having conceived the pre-eradication strategy for Africa simply to shift the costs of surveillance from the malaria eradication account to that of the general health services. This was a grave accusation indeed, and reveals Soper's adamant belief in vertical programs, with autonomy of the general health services as the basis of achieving success in international health and even the basis of constructing health systems. His earlier experience with the hookworm campaign in Brazil with the RF in the 1920s had convinced him that the general health services could not be expected to play

an important role in any area-wide disease campaign, since these services were inevitably directed toward individual care, mostly of the curative kind. House-to-house visits and family contacts, which Soper considered essential to satisfactory operations, were all too often exclusively limited to urban populations which were easily accessed. As he explained many years later in his diary, the Rockefeller Foundation's experience had shown that when a specific hookworm program was integrated into the general services, hookworm disease "became another disease to treat when the… patient came to the dispensary." Soper (4 May 1964) believed that integration of disease control programs into the general health services produced a decline in the fight against specific diseases; he feared the same consequences for malaria.

Like other arch-eradicationists, Soper saw no role for the health services in malaria control. His position was rather simple. Like George Macdonald, the British scientist, had proposed earlier, he envisioned eradication starting in one or more areas and expanding to cover major regions until the entire globe was free of malaria. By stressing the role of the health services in safeguarding whatever degree of eradication had been achieved, even if only confined to a national or sub-national level, Soper argued that this doomed the campaign, since there were not enough resources to simultaneously pursue global eradication and develop health services capable of carrying out the epidemiological surveillance required to maintain eradication on a limited basis. As far as I am aware, Soper's position was never expressed clearly in any public setting after his retirement from PAHO. Only in his diary, after the WHO campaign was clearly in serious trouble, did he express himself in unambiguous terms, as can be seen in this entry from May 4, 1964:

> I refuse to be pessimistic regarding the future … the measures which are building up will eventually force the World Health Organization to abandon the Alvarado [the Argentine Director of the Malaria Eradication Programme] proposal for rural health infrastructures and will lead to the development of more highly specialized malaria eradication efforts with adequate technical and administrative support for efficient and honest services (Soper, 4 May 1964).

Soper couched his public criticism of WHO's malaria program in such vague terms as to leave doubt as to whether even those sympathetic to his position were fully aware of how strongly he opposed the manner in which WHO was engaging the eradication campaign. This may account for the fact that the debates in the 1960s over the feasibility of eradication make no reference to Soper's position. Had such a debate taken place with Soper's participation, supporters of general public health systems would have learned not only that there was a major division in the eradication camp, but also that the role of the health services in malaria control was a difficult, even controversial, subject of major importance. They would have learned, for example, that the Venezuelan Arnoldo Gabaldón, who was responsible for establishing the first Malaria Expert Committee in 1946 and who had participated in almost all of its first 15 sessions, approached the question of malaria eradication in a manner that antagonized both Soper and WHO. He neither sought total eradication throughout all of Venezuela, nor did he rely at all on the general health services to maintain what the eradication program had achieved. Instead, he went so far

as to consider spraying as a measure to be applied seasonally, like periodic vaccination campaigns (Litsios, 1998, p.234).

There can be little doubt that the possibility of funding for the basic infrastructure prospects that became popular among donors and international agencies played a critical role in pushing WHO to promote the fortification of local health services at the expense of an all-out vertical global effort to eradicate malaria, and several experts and even newspapers argued that a ten-fold increase was needed to continue the eradication campaign. Having heavily invested in the program over the previous years, the US Congress decided to close any further appropriations for malaria eradication after 1961. This decision can be explained by frustration among politicians in the absence of rapid results, and the growing attraction of other international themes, such as family planning and smallpox control. The other major supporter of the global campaign at that time, UNICEF (support which Soper assiduously helped generate, through his friendships with several highly-placed UNICEF staff), was also showing signs of financial weariness. Knowing this, Candau attended the June 1961 session of UNICEF's Executive Board to ask this agency to maintain its financial support. Although the board re-affirmed the USD 10 million ceiling for malaria projects, in practice no effort was made thereafter to achieve it. In fact, UNICEF's contribution had already peaked in 1959 at USD 8.8 million. The economic crisis of the early 1970s, with recession, high unemployment, and high inflation in the USA and several other countries, further contributed to the accelerated contraction of funding for malaria control. Moreover, oil shortages caused considerable increases in insecticide prices, since petroleum was an important component of DDT and other insecticides.

The global campaign formally ended in 1969, when the World Health Assembly that took place in Boston formally approved a resolution stating that while eradication could not be achieved in the foreseeable future, it remained as an ultimate goal (Packard, 2007, p.173). The Assembly really decided that programs to control and eradicate malaria would coexist (in contrast with the idea of the mid-1950s). It was not an easy decision, and many representatives from developing countries wanted to continue with the global eradication campaign.This goal was not taken seriously by subsequent World Health Assemblies, and work on malaria was deemphasized. However, an important change was under way in terms of WHO membership which would have an effect on the priority given to malaria in the future. Between 1960 and 1965, 24 new African countries entered the UN and WHO. Given the enormous importance of malaria in Africa, they naturally pressured WHO to pay more serious attention to their continent. This influence had an impact in the 1970s and the following decades.

Post-eradication: 1969-present

After 1969, the idea of malaria eradication declined for some years; a return to malaria control during the 1970s was not easy, and did not occur quickly. As far as WHO's malariologists and its expert committee were concerned, the World Health Assembly's call for flexibility in malaria operations in 1969 did not invalidate the notion of eradication, as we can see from the 15th Malaria Expert Committee that met in 1970, extending the

original notion of a time-limited program to one that was long-term with definite time targets for attaining interim objectives and leading ultimately to eradication. Postponing eradication was the mainstream tone. According to the Committee, those countries not yet ready for a time-limited program (such as those in tropical Africa) could begin by organizing malaria control operations as a routine activity of their general health services under the direction and supervision of a special antimalaria unit in order to specifically reduce malaria. Then at a later (and unidentified) stage, they would plan a unified nation-wide eradication program (WHO, 1970, p.9). A corollary statement was made by the 16th Malaria Expert Committee meeting of the WHO in 1973; eradication remained the long-term goal, and the achievements of the global program were "most encouraging." At the same time, control was praised. The 1973 Committee recommended that WHO, while continuing to support malaria eradication programs, should "stimulate, guide, and assist malaria control programs with renewed vigor" (WHO, 1973, p.80). Contrary to Soper's ideas, the committee fully recognized malaria programs as an integral function of the basic health services (p.80). Only in the 1975 and 1976 sessions of the Executive Board (EB) of WHO and the World Health Assemblies approved resolutions that no longer referred to eradication, as seen in the 57th EB meeting in January 1976 requesting the director-general to help countries develop more "realistic and flexible approaches" in antimalaria programs adapted to their different epidemiological and socioeconomic conditions (WHO, 27 Jan. 1976). The inherent difficulty can be seen in a comment by Dr. T. Lepes, director of the WHO malaria program in the 1970s, who subtly criticized the director-general because his report did not clearly explain how these programs could be organized (WHO, 1975, p.523). This was not the only critique from within the agency; Mohyeddin A. Farid, a retired senior WHO malariologist, chaired the 1970 session of the Malaria Expert Committee. He was an ardent advocate of eradicating malaria, and closely followed Soper's ideas. When asked how he remembered the early 1960s, Farid told of how in one staff meeting, Carlos Alvarado (the director of the Malaria Eradication Program in Geneva) had illustrated the shift in strategy by placing a full glass of water on a tray (the old vertical strategy) and then pouring its contents out into the tray (the new total coverage horizontal strategy), which prompted Farid (1980, p.425) to observe ironically "In no time at all it will evaporate." Farid believed that the goal of global malaria eradication should be maintained.

A change in the leadership of the main multilateral health agency represented a problem for those who supported Farid and Soper's ideas. Candau was succeeded as WHO director-general by the Dane Halfdan Mahler, in 1973. Mahler was a tuberculosis specialist who was re-elected for two successive five-year terms, and remained as director-general until 1988. It was under his leadership that the Primary Health Care (PHC) approach was developed (an approach seen by many as a staunch defense of general health services). When addressing the EB in January 1976, Mahler noted that his attitude toward malaria eradication was partly derived from his experience with a past proposal that WHO should develop an eradication program for tuberculosis. He had resisted that proposal on technical grounds, and for the same reasons felt it unwise to expect global malaria eradication within a specified time

frame (WHO, Jan. 1976, p.181). More revealing is his statement to the Ad Hoc Committee on Malaria that the EB had established, when he indicated that it was probably "a mistake" to stipulate that global eradication remained as the objective of the agency when it was "obviously out of reach for decades to come, with the means at our disposal" (WHO, 1976, Annex 2, p.12). The committee itself toned down his criticism by observing that it was important to stress that control of malaria, including its ultimate eradication, should be a continuing, long-term activity requiring periodical evaluation and reconsideration of strategies applied, and emphasizing the need for "sustained efforts" by governments and international organizations in providing financial support for the program (WHO, 1976, p.60). For all intents and purposes, the campaign to eradicate malaria as conceived in the mid-1950s was abandoned in the late 1970s and early 1980s.

After PHC displaced malaria as WHO's top priority, it is not surprising that Mahler, in his address to the 17th Malaria Executive Committee meeting in 1979, stressed the significance of the development of the PHC concept and the inclusion of curative and preventive services (including control of infectious diseases) in the framework of PHC. The author of this article attended this meeting and remembers that the reputed British malariologist Leonard Bruce-Chwatt (author of *Essential malariology*, published the following year) said that Mahler was speaking to the converted. Farid, known for his staunch support of eradication, who was present, did not say anything. His silence suggests that the supporters of the original idea of malaria eradication conceived in the mid-1950s were in retreat and preferred to maintain a low-key profile at the agency.

The 17th session of the Expert Committee of 1979 is also notable for the lack of any substantive discussion of ongoing malaria eradication efforts. Nevertheless, the report of the session stated that the "ultimate objective of any malaria control program" was still seen to be the "eradication of the disease from an area, a country, a continent, and eventually from the globe" (WHO, 1979, p.13). For some, this statement contradicted the new general orientation Mahler wanted to give to the agency and reflected the persistence of technocratic approaches to disease control at WHO. In any case, it appears that both approaches – malaria eradication and PHC – coexisted in the organization. Given the ascendency of PHC, the 17th Expert Committee did pay particular attention to community participation, noting that it should be *sine qua non* along with "community's understandings of the effects of the different methods of control, and even considered that success of disease control operation greatly depend on the work with community leaders" (WHO, 1979, p.13). This was the first time in the history of WHO that the roles of individuals and communities in a disease control program were emphasized and specified; these roles included vector control methods as well as individual protection against mosquito bites. Farid did not believe that vector control could be incorporated into the PHC approach. In his opinion, adequate treatment could only be done by professional or trained health workers, not by uneducated lay personnel living in communities. Moreover, according to Farid (1998, p.420) vector control was a military operation, and there was no "democracy" in this operation because certain measures had to be imposed. This idea reflected an important assumption of malaria eradication: the experts knew what was good for the general population.

In 1982 a study group was convened by WHO on malaria control as part of PHC. It is important to explain that this study group differed from an expert committee in that it dealt with a subject considered to be problematic; in other words, it addressed problems of a highly uncertain character for which expert consensus may not be available. While there was a positive attitude by the group towards PHC, many outstanding problems related to human health resources were identified, one of them the fact that the manpower and associated training required for malaria control have been made "even more complicated" because "traditional, vertical, disease-oriented programs are no longer an acceptable way of meeting the health needs of populations in the developing world" (WHO, 1984, p.26). It is important to underline that this was one of the first criticisms of the vertical approach in the agency. The study group also identified some operational problems and knowledge gaps that hampered program implementation in individual countries and could only be resolved by practical experience. Furthermore, it stated that potential solutions "must be tried out carefully, and evaluated in the context of the actual situations" (WHO, 1984, p.47). Many of the problems considered by the group concerned the role of health services workers in malaria control, an issue dear to the supporters of PHC.

The 18th Executive Committee (which met in September 1985) acknowledged that most countries were experiencing great difficulty in modifying established health services, some because of the ongoing perpetuation of vertical programs and others due to the loss of professional and skilled staff. Another reason for this difficulty was undoubtedly the low level of political commitment to developed comprehensive national health systems. Additionally, the Committee noted that malaria control activities were rarely designed with serious consideration of the different social and economic development patterns within countries (WHO, 1986, p.11). While China – which did not participate in the global campaign of the 1960s – had managed to virtually eliminate malaria mortality through its PHC approach, the Committee noted that even if malaria control activities became an integral part of general services, severe problems related to interpretation, delays in implementation, and reluctance to change plagued that integration (WHO, 1986, p.14). The Committee went on to call upon countries to review their antimalaria activities in the light of the principles of PHC and their state of development. Moreover, it emphasized that the planning of malaria control as a component of PHC should take into account concurrent activities for health promotion and control of other diseases (WHO, 1986, p.93). As a result, despite China's experience, the expert committee was at a loss to recommend in more precise terms the changes that national governments had to make to improve the role of the health services in the control of malaria.

In November 1986, a scientific group was held on the Integration and Management of Vector Control in PHC. Given its mandate, malaria was just one of several diseases considered. Unlike the 1982 study group on malaria discussed above, this meeting was served by a relatively large number of background papers, several of which expressed sentiments that questioned PHC to some extent. In particular, Jean Mouchet (a medical

anthropologist and former member of the Institute Français de Recherche Scientifique pour le Développement en Coopération in Paris) wrote explicitly on the limitations to community action for vector control (Mouchet, 1986, p.17). Like Farid, he questioned the ability of villagers to learn how to use appropriate technologies for malaria control and difficulties sustaining motivation among members of the community. Nevertheless, the group agreed that many malaria vectors could be successfully controlled by the community with guidance and support from a professional core group or the district health management team. As for malaria prevention, it noted that personal protection methods were increasingly implemented to exclude man-vector contact, bednets in general and insecticide-impregnated bednets in particular. In a statement that would have a lasting influence, the group said that local production of bednets should be encouraged (WHO, Nov. 1986, p.14).

In view of the malaria control situation, which remained especially critical in sub-Saharan Africa, a ministerial conference on Malaria was organized and held in Amsterdam in October 1992. The Amsterdam Conference endorsed a Global Malaria Control Strategy, which included the need to provide early diagnosis and prompt treatment, to plan and implement sustainable prevention (including vector control), and to contain epidemic outbreaks as soon as possible. The conference also stressed the importance of strengthening local capacities in basic and applied research to assess a country's malaria situation while paying attention to the ecological, social, and economic determinants of the disease, and support of decentralized structures in which those closest to the problem employ available resources. In January 1993, the executive board endorsed the World Declaration on the Control of Malaria that had been adopted by the ministerial conference held in Amsterdam the year before. The following month a study group was held to discuss the implementation of the new global malaria control strategy. It recommended, *inter alia*, that malaria control be developed as an integral part of national policies for the implementation of PHC. Furthermore, countries were urged to support efforts to review their current antimalaria control activities within the broader health care context; the group recognized that malaria control activities could be undertaken in isolation by the health sector alone, and called for greater intersectoral cooperation in malaria control activities within the PHC strategy at local, national, and international levels (WHO, 1993, p.54-55).

A major change in antimalaria efforts at WHO occurred a few years later, when a unit received sizable funds and embraced a comprehensive strategy. The Roll Back Malaria (RBM) initiative was launched as a WHO Cabinet Project in 1998; it reported directly to WHO's newly-appointed director-general, Dr. Gro Harlem Brundtland, a physician from Norway who was a newcomer to the agency and was determined to launch major programs and an internal reform. At the time, the British director of RBM, David Nabarro (who had worked inthe UK's bilateral agency which was providing much of the funding for RBM), invited the author of this article to supposedly talk about the malaria book he had read. Instead, he showed a Power Point presentation on RBM. Upon reaching the main hall of WHO, the author of this article met two senior members of the malaria unit, who asked "Tell us what it is" (referring to the Roll Back Malaria program), suggesting that key members of the malaria unit were unaware of the RBM initiative. This can be explained by the fact

that it had emerged from the Tropical Disease Research program under the leadership of its Director Tore Godal from Norway, in other words, not directly from WHO's malaria unit. RBM endorsed a multisectoral approach involving a range of government ministries, and called for the reinforcement of basic health services (RBM, 2019).

An important parallel development to RBM was a decision to recruit prominent non-WHO leaders. Brundtland invited Jeffrey Sachs, a Harvard University economist described by the *New York Times* as "probably the most important economist in the world," to lead a Commission on Macroeconomics and Health established in January 2000. The Commission's report, *Macroeconomics and health: investing in health for economic development*, concluded among other findings that malaria was "taking a far greater toll on the economy of many developing countries than had been previously estimated" (Chorev, 2012, p.183). In 2001, Sachs and John Gallup (also from Harvard) published an article entitled "Economic burden of malaria" in *The American Journal of Tropical Medicine and Hygiene* which showed a high correlation between countries with low GDP and those with malaria (Packard, 2007, p.201). The article became an example of the cost-effective justification that was becoming so popular in validating disease control programs in the new neoliberal era which had emerged in most of the countries during the 1990s. Despite the argument that investing in malaria made good economic sense, adequate global funding to sustain RBM proved problematic, since donor agencies had other priorities besides malaria, including AIDS and tuberculosis. More disturbing is the fact that the funds provided were focused on distributing materials, mainly insecticide-treated bednets (ITNs, which were dip-treated in a synthetic pyrethroid insecticide, doubling protection compared with untreated nets), rather than addressing the underlying weaknesses of health systems (Packard, 2007, p.224). This occurred almost simultaneously with a return to DDT, around 2006. After decades of being criticized as an insecticide that contaminated the environment, DDT was touted and approved by USAID and WHO as an effective way to fight malaria.

That the emphasis on technology persisted is suggested by WHO reporting in 2015, which hoped to accelerate progress on malaria work by solving technical challenges. The report only partially included inadequate performance of public health systems as a challenge. In fact, this was a major problem because they sustained weak systems for surveillance, monitoring, evaluation, and management of drugs and personnel, as well as an unregulated private health sector that resorted to ineffective antimalarial medicines or vector control products. In addition, problems that went beyond the scope of technological solutions included lack of adequate technical and human resource capacities to sustain and scale up efforts and a disproportionate risk of malaria among hard-to-reach populations, including high-risk occupational groups, migrants, people in humanitarian crises, and rural communities with poor access to health services (WHO, Oct. 2015, p.6).

An effort to address some of these problems has been made during the past few years. The Malaria Policy Advisory Committee (MPAC) was established in 2011 to provide independent advice to WHO on developing policy recommendations to control and eliminate malaria. It brought together some of the best experts in the world, and convenes twice a year in Geneva. A WHO Strategic Advisory Group (SAG) on malaria eradication, formed by 13 experts representing a range of disciplines, was established in 2016, and was supported by

the assistant director-general for HIV/AIDS, Tuberculosis, Malaria and Neglected Tropical Diseases. The initial task of the SAG was to analyze the evolving malaria landscape, taking into consideration a broad set of factors that underpin the disease: biological, technical, financial, socioeconomic, political, and environmental. Its members reviewed trends in poverty and population growth, mobility, agricultural use, urbanization and communication. It also considered other factors including the role of climate change and potential developments in research and innovation.

On November 19, 2018, WHO and the RBM Partnership to End Malaria (the new name for RBM) launched "a new approach to jumpstart progress in the fight against malaria." The new approach was launched during a high-level meeting held in Maputo, Mozambique which included wide representation from malaria-affected countries, donor agencies, and global health organizations. At the same time, the World Malaria Report published by the WHO in 2018 showed that progress in the global malaria response had stalled. According to this report, in 2017 there were an estimated 219 million cases globally, and 435,000 deaths related to the disease (WHO, 2018). It considered what was needed to get back on track, and its role in achieving greater impacts in countries with a high malaria burden. The new "high burden high impact" approach is anchored by four pillars: a call on leaders to translate their political commitments into resources and tangible actions; the use of strategic data to pinpoint in a given country where to deploy the most effective malaria control tools for maximum impact; improved and targeted global policies and strategies to help countries deliver the optimal mix of tools; and a coordinated country response that aligns partners and engages sectors beyond health.

This proposal emerged when WHO was no longer the only global organization fighting malaria; many bilateral and philanthropic organizations and transnational NGOs have solid malaria programs. In 2007, the Bill and Melinda Gates Foundation announced that malaria eradication was one of its main goals, invested sizable resources, and expressed its hope to eliminate the disease during the next few decades. Further evidence of new institutional actors in this fight was the 2007 launch of the University of California San Francisco Global Health Group's Malaria Elimination Initiative (MEI), which is an independent global advisory body charged with clarifying and advancing the operational, technical, and financial requirements for national and regional malaria elimination. The MEI, like the Gates Foundation (and WHO), believes global malaria eradication is possible within a generation.

The MEI and *The Lancet* convened the Lancet Commission on Malaria Eradication, which is designed to complement and supplement the WHO Strategic Advisory Group on malaria eradication. The commission will elaborate the scientific, financial, and operational requirements to achieve malaria eradication, and comprises 27 leaders in science, epidemiology, policy, finance, economics, and implementation who planned to meet during a 12-month period and eventually publish the commission's report in 2019 (Chen et al., 2018). The commission was expected to develop the scientific, financial, and operational requirements to achieve malaria eradication. It is important to mention that this is part of a series of new initiatives aimed at keeping malaria high up on the political agenda, mobilizing additional resources, and empowering communities to take ownership of malaria prevention and care.

Final considerations

As this historical account demonstrates, major changes in the assumptions on control and elimination of malaria have been seen the past few decades. However, solving poverty in rural areas and paying full attention to human resources rarely received the attention they deserved. I am in no position to judge whether current global strategies concerning malaria will lead to the eventual world-wide elimination of malaria. There has been a significant decline in the morbidity and mortality of malaria over the past few years, and this is an important achievement. However, it is important to take into account the problems related to infrastructure, human resources, and politics which are still pending in order to eliminate this disease. There has been (and still is) an overemphasis on management and technology, and the financial resources for malaria are insufficient and declining. Given the ability of the malaria parasite to hide in humans, I think it is no longer reasonable to propose a goal of complete eradication over the next decades, as some international organizations have stated in recent years. I cannot help but express my great disappointment, and even dismay, at how little of the global fundingin existence today has been used to strengthen the ability of health services to control malaria. Admittedly, in the final analysis it is up to national governments to provide sufficient leadership, trained personnel, and technical support for the health services to perform better, but greater funding from all developed and developing countries is urgently needed to prod them into performing better. Unfortunately, if history is to serve as a guide, future prospects even for elimination remain poor.

REFERENCES

BAGSTER WILSON, Donald. *Report of the Malaria Unit*. Moshi, Tanzania: Printed by the Government. 1938.

BRADLEY, David. The last and the next hundred years of malariology. *Parassitologia*, v.41, n.13, p.11-18. 1999.

CHEN, Ingrid et al. The Lancet Commission on malaria eradication. *The Lancet*, v.391, n.10130, p.1556-1558. 2018.

CHOREV, Nitsan. *The World Health Organization between North and South*. Ithaca: Cornell University Press. 2012.

DU BOIS, Cora. Letter to Mani, 6 June 1950. Tozzer Library, Harvard College Library. Cora Alice Du Bois Papers (Harvard University, Cambridge, MA). 6 June 1950.

FARID, Mohyeddin. The malaria campaign: why not eradication. *World Health Forum*, v.19, n.4, p.417-427. 1998.

FARID, Mohyeddin. The malaria programme: from euphoria to anarchy. *World Health Forum*, v.1, p.8-33. 1980.

FARLEY, John. *Brock Chisholm, the World Health Organization, and the Cold War*. Vancouver: University of British Columbia Press. 2008.

HACKETT, Lewis. *Malaria in Europe*: an ecological study. London: Oxford University Press. 1937.

LITSIOS, Socrates. William Crawford Gorgas (1854-1920). *Perspectives in Biology and Medicine*, v.44, n.3, p.368-78. 2001.

LITSIOS, Socrates. Arnoldo Gabaldón's independent path for malaria control and public health in the Tropics: a lost "paradigm" for WHO. *Parassitologia*, v.40, n.1-2, p.255-278. 1998.

LITSIOS, Socrates. Malaria control, the Cold War, and the postwar reorganization of international assistance. *Medical Anthropology*, v.17, n.3, p.255-278. 1997.

LNHO. League of Nations Health Organization. *Report of the Intergovernmental Conference on Far-Eastern*

Countries on Rural Hygiene: Bandoeng, August 3rd to 13th 1937. Geneva: League of Nations. 1937.

LNHO.
League of Nations Health Organization. Report of the Pan-African Health Conference: Johannesburg, 20 to 30 July 1935. *Quarterly Bulletin of the Health Organization*,v.5, n.1, p.1-209. 1936.

MOUCHET, Jean.
Limitations to community action for vector control. VBC/PMO/SG/WP/86, unpublished WHO document (Library of the World Health Organization, Geneva). 1986.

PACKARD, Randall.
The making of a tropical disease: a short history of malaria. Baltimore: John Hopkins University Press. 2007.

PACKARD, Randall; GADELHA, Paulo.
A land filled with mosquitoes: Fred L. Soper, the Rockefeller Foundation, and the Anopheles gambiae invasion of Brazil. *Parassitologia*, v.36, n.1-2, p.197-213. 1994.

RBM.
Roll Back Malaria. *RBM partnership to end malaria vision*. Available at: <https://endmalaria.org/about-us/vision>. Access on: 7 July 2019. 2019.

RUSSELL, Paul.
Man's mastery of malaria. London: Oxford University Press. 1955.

RUSSELL, Paul.
Diary entry, 14 May 1952. Russell, Paul F. Diary; Rockefeller Foundation records; Officers' diaries, Record Group 12.1 diaries (Rockefeller Archive Center, Sleepy Hollow, NY).14 May 1952.

RUSSELL, Paul.
The present status of malaria in the world. *The American Journal of Tropical Medicine and Hygiene*, v.1, n.1, p.111-123. 1952.

RUSSELL, Paul.
Malaria and society. *Journal of the National Malaria Society*, v.10, n.1, p.1-7. 1950.

RUSSELL, Paul.
Diary entry, 14 May 1948. Russell, Paul F. Diary; Rockefeller Foundation records; Officers' diaries, Record Group 1212.1 diaries (Rockefeller Archive Center, Sleepy Hollow, NY). 14 May 1948.

RUSSELL, Paul.
Diary entry, 13 May 1948. Russell, Paul F. Diary; Rockefeller Foundation records; Officers' diaries, Record Group 1212.1 diaries (Rockefeller Archive Center, Sleepy Hollow, NY). 13 May 1948.

RUSSELL, Paul.
Diary entry, 27 Aug. 1947. Russell, Paul F. Diary; Rockefeller Foundation records; Officers' diaries, Record Group 1212.1 diaries (Rockefeller Archive Center, Sleepy Hollow, NY). 27 Aug. 1947.

RUSSELL, Paul.
Lessons in malariology from World War II. *American Journal of Tropical Medicine*, v.26, n.1, p.5-13. 1945.

RUSSELL, Paul.
Epidemiology of malaria in the Philippines. *American Journal of Public Health*, v.26, n.1. p.1-7. 1936.

SOPER, Fred.
Diary entry, 4 May 1964. Fred Lowe Soper Papers, Archives and Modern Manuscripts Program, History of Medicine Division (National Library of Medicine, Bethesda, MD). 4 May 1964.

WELLER. Tom H.
The field of Tropical Medicine and research in the field: perfectionism at the end of the line. *The American Journal of Tropical Medicine and Hygiene*, v. 28, n.2, p.180-183. 1979.

WHO.
World Health Organization. *World Malaria Report 2018*. Available at: <https://apps.who.int/iria/bitstream/handle/10665/275867/9789241565653-eng.pdf?ua=1>. Access on: 1 Sept. 2019. 2018.

WHO.
World Health Organization. *Malaria situation, 2015*: based on updated WHO Fact Sheet. Geneva: WHO. Oct. 2015.

WHO.
World Health Organization. *Study Group on the implementation of the Global Plan of Action for Malaria Control*: 1993-2000, Geneva 8-12 February 1993 (WHO Technical Report Series, n.839). Available at: <https://apps.who.int/iris/bitstream/handle/10665/37106/WHO_TRS_839_eng.pdf?sequence=1&isAllowed=y>. Access on: 31 Aug. 2019. 1993.

WHO.
World Health Organization. Expert Committee on Malaria. *Eighteenth Report* (WHO Technical Report Series, n.735). Available at: <https://apps.who.int/iris/bitstream/handle/10665/39415/WHO_TRS_735.pdf?sequence=1&isAllowed=y>. Access on: 13 Aug. 2019. 1986.

WHO.
World Health Organization. *Vector control in primary health care*: report of a WHO scientific group (Technical Report Series, n.755). Available at: <https://apps.who.int/iris/

bitstream/handle/10665/38327/WHO_TRS_755.pdf?sequence=1>. Access on: 1 Sept. 2019. Nov. 1986.

WHO.
World Health Organization. *Malaria control as part of primary health care* (Technical Report Series, n.712). Available at: <https://apps.who.int/iris/bitstream/handle/10665/38825/WHO_TRS_712.pdf?sequence=1&isAllowed=y>. Access on: 28 July 2019. 1984.

WHO.
World Health Organization. Expert Committee on Malaria. *Seventeenth Report* (Technical Report Series, n.640). Available at: <https://apps.who.int/iris/bitstream/handle/10665/41359/WHO_TRS_640.pdf?sequence=1&isAllowed=y>. Access on: 28 Aug. 2019. 1979.

WHO.
World Health Organization. Development of the Antimalaria Programme. *Executive Board resolution EB57.R26*. Available at: <https://apps.who.int/iris/bitstream/handle/10665/90921/EB57R26_eng.pdf;sequence=1>Access on: 2 Aug. 2019. 27 Jan. 1976.

WHO.
World Health Organization. Fifty-seventh session of the Executive Board. *Official Records of the World Health Organization*, n.232. Available at: <https://apps.who.int/iris/bitstream/handle/10665/86028/Official_record232_eng.pdf?sequence=1>. Access on: 22 Aug. 2019. Jan. 1976.

WHO.
World Health Organization. Development of the Antimalaria Programme: report by the Ad Hoc Committee on Malaria of the Executive Board. EB57/19, Annex 2. Geneva: World Health Organization. Available at: <https://apps.who.int/iris/bitstream/handle/10665/152508/EB57_19_eng.pdf?sequence=1&isAllowed=y>. Access on: 1 Aug. 2019. 1976.

WHO.
World Health Organization. Twenty-Eighth World Health Assembly: verbatim records of plenary meetings: summary records and reports of committees. Geneva, 13-30 May 1975. *Official Records of the WHO*, n.227. Available at: <https://apps.who.int/iris/handle/10665/86023?search-result=true&query=WHO+Twenty-Eighth+World+Health+Assembly%2C+Geneva%2C+13-30+May+1975%2C+Off+Rec+WHO+227%2C+1975.&scope=&rpp=10&sort_by=score&order=desc>. Access on: 31 July 2019. 1975.

WHO.
World Health Organization. Expert Committee on Malaria. *Sixteenth Report* (Technical Report Series, n.549). Available at: https://apps.who.int/iris/bitstream/handle/10665/41087/WHO_TRS_549_eng.pdf?sequence=1&isAllowed=y>. Access on: 29 July 2019. 1973.

WHO.
World Health Organization. Expert Committee on Malaria. *Fifteenth Report* (WHO Technical Report Series, n.467). Geneva: WHO. 1970.

WHO.
Seventeenth World Health Assembly, Geneva, 3-20 March 1964. *Proceedings*, part II: plenary meetings/verbatim records: committees: minutes and reports. Geneva: WHO. 1964.

WHO.
World Health Organization. Proceedings of the Fifteenth World Health Assembly. *Official Records of the WHO*, n.119. Available at: <https://apps.who.int/iris/bitstream/handle/10665/85749/Official_record119_eng.pdf?sequence=1&isAllowed=y>. Access on: 2 Aug. 2019. 1962.

WHO.
World Health Organization. Proceedings of the Fourteenth World Health Assembly. *Official Records of the WHO*, n.110. Available at: <https://apps.who.int/iris/bitstream/handle/10665/85737/Official_record110_eng.pdf?sequence=1&isAllowed=y>. Access on: 1 Aug. 2019. 1961.

WHO.
World Health Organization. Proceedings of the Thirteenth World Health Assembly. *Official Records of the WHO*, n.103. Available at: <https://apps.who.int/iris/bitstream/handle/10665/85729/Official_record103_eng.pdf?sequence=1&isAllowed=y>. Access on: 28 July 2019. 1960.

WHO.
World Health Organization. Resolutions and decisions: plenary meetings: verbatim records: committees: minutes and reports: annexes. *Official Records of the WHO*, n.95, p.78. Available at: <https://apps.who.int/iris/handle/10665/85719?search-result=true&query=official+records+of+the+WHO+no.+95&scope=%2F&rpp=10&sort_by=score&order=desc>. Access on: 31 July 2019. 1959.

WHO.
World Health Organization. *Sixth Malaria Expert Committee*. Document WHO/MAL/180 (WHO Archives and Library, Geneva). 30 Nov. 1956.

WHO.
World Health Organization. *Malaria control and DDT resistance of Anophelines*. EB5/74 (WHO Archives and Library, Geneva). 17 Jan. 1955.

WHO.
World Health Organization. Eighth World Health Assembly, Mexico 10-27 May 1955. *Official Records of the WHO*, n.63. Available at: <https://apps.who.int/iris/bitstream/handle/10665/85662/Official_record63_eng.pdf?sequence=1&isAllowed=y>. Access on: 30 July 2019. 1955.

WHO.
World Health Organization. *Report of the Fourth Session of the Malaria Expert Committee*. WHO/MAL/70 (WHO Archives and Library, Geneva). 17 Jan. 1951.

WHO.
World Health Organization. *Joint programme based on cooperation between government*: FAO and WHO to increase world food production and raise standards of health. Paper for 2d WHA-A2-5410; unpublished paper (WHO Archives and Library, Geneva). June 1949.

WHO.
World Health Organization. WHO Expert Committee on Malaria. *Report on the First Session of the Malaria Expert Committee*. WHOIC-79 (WHO Archives and Library, Geneva). 30 June 1947.