



Policy Frameworks for Malaria Eradication

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ABSTRACT

Malaria eradication remains one of the most ambitious global health goals, demanding robust and adaptive policy frameworks that bridge scientific innovation with effective local implementation. This paper critically examines the evolution and effectiveness of malaria eradication policies, emphasizing the interplay between global strategies and national-level action. Despite the availability of evidence-based interventions, including vector control, chemoprevention, and surveillance, policy translation continues to face substantial barriers such as inadequate funding, weak governance, limited community ownership, and insufficient integration with broader socio-economic and environmental policies. Sustained political will and transparent governance are shown to be indispensable for program continuity, while meaningful community engagement emerges as a key determinant of intervention success. Resource allocation and monitoring frameworks are explored as essential policy instruments for ensuring accountability, optimizing intervention delivery, and guiding adaptive decision-making. The study analyzes successful eradication case studies from Sri Lanka and Morocco, highlighting how context-specific strategies, leadership, and multisectoral collaboration drove elimination outcomes. Emerging technologies such as gene-drive mosquitoes, mobile health solutions, and genomic surveillance, are identified as transformative tools for strengthening eradication efforts. However, their deployment raises complex ethical concerns around equity, access, and informed consent, especially in low-income, high-burden regions. The paper concludes that future malaria eradication policy must prioritize sustainable financing, intersectoral integration, ethical governance, and flexibility to accommodate climatic and epidemiological variability. Achieving malaria eradication by 2030 under the Sustainable Development Goals will require innovative partnerships, local empowerment, and global solidarity to translate scientific advances into equitable and enduring health outcomes.

Keywords: Malaria Eradication Policy, Global Health Governance, Community Engagement, Innovative Technologies, and Ethical and Equity Considerations.

INTRODUCTION

Malaria is a parasitic disease transmitted by Anopheles mosquitoes that threatens five billion people worldwide [1]. It poses a significant challenge to global health policy due to its far-reaching impact on economic development, especially in sub-Saharan Africa [1]. Malaria control aims to lower the incidence and prevalence of the disease through interventions that reduce transmission intensity or the risk of infection among exposed populations. Malaria prevention focuses on maintaining transmission at low levels or reducing the risk of infection to zero. Malaria elimination involves achieving zero malaria incidences in a defined geographical area through deliberate activities designed to interrupt ongoing transmission, lasting at least three years [2]. Malaria eradication is a program of interventions implemented with the goal of interrupting transmission country-wide and reducing the risk of re-introduction to zero. Eradication has yet to be achieved; however, nearly half of the world's countries were malaria-free by the 1960s and significant progress has been made towards global eradication since 2000 [8]. Effective policy frameworks are essential for malaria eradication. Nonetheless, their diversity represents a major challenge to the design and coordination of optimal strategies. International standards issued by the World Health Organization aim to coordinate national policy frameworks. However, this effort has proven insufficient to address the diversity of contexts across endemic countries [3]. Consequently, local initiatives emerge to fill gaps and complement these international standards with respect to local

particularities [6]. Yet, this complementation remains under-explored and little guidance is available to coordinate national policy frameworks accordingly. Given the significant costs and investments required to eliminate the disease, it is critical for insects to delineate how environmental and sociological contexts shape complementary policy-making models and how these models can be articulated with WHO international standards in order to optimize the chances of global malaria-eradication success [7].

Global Malaria Burden

Malaria remains a major global health burden, especially for the poor and vulnerable. In 2016, malaria caused an estimated 445,000 deaths and 216 million episodes of clinical illness [2]. The disease is endemic in 91 countries and is caused by *Plasmodium* parasites transmitted by mosquitoes [3, 2]. Five species are responsible for the bulk of human disease, and of these *Plasmodium falciparum* is the most common in sub-Saharan Africa, the most severe globally, and the species historically associated with the greatest morbidity and mortality [4]. Interventions where fully deployed, properly managed, and locally appropriate have demonstrated substantial impact [5]. For this reason, malaria eradication is an aspirational global goal.

Historical Context of Malaria Control

Malaria has been a major cause of human suffering for thousands of years [6]. Throughout the twentieth century, attempts to limit the impact of malaria were at times surprisingly successful, but parasite and vector populations were resilient and the disease has remained a tropical scourge to this day [6]. In 1955, the World Health Assembly made malaria eradication the goal of national programmes worldwide; formally recognizing what had been the de facto aim of the previous 20 years. Since the discovery of dichloro-diphenyl-trichloroethane (DDT) in 1939, it was known that transmission could be interrupted by controlling adult mosquitoes. Experience from the campaign in Greece early in the century showed that uninterrupted transmission could be virtually eliminated by DDT residual spraying [5]. In the early 1950s, large parts of Italy were also declared free of malaria. Although the parasite was eventually eliminated, the mosquito remained endemic and resistant to DDT [17]. Considering the scientific advances and the spectacular results achieved in southern Europe, the lack of flexibility to adapt to local conditions became a crucial factor in the reappearance of malaria in areas previously cleared of the disease [7]. This was in large part a consequence of trying to design a universal strategy that was suitable for all endemic countries, without consideration of the socio-economic and cultural differences among them [7]. After the interruption of the global eradication campaign in 1969, it was clear that much of the world's malarious areas, and especially those of tropical Africa, would not be able to eliminate transmission of the disease in the short term. At a 1972 conference in Brazzaville, participants agreed that any control programme that combined chemotherapy with residual spraying could potentially eliminate malaria gradually, even in areas of hyper and holo-endemic transmission, but such success was uncertain [17]. They also concluded that the technical feasibility of an extensive anti-malaria programme had changed little since the beginning of the eradication era [7]. Although existing health services could not at the time manage effective, large-scale malaria control operations; they could nevertheless play an important part in treating cases, assisting in mass drug-administration campaigns, collecting data for monitoring purposes, and in providing health education [9]. Health education was considered the most important component, since one of the greatest hopes for any new campaign was to draw on the considerable resources of rural communities. Community leaders, schoolteachers, and voluntary health workers were seen as resources that could be exploited profitably by any successful malaria programme, but adequate health education was necessary in order to stimulate such co-operation [4]. It was emphasized that there was no point in initiating health education until proper research had been carried out to determine how to communicate effectively with such communities, and that pilot projects were almost a pre-requisite in order to provide people with a 'realistic picture of what it is possible to do'. The Alma Ata Declaration of 1978 completely changed the organization of health care services in the Third World, with Primary Health Care (PHC) becoming the cornerstone of health policy [23]. The concept was strongly endorsed by the international anti-malaria community, which devoted considerable new interest to the need to encourage active community involvement in control, and strategies that included health education and promotional work, both absent from the global eradication campaign of the 1950s [13]. American malariologists considered that the most important challenge of the post-eradication period was to integrate anti-malarial measures with programmes of PHC, and to train a workforce capable of delivering such services to rural populations [15]. This was the beginning of a much more community-centered approach to malaria.

Current Policy Frameworks

A major milestone in the eradication of malaria occurred in 2016 when World Health Assembly Resolution (WHA) 69.1 called for the global elimination of malaria as a public health threat by 2030 [8]. This bold and unprecedented goal is now embedded in the Sustainable Development Agenda 2030 [1]. Despite the public-health significance of this resolution, a much-needed policy framework that defines the components and scope of a comprehensive malaria eradication policy does not yet exist [1, 8].

World Health Organization Guidelines

WHO guidelines for malaria control underpin the global strategy for elimination and eventual eradication across the wider elimination agenda [2]. The Secretariat recommends a World Health Assembly (WHA) resolution on malaria eradication in 2020 and preparation of a technical report before the subsequent WHA meeting [8]. Work has started on a technical and strategic framework for malaria elimination alongside WHO analyses of trends towards eradication [2, 8]. New tools have facilitated substantial extensions of the elimination agenda. A wide range of national and regional efforts to expand the coverage of elimination is underway on every continent. The worldwide and regional programs of the Organization have important responsibilities in the effort to eradicate malaria from at least some, and possibly all countries of the world [7, 9]. WHO has recommended a reiteration of those responsibilities in the hope that they will receive greater attention at the national level [9]. The confidence with which it is possible to speak of eradication as a goal is justified by evidence of progress and the feasibility of extension [9, 10].

Regional Strategies and Initiatives

International initiatives combine with regional schemes to strengthen national programmes, encourage knowledge exchange and support elimination [8]. Several international organizations now facilitate collaboration and political dialogue on malaria control and elimination, including the Asia Pacific Malaria Elimination Network, Asia Pacific Leaders Malaria Alliance, Elimination Eight, and the Malaria Elimination Initiative [9]. For example, countries in the Elimination Eight initiative in southern Africa have committed to standardizing reporting methods, indicators and case definitions, harmonizing data, surveillance systems and drug efficacy studies, and alleviating the administrative burden on cross-border populations [10]. Cooperation on these issues mirrors that of onchocerciasis and lymphatic filariasis programmes in the sub-region and facilitates the coordinated introduction of elimination programmes and other public health policies. Similarly, the Asia Pacific Malaria Elimination Network connects countries and other partners in the region seeking to eliminate malaria before 2030. By pooling data and expertise, the network helps countries to attain and maintain malaria-free status through better surveillance, case study development, capacity building and policy development [8, 9].

Key Stakeholders in Malaria Eradication

Various levels and types of stakeholders, and their responsibilities and accountability, exist during the various phases of malaria eradication and, at any one time, span from the local to the international level in all countries of the world [23]. Governments and government agencies are primary players in eliminating malaria, with the assistance of certain non-governmental organizations and individuals. Internationally, national health authorities together with the World Health Organization (WHO) are key actors [30]. Large-scale programs require substantial and reliable funding [4]. These financial resources can be supplied by the beneficiaries themselves, the national treasury, a lot of money or a few people who profit from having the country malaria free, governmental bilateral assistance, the Global Fund to Fight AIDS, Tuberculosis and Malaria and the private sector [31]. The stakeholder map is equally broad when evolving policy and making the operational decisions needed for the elimination or eradication of malaria, both before and during the implementation phase [2, 30]. Within the health sector, decisions regarding vector control, surveillance and treatment generally rest with a mixture of the very top to intermediate levels of the national health authority, and particularly with the malaria control unit [21]. The Ministry of Health must support the malaria control services and accept the strategy proposed by the malaria control unit [5, 8]. As policies change with the epidemiological situation, other parts of the health service as well as other government agencies will become involved. Other areas outside the health sector will also become involved in the policy-making process, as will aid agencies and donors [7, 8].

Government Agencies

The elimination of malaria necessarily involves inter-sectoral collaboration, with donor assistance sometimes catalyzing national political engagement [19, 5]. In countries with substantial malaria burdens, eradication programs have often been modeled on vertical programmes directed and implemented by the health sector, yet experience on the island of Zanzibar and elsewhere highlights the need for wider government and community involvement [10]. Governments also have responsibilities for coordinating external contributions and disease control efforts across regions [5, 10]. In some instances, they act as intermediaries through which external assistance is disbursed to local implementing partners. Accurate resource planning and efficient use often depend on prior policy commitments, which are foundational for sustainable operations [5, 10]. Furthermore, the eradication agenda responds to the growing aspiration for health security, viewed by the World Health Organization (WHO) as equally important as global food security, global trade, and the protection of the environment [10]. The focal point of policy-makers' immediate aspirations should therefore be the continued effective worldwide implementation of malaria control measures, together with programme designs and infrastructure that foster flexibility for country-specific development and the capacity for eradication when conditions permit [10]. Policy frameworks for malaria eradication therefore address the planning, management,

financing, coordination, evaluation, and implementation of programmes in both the short and long term. At different stages, various governmental entities have responsibilities for malaria control and eradication [5]. Routing support through an appropriate high-level institution enhances sustainability, inter-sectoral collaboration, and national ownership. Such an institution may provide technical or administrative oversight of specific activities, act as an arbitrator in internal disputes, or convene meetings to determine strategy and coordinate efforts [5, 10]. It can remain in place throughout the different phases, gaining in authority and influence and eventually assuming direct operational responsibilities. National health policy-making bodies are the primary agencies charged with deciding on control or eradication programmes; additional responsibilities are often assigned to the Ministry of Health or the Malaria Department, whichever has the greatest technical capacity, experience, and mandate. In countries where malaria has ceased to be a public health problem, other ministries (e.g. agriculture) often assume responsibility for regulatory functions [5].

Non-Governmental Organizations

International financing for malaria eradication comes primarily from bilateral aid and the Global Fund to Fight AIDS, Tuberculosis and Malaria, but the private sector and philanthropic foundations provide additional resources, especially for research [5]. Non-governmental organizations (NGOs) make innumerable essential contributions to malarial programmes [5]. Amnesty International, the Campaign for Tobacco Free Kids, the Carter Center, Children's Dignity Forum, Clear the Air, the Clinton Health Access Initiative, Community Aid Abroad, Concern Worldwide, Environment and Medicine, Food and Water Watch, Friends of the Earth, InterAction, Malaria Foundation International, Malaria No More, MAP International, Médecins Sans Frontières (Doctors Without Borders), Medicines for Malaria Venture, MEDSIN, Mothers to Mothers, Oxfam International, Partners in Health, PATH, Project Hope, Protect the People, RESULTS, Rotary International, Save the Children, the Wilson Center, and the World Health Organization contribute through the development and dissemination of resources, advocacy, fundraising, programme delivery, scientific research and policy development [5].

International Partners

Financial assistance from international partners represents a core component of the funding landscape for malaria programmes. International donor agencies and international financing institutions across the major multilateral and development banks constitute the largest financial contributors in many countries [3, 28]. Collaboration with international and bilateral donors therefore becomes instrumental in maintaining the financial infrastructure necessary for battling malaria and other large-scale diseases. UN agencies such as the WHO, UNICEF, UNDP, the United Nations Office for Project Services, the Food and Agriculture Organisation and the International Atomic Energy Agency constitute important points of contact for support within the broader United Nations family [3, 29]. The World Bank and Afro-Asian Development Banks, Asian Development Bank, Inter-American Development Bank and the Islamic Development Banks all operate numerous funding schemes for the management of tropical and infectious diseases, as well as having the general capacity to spread the financial risk associated with health systems among more donor communities [29]. Bilateral aid comes from developed donor countries and represents a further source of finance for projects linking tropical diseases with poverty alleviation and health promotion within the International Development Cooperation dimension [28]. National government aid agencies facilitate investments in countries where the budgetary resources for large-scale projects are limited [3]. The subscription of private sector industrial organisations to malaria programmes through contributions based on their own business vision has also come to represent a growing dimension of the international support mechanism. In particular multinational corporations operating in sectors such as the commercial, communications, banking, extractive industries and manufacturing demonstrate significant impact [3]. In a number of instances such corporations have developed specific malaria prevention projects within their sphere of influence both internationally and nationally [3].

Funding Mechanisms for Malaria Programs

Malaria eradication programs require adequate funding for various activities, such as infrastructure and human resources, distribution and implementation of prevention methods, and conducting research and development for new solutions [6]. Funding support for malaria programs is distributed through multiple stakeholders including source, flow, and receiver [2]. Funding sources of malaria programs include domestic funding and external funding. Domestic or country funding may come from central government, state government, or local government [4]. External funding may originate from bilateral or multilateral agencies and organizations or from the private sector or nongovernmental sectors [8]. The Global Fund that was created in 2002 has become the largest funding body. It is supported by governments, private sector organizations, and individuals. The largest bilateral donor to malaria programs is the United States Agency for International Development (USAID) through the President's Malaria Initiative (PMI) [15]. Together with the Central for Disease Control and Prevention (CDC), the PMI provides malaria support to 19 countries in sub-Saharan Africa and 2 in Asia that collectively have half of the global malaria burden. Other significant bilateral donors include the United Kingdom, France, Italy, Japan, and

the World Bank [11]. Widely credited for progress in malaria control, global funding for malaria is estimated to have increased threefold between 2000 and 2010, reaching \$2.7 billion in 2011 [18].

Global Fund Financing

Financing plays a critical role in malaria eradication programmes, and a range of sources, including malaria-endemic countries' governments, the private sector and external donors, contribute to such efforts [11]. Additionally, domestic fund-raising activities by National Malaria Control Programmes (NMCPs) and civil society help support interventions and increase awareness [24]. In 2013, funding landscape analyses indicated that most malaria-endemic LMICs lacked reliable data systems adequate for assessing spending by sector, activity or intervention [7]. Bilateral agencies provide support through loans and grants, while the Roll Back Malaria Partnership acts as a financing clearinghouse for eradication-supporting projects [15]. Private sector contributions include co-financing, matching funds, corporate social responsibility investments, philanthropic donations and leveraging of technical expertise [15, 17]. Furthermore, development financing institutions typically provide repayable loans to middle-income malaria-endemic countries once a robust national malaria control strategy is in place [5]. The Global Fund to Fight AIDS, Tuberculosis, and Malaria (GFATM) is a global funder financing approximately 12% of all global malaria activities [26]. It is the main provider of grants to lower-middle-income countries many of which aim to be malaria-free by 2030 and supports the Elimination [8], Malaria Elimination in Mesoamerica and Hispaniola (EMMIE) and Regional Artemisinin-resistance Initiative (RAI) partnerships [16]. The fund's new funding model (NFM), launched in 2013, with allocations for 2014–2016, prioritizes programmes supporting malaria elimination [18]. In 2014, a minimum of \$8 million was included in the NFM to accelerate eradication in southern Africa. An allocation is established for programme support in priority regions and for cross-border coordination requirements. Additional regional grants and support activities under the new model assist country implementation and strengthen regional coordination for countries requesting NFM allocations [13]. The fund's disbursement process covering allocation calculation, eligibility criteria, country dialogue, application development, submission and review emphasizes alignment of resources with priorities and supports countries and partners in achieving impact [12].

Bilateral Aid

The Global Fund constitutes the primary source of external financing for countries embarking on malaria-elimination initiatives [11]. Bilateral funding is another major source of external funding for malaria programmes. Although the actual amounts of external financing disbursed for malaria over the years remain unknown, funding from the United States was the largest known bilateral contributor to malaria control over the past decade [11, 23]. Various national and regional initiatives provide resources to target malaria programmes in eliminating countries, notably those supported by the Roll Back Malaria (RBM) partnership and by The World Bank Malaria Booster Programme [11, 13]. Three major regional programmes comprise the RBM partnership among eliminating countries: the Southern African Development Community (SADC), the Elimination Eight (E8) regional initiative, and the Asia Pacific Malaria Elimination Network [23]. These initiatives seek to assist progress with elimination by the provision of coordination, expertise and resources. Additional organisations provide financial and technical resources suitable for the test and implementation of various policies [13].

Private Sector Contributions

In the Greater Mekong Subregion, the private health sector is engaged in the management of more than half of malaria treatments [14]. Malaria market landscaping in Cambodia, Laos, Myanmar, and Thailand has shown that treatments commercially available through the private sector may be clinically inappropriate or delivered in incorrect dosages. A lack of financial incentives for the distribution of first-line anti-malarials leads providers to sell low-cost alternatives [14]. Providers in the informal sector often have limited training and receive minimal guidance on medicines subject to frequent changes due to evolving drug resistance. These challenges pose a threat to contemporary elimination goals and strategies for the entire subregion. Five approaches to the support and engagement of private-sector providers have been implemented across the region: regulation, licensing, subsidized commodities, training, and supervision [13, 17]. The private sector is a significant contributor to national malaria surveillance systems and an important actor in the ultimate elimination of malaria [15]. Malaria case management in the GMS involves multiple and varied private-sector providers, with up to 70% of people seeking fever treatment initially approaching private-sector outlets [16]. Nevertheless, despite epidemiological and political support and the recommendations of the World Health Organization to include the private sector in mandatory reporting, none of the six GMS countries regularly collected complete case data from the private sector and incorporated them into the national malaria surveillance information system [18]. In elimination settings, surveillance systems in the region are being enhanced towards real-time notification and case-based reporting. Hence, private-sector providers must be incorporated and an efficient operative system put in place [12, 15]. The literature offers few detailed descriptions of effective approaches to operationalizing timely case notification and integrating private-sector data into national surveillance systems, highlighting an important knowledge gap [18].

Since 2016, the GMS Elimination of Malaria through Surveillance program has provided technical assistance to National Malaria Programs in Cambodia, the Lao PDR, Myanmar, and Vietnam in strengthening private-sector case detection, notification, reporting, and integration of these data in national malaria surveillance systems at the subnational and national levels. Country case studies present responses to this challenge and evaluate the impact of private-sector surveillance activities on overall case-based surveillance [20, 25].

Epidemiological Approaches to Policy Development

According to Gueye et al., most countries have adopted national malaria strategies aimed at both reducing disease burden and, in some cases, pursuing elimination [9, 13]. These strategic plans generally incorporate a broad spectrum of interventions, including vector control, chemoprevention, tools for diagnosis and treatment, surveillance, social and behaviour change communication, health system strengthening, and operational research. Due to variations in transmission, infrastructure, and resources, strategies are frequently adapted to fit local conditions [8, 19]. Several planning models employ diverse epidemiological and feasibility factors to guide resource allocation [8]. Epidemiological considerations such as intensity of transmission, vector species, seasonality, parasite species, and the presence of infection reservoirs inform tailoring of interventions [5, 7]. Feasibility factors including costs of interventions, resource capacity, operational support, expected coverage, and timing since programme launch influence strategy adaptation [5, 6]. Monitoring and evaluation frameworks reinforce the pivotal role of epidemiological data in shaping policy: programmes track indicators like confirmed cases, severe disease, deaths, parasite prevalence, vector species distribution, and insecticide resistance to assess effectiveness and inform adjustments. By integrating surveillance data, programmes align their strategies with empirical evidence to optimize impact [5].

Data Collection and Analysis

Malaria eradication programs rely on an extensive network of data collection, analysis, and forecasting tools to generate an extensive range of experimental, observational, survey, meteorological, epidemic intelligence, and exposure information [7, 27]. The uninterrupted supply of such information integrating routine national records, international data-sets, and earth observation databases is a fundamental prerequisite for malaria control. Consequently, the first policy decisions revolve around the location of data acquisition procedures and the methods of analysis that will follow [8, 25]. Data collection operates on two complementary axes; on one side is the national malaria control program itself, responsible for a broad array of routine statistics, monitoring information, and feedback from testing new initiatives; on the other lies a complex set of outside activities designed to gather specific information on specialized topics [5, 16]. These additional activities are often organized on a regional or continental scale, serving as external points of reference to national data. Significant continental contributions emanate from the widespread use of spatial collection methods such as the Malaria Hot Spots Epidemics and Control Programme across countries and efforts targeting global-focal and epidemic countries through projects like the Worldwide Anti-Malaria Vaccine Development [5]. Due to their geographic spread, the data must be extensively geographically referenced, a requirement that also provides a valuable framework for detailed national surveys. In spite of potential overlaps, national and external activities are coordinated through data exchange and consultation, with efforts sometimes planned concurrently [16].

Modeling and Forecasting

Mathematical and computational models synthesise empirical information, quantify uncertainty and risks, and provide a framework for extrapolation beyond current observations [32]. A global malaria eradication effort will require changes to complex biological systems, yet because of evolution of parasite and vector populations, fluctuations in host immunity and drug use, and changes in human behaviour and vector control it is not possible to predict the path to eradication solely on the basis of limited trial data [33]. Surveillance must accompany each successive step and models must be continually updated with new information and decisions must be deferred whenever the range of plausible knowledge is too large [34]. Models will play a central role in mapping out, testing and updating the strategic plan for eradication [17]. Within the health sector, policy decisions are increasingly based on epidemiological and economic modelling. Within the malaria eradication agenda there are numerous areas where quantitative modelling at all levels is lacking, and a well-defined and focused agenda is required [18]. Population-level models need to be expanded to include all *Plasmodium* species, parasite and vector genetic and antigenic variation, distinctions between immunity to blood-stage and to liver-stage parasites, patterns of host-vector contact and the intensities with which interventions are applied [18]. All models need to be much better informed about human and vector behaviour and heterogeneity in all aspects of parasite transmission. Small-scale spatial simulation models need to be expanded to link with models describing the evolution of drug and insecticide resistance [9, 17]. A malaria eradication programme will need to combine interventions in an adaptive network of successive and tightly coupled steps over several decades [20]. Patterson described an adaptive management cycle in which policy is set in council, translated into management strategy, then quickly fed

back to policy-makers through operational experience and more detailed models. An initial stage of maladaptation and learning is followed by successive improvements in both policy and strategy, as recurring divergences of expectation generate new questions and new modelling challenges [5, 14]. The malERA Consultative Group on modelling was formed to define a research agenda that can improve the analytical framework linking policy to implementation, intellectual innovation to operational relevance, and data to decisions [4, 18]. The greatest challenge is that the research agenda should support current needs for regular, robust policy recommendations while nurturing longer-term innovation that can address questions that do not yet appear realistic. This balance is at the core of the malERA modelling agenda [7, 19].

Interventions for Malaria Control

An integrated malaria prevention strategy combines environmental management, modification, and chemical methods to curtail the spread of the disease and the impact of control interventions [18]. This approach encompasses eliminating vector breeding sites, prevention strategies, housing improvements, and the use of insecticide-treated bed nets and indoor residual spraying (IRS). The core vector control measures, long-lasting insecticidal nets (LLINs) and IRS, lessen the risk of malaria infection but fall short of eliminating transmission, as evidenced by the persistence of malaria in some countries despite intensive control efforts [18]. Malaria transmission typically arises from a single mosquito bite, requiring the subsequent parasite development phase within the mosquito before onward transmission to other individuals [18]. In shielding people from mosquitoes, the risk of parasite transmission diminishes substantially [9]. Vector control effectively mitigates both entomological and clinical malaria prevalence and overall transmission, facilitating the interruption of it [10]. At the centre of malaria control and elimination efforts lies the national malaria control programme, which formulates a comprehensive strategy centred on a well-structured national strategy delineating the policy framework and methods of implementation. National programmes frequently implement a national malaria control strategy that dictates the approach to vector control, incorporating interventions such as LLIN/ITNs and IRS [9]. Although other interventions have yet to be broadly adopted, areas demanding attention include larval control, containing insecticide resistance, surveillance, and monitoring of implementation [5, 18].

Insecticide-Treated Nets

The use of insecticide-treated nets (ITNs) represents a central malaria vector intervention [19]. The application of insecticide through a long-lasting formulation protects individual users from mosquito bites and, when community-wide coverage is achieved, suppresses vector populations and inhibits malaria transmission [18]. ITN coverage has reached 85% in parts of western Kenya, following the launch of a government initiative in 2006 distributing free nets to children under five as well as the sleep spaces of pregnant women [20]. However, ITN use declined afterwards, with the fraction of children sleeping under a net down to 50% in 2015. As a consequence, malaria among schoolchildren resurged by more than 50%. Monitoring efforts also revealed a 20-fold increase in the indoor-resting density of *Anopheles funestus* in some areas [17]. These analyses underscore the necessity of complementary or improved interventions to enhance malaria-control efforts and reinforce the significance of longitudinal studies in guiding malaria policy adjustments [21].

Indoor Residual Spraying

Indoor residual spraying (IRS) is a principal strategy for malaria control and elimination, whereby long-lasting insecticides are applied on the interior walls of buildings to kill mosquitoes that rest there after consuming a blood meal [20, 21]. The duration of efficacy depends on the physicochemical properties of the formulation, the type of sprayed surface and local conditions; the intervention must therefore be applied at regular intervals of approximately 6 months or less [20]. Spray operations are complex and costly, and typically involve targeting defined areas during short periods when transmission is low [21]. For elimination, IRS needs to achieve very high community coverage and be applied consistently for a sufficient length of time [10]. The choice of insecticide is particularly important when IRS is deployed as the sole vector control intervention or as part of a resistance management strategy [6]. Longer-lasting IRS formulations are available as capsule suspensions (CS) or more recently as a wettable powder (WP), and have proven effective under operational settings for controlling insecticide-resistant populations [30]. PMI's operational IRS programmes currently use micro-encapsulated pirimiphos-methyl (Actellic 300CS) across many countries in Africa. Trials and operational studies have confirmed that this formulation provides residual control which exceeds 6 months on most substrates, with only wood cement or mud-plastered mud showing shorter residual activity [32]. Four years of annual IRS with Actellic 300CS significantly reduced the number of malaria cases reported through routine surveillance in one district of Malawi, although beneficial impact varied seasonally and IRS was implemented alongside other vector control methods [6]. Combining IRS with insecticide-treated nets (ITNs) enhances malaria prevention efforts, particularly in areas with pyrethroid resistance, and may contribute to accelerating progress towards elimination [13]. Lower-coverage IRS also offers partial community protection and substantial personal protection for sprayed households [21].

Antimalarial Medications

Antimalarial drugs treat malaria, prevent infection and disease caused by Plasmodia, eliminate dormant parasites from the liver, and block transmission [8]. Eliminating malaria relies largely on treatment and prevention, including mass drug administration, as emphasized by the malERA Drugs Consultative Group. Global eradication means interrupting transmission worldwide; elimination targets a specific area, and control reduces disease incidence to a manageable level [22]. The ideal medicine, proposed in 2011 under a single-encounter radical cure and post-treatment prophylaxis (SERCAP), would contain at least two active molecules to prevent resistance and effect a radical cure [5]. Clarity has emerged on medicines' roles in reducing malaria to zero and maintaining elimination [5]. Most new blood schizonticides will not be approved until the 2020s; initial reduction therefore relies on current medicines optimized for deployment [23]. Transmission blocking occurs primarily through insecticides and vector control. New classes of medicines are needed as resistance develops, capable of shortening treatment courses and simplifying therapy to two- or three-day regimens. Pre-elimination and elimination countries require new chemoprotectants [22]. The key role of new medicines, outlined in the first Target Product Profile (TPP1), involves rapid reduction of parasitemia, prevention of transmission, and simplified regimens following a single health encounter [7]. Recent studies provide valuable data on the safety of current medicines and identify strengths and weaknesses for further investigation [23].

Barriers to Effective Policy Implementation

The translation of global policy frameworks into effective action on the ground can be hampered by various implementation challenges at local level [5, 7]. The continuation of malaria transmission in predictable contexts, despite the existence of appropriate evidence-based vector control, drug-treatment, and surveillance technologies, and policies promoting their use, may be seen as a policy failure [8]. Without the involvement of key stakeholders, adequate funding, and a sufficient local disease burden to sustain political interest and advocacy, many parasite reservoirs will persist despite years of control efforts. In the absence of a sense of ownership of a malaria control programme by the local community, interventions such as indoor residual spraying may not be accepted and implemented [8, 16]. Without strong leadership and good governance, operational systems for procurement, supply, and redistribution of commodities essential for malaria control, and remuneration and motivation of the health workforce, are unlikely to operate at an optimal level [18]. Malaria control programmes may be unable to operate effectively without external funding, since the majority of endemic countries face competing and overwhelming demands on their health and other services budgets [17]. Without adequate incorporation of malaria control needs into climate and weather policies, organisations are likely to face considerable difficulties in preparing for and responding to the discordant seasonal and annual changes that occur under current climatic variability and extremes [1, 11]. Inadequate incorporation of malaria control needs into climate policies will exert a similar effect, because climate and weather variability and extremes are important determinants of the location and size of malaria burden [9, 18]. There is a strong notion at present within international funding agencies and recipient governments that external bilateral and multilateral funding should be biased towards revival of an economic growth strategy for the country or sector rather than supporting health care and social services for the poor population [3, 13]. However, in countries where structural adjustment policies have resulted in economic stagnation and expansion in poverty, there has been little evidence that such a policy has in fact stimulated rapid economic growth, though it has indeed had a very damaging impact on the poor majority [5, 16]. This has caused a paradox to arise with respect to the impact that macroeconomic policies, including those supported by the World Bank, have on plastic and vulnerable diseases such as malaria [4, 14]. Many of these diseases affect primarily the poor in the poorest countries without the potential for any likely economic growth response, and structural adjustment policies have seen only greater and not lesser constraints on public investment in controlling them [9, 27].

Political Will and Governance

Political will and good governance are not merely facilitators of becoming malaria-free; they are essential conditions of such an achievement [3, 8]. Sustained political commitment at the highest level of government is vital in overseeing the planning, implementation and financing of malaria-agenda activities until eradication is achieved. It is a sine qua non for the uniform application of the essentials of good governance, which include transparent and responsive program management, equitable and fair resource distribution, and accountability. Broad community consensus on the malaria-elimination programme should be sought by raising awareness about the disease and its eradication [12, 5]. The demand for eradication will then become a powerful political force [4, 8]. The community must be receptive to eradication activities. Local governments and non-governmental organizations (NGOs) should be mobilized to help communities take part. Malaria control workers will feel proud to be associated with an activity that is perceived to be a top government priority. Political leaders derive satisfaction in responding to people's needs [7, 14]. In addition, a political environment that is free from conflict and tension is an important prerequisite of attaining a malaria-free status [8].

Community Engagement

Between 2000 and 2015, 17 countries achieved malaria elimination, with an additional 10 expected to follow by 2020 [24]. Progress has recently stalled or regressed in some countries, predominantly in the World Health Organization (WHO) African Region. Around 219 million cases were reported in 2017. Transmission tends to cluster in localized geographic areas and among subpopulations bearing specific risks. Established interventions, such as the use of insecticide-treated bed nets and indoor residual spraying remain effective only if they are both accessible and accepted by communities [21, 6]. Many challenges are site-specific and require tailored approaches. Community engagement is now recognized as an essential strategy for fostering local solutions rather than merely disseminating information [9]. Effective engagement is complicated by heterogeneous transmission patterns, inaccessible locations, marginalised populations, and shifting perceptions of risk [22, 7]. Community health workers typically conduct case management, surveillance, vector control, and communication activities. To enhance engagement, programmes can draw on successful practices from other health and development fields in order to involve communities more meaningfully in malaria interventions [8]. Efforts to eliminate malaria from the Greater Mekong Sub-Region (GMS) further illustrate the critical role of community engagement [25]. As the disease burden declines, additional resources are required to detect and treat the last remaining cases [26]. Community involvement thus becomes indispensable both for promoting intervention uptake and for ensuring that residual infections are identified before resurgent outbreaks can occur [8]. Strategies are gradually transitioning from top-down to more participatory, bottom-up approaches; such approaches empower communities to plan and execute interventions, albeit with challenges arising from power asymmetries that can hinder meaningful participation [10]. Established tools and activities such as community meetings are evolving towards formats that encourage open dialogue and co-execution, thereby enabling malaria programmes to adapt their content and delivery to local values and cultural norms [11]. Trust between communities and researchers or implementer is also a decisive factor influencing the effectiveness of engagement, and continuous relationship-building through dialogue constitutes a key method for addressing stakeholder concerns [15]. Whereas field research has emphasized the importance of local community roles, policymakers and other stakeholders appear less informed about if and how community engagement is framed and prioritised in malaria elimination endeavors [16].

Resource Allocation

It is a well-known fact that malaria programmes are chronically under-funded [5]. The quantity and quality of every intervention are constrained by available resources, which vary over time and across countries. Such funding limitations have led to a narrow focus on low-cost tools with a reduced capacity to address sustainability and health systems strengthening [5, 25]. International and national public funding remain the dominant sources of malaria financing and have an important role in the scaling-up of efforts [4, 18]. However, these traditional sources must be complemented by greater private investment, increased domestic resources and innovative financing mechanisms [6]. These have implications for the wider policy framework. For example, continued reliance on international financing may encourage a narrow focus on donor priorities [5]. The Global Fund to Fight AIDS, Tuberculosis and Malaria plays a major role in financing malaria and eradication programmes. Although some countries only receive Global Fund support, it often represents one component of a larger array of financing arrangements from bilateral donors or the private sector that require coordination [12]. The approved Global Fund grant incorporates details of the proposed response, including indicators and proposed evaluation procedures, and forms the basis for negotiating country-specific policy frameworks. If, following an initial round of funding, a programme proposal is not recommended for funding, the Global Fund relies on other donors and partners to engage with the country to help it address any shortcomings [29]. Through the involvement of key partners, the Global Fund encourages a collective approach. Similarly, the development of a nationwide policy framework for malaria eradication relies heavily on effective collaborations between the main public, non-governmental and private stakeholders working in specific countries and across larger regions [26].

Monitoring and Evaluation Frameworks

Malaria eradication policy frameworks need to incorporate monitoring and evaluation mechanisms to assess the intensity of malaria transmission and programme impact across a range of settings [4, 13]. Monitoring and evaluation also provide feedback on the accuracy of information on which policy is based, and contribute to the prioritization of activities, essential to ensure that resources are allocated as efficiently as possible. Monitoring and evaluation are also needed for accountability, a critical issue for programs that receive international financing [7, 34]. Several guidelines and manuals published by the World Health Organization and others provide frameworks for the evaluation of national malaria control programmes, including impact assessments in different epidemiological settings. Their evaluation has identified additional indicators of programme success [3, 27]. Important parameters for national policy have been linked to the goal of providing universal access to malaria prevention, diagnosis and treatment integrated within systems for universal health coverage: all malaria

programmes are required to measure coverage of insecticide-treated nets, availability of rapid diagnostic tests in health facilities, and the proportions of suspected malaria cases undergoing parasitological testing and receiving treatment with an artemisinin-based combination therapy [2, 22]. A further parameter was added to capture whether real-time information from malaria-information systems is being used to guide timely reallocation of resources and response activities [6, 13]. An additional eight indicators that are important for universal access are either strongly recommended or recommended for consideration. An effective national monitoring and evaluation system also includes four elements: a surveillance system capable of ensuring that the true burden of malaria is measured accurately and in a timely manner (case reporting was one element); health and diagnostic-services and commodity-availability surveys and systems to assess data quality and track implementation progress; and a national programme review platform, to evaluate data generated by the first three elements and provide information on programme successes and constraints to guide policy revisits [16]. Some 15 principles must be considered in the design, implementation and interpretation of the malaria programme monitoring and evaluation system [5]. The primary purpose is to improve programme management and quality-control functions, providing information on strengths and weaknesses and a mechanism for identifying remedial actions; while impact evaluation is mandatory, the procedures should be streamlined and planned well in advance to ensure that the most appropriate, feasible and efficient design is selected [6, 16]. Monitoring and evaluation systems must achieve the right balance between needs and available resources. Priority is given to indicators related to burden, coverage, processes and quality; analysis must reach down to the lowest possible administrative level; neither anecdotal nor newsworthy evidence is sufficient to inform decisions; and epidemiological information, although essential, is only one component of a holistic evaluation process [16, 23].

Performance Indicators

Performance indicators are a crucial component of any malaria surveillance, monitoring and evaluation, or strategic plan [6, 10]. Where such plans exist at different levels of the health system, performance indicators can be expressed in a standard format to allow for comparison within and across malaria control programmes in both endemic and non-endemic settings [4, 8]. The Malaria Progress Index, introduced in the 2012 World Malaria Report, is an epidemiology-based approach aimed at quantifying malaria progress globally, regionally, or nationally through time and encouraging greater use of malaria data for programme management [8, 19]. Rigorous, evidence-based policy development requires an understanding of both the relevant epidemiological, demographic, and health-system context, as well as the performance of current malaria-protection measures [5, 7]. For these reasons, policies ideally also include appropriate monitoring and evaluation frameworks, the development of which typically follows the identification of intended key directives within the overall policy document [6, 21]. Performance indicators with accompanying definitions, targets, and data sources for a malaria control programme are provided in the following section [5, 20].

Impact Assessment

Epidemiological information is the foundation for malaria policy decisions regarding interventions and assessing their impact [5, 6]. A decrease in malaria morbidity and mortality is considered evidence of intervention effectiveness and constitutes part of the impact indicator defined by the World Health Organization (WHO). Reduction in transmission is proposed as an additional criterion for shifting from control to pre-elimination and elimination, and finally to certification of eradication [4, 6]. The decision to pursue eradication through control, pre-elimination, elimination and prevention of reintroduction is largely based on the malaria situation, which is usually assessed weekly/monthly/seasonally, according to the country's burden of malaria. Therefore, impact assessment is deeply interpenetrated with malaria epidemiology [6, 9]. Impact assessment is based on changes in epidemiology and malaria transmission relative to intervention strategies, and considers the interactions of different interventions with the ecosystem and vectors, such as the effects of indoor residual spraying (IRS) with larval control, the interactions of all interventions with immunity, and the interactions of very large reductions in vector populations with the ecosystem [7, 9]. Impact indicators typically case incidence, number of deaths, and parasite prevalence are developed in relation to the four stages on the path to eradication defined by the WHO: control, pre-elimination, elimination, and prevention of reintroduction [1, 5].

Case Studies of Successful Eradication Policies

Numerous countries and regions have successfully eliminated malaria. Sri Lanka, where over 1 million cases occurred annually before 1999, reported zero locally acquired cases in November 2012 and was certified malaria free from the World Health Organization in 2016 [1, 5]. Bali Province in Indonesia recorded zero locally acquired cases since October 2018. Morocco was malaria free in 2007 and has continued to reports zero locally acquired cases. Malaria case trends for recently certified or close to certification countries or provinces highlight the substantial effect achievable [10, 5].

Elimination in Sri Lanka

Following four decades of concerted effort, the island of Sri Lanka is free of malaria. This example represents a number of countries such as Brazil and Morocco that provide important lessons for the eradication of malaria globally [4, 30]. Sri Lanka was an early adopter of DDT for vector control, and populations in the wet, low-elevation regions were well protected [3, 13]. These heavy rains were responsible for maintaining very high population densities, whereas the population declined and stabilized in drier areas. As a result, one population believed it was no longer at risk and demanded a total interruption of spraying [4, 21]. The government acquiesced, resulting in a resurgence of the disease and another large epidemic that moved south along the coast once again. The populations along the southern coast then demanded a resumption of DDT use, which was then implemented and eradicated the disease in those areas [7, 16].

Success in Morocco

Malaria eradication represents a central goal for people worldwide [5, 31]. Throughout history, several countries and areas have succeeded or are on the verge of success in interrupting malaria transmission. One example that clearly illustrates the role of policies aimed at the successful implementation of malaria eradication is Morocco, situated in North Africa [4, 27]. The development of malaria control policies in Morocco was supported by the Global Malaria Morbidity Survey conducted during 1993–1999 [5, 34]. This survey assessed the burden of illness and malaria epidemiology in the country and defined risk areas accordingly. Epidemiological information facilitated effective decision-making, adjusting the policy framework for malaria control. Morocco adopted a multipronged approach aimed at reducing malaria morbidity and mortality [2, 21]. It included surveillance and epidemiological research, preparedness and response capacity, prompt and effective treatment, prevention and control of transmission, health education and communication, risk assessment, and resource mobilization [5, 34]. The National Malaria Strategy for 2002–2005 marked an essential step in articulating the country's goals. Its main objective was to interrupt the transmission of *Plasmodium falciparum* by 2002 and the transmission of *Plasmodium vivax* by 2010 [6, 21]. Two main strategies supported this objective: (1) providing early diagnosis and treatment to all populations at risk and (2) limiting parasite transmission by means of selective vector control and protection of populations exposed to the risk of infection [7, 28].

Innovative Approaches and Technologies

The global health community has witnessed the development of new tools offering increased effectiveness or different mechanisms of action that complement the existing arsenal of interventions [3, 28]. Despite continued progress with current interventions, innovations will be required to achieve and sustain elimination in many countries [5, 27]. Tools that can reduce transmission from subclinical asymptomatic infections would be particularly valuable in this regard, as non-immune populations expand in the absence of recent infection, the risk of major epidemics also rapidly increases [1, 25]. A number of recent discoveries offer promise for the development of new approaches for vector control, chemotherapy and vaccines with additional potential to interrupt transmission. The availability of next-generation sequencing technologies has driven a step change in the discovery and development of new biological tools with the capacity to impact malaria transmission [7, 18]. Genome sequences are now available for all the major human malaria parasite species in addition to key vector species. These have provided an improved understanding of the molecular mechanisms underlying parasite biology and inaccuracies in key processes such as drug mechanism of action and resistance and host/vector specificity [3, 16]. Species-specific molecular markers have also been developed for the accurate assessment of population level genetic diversity [3, 17]. Taken together, these resources have provided an improved basis for the identification of potential transmission blocking candidates and contributed towards the early prioritization of products before costly development processes begin [5, 30]. At the vector level, new insights into the genetic basis of host seeking behaviour, fecundity, insecticide resistance, flight dispersal and *Plasmodium* susceptibility have introduced novel opportunities for transmission-blocking interventions that have either proven unachievable or unexplored previously [4, 29].

Genetic Control Methods

Gene drive mosquitoes offer a promising and potentially transformative strategy to assist malaria control programs in sub-Saharan Africa. Gene-drive systems bias inheritance such that favored traits spread rapidly through populations [5, 28]. Two main types of strategies exist for malaria: (1) population suppression, which reduces vector populations and the number of female mosquitoes available to transmit *Plasmodium* to levels below local transmission thresholds; and (2) population replacement, which modifies mosquitoes to reduce their ability to transmit the parasite [8, 27]. Population-replacement approaches focus on imparting parasite resistance or blocking key mosquito behaviors facilitating transmission, such as blood-feeding or biting preferences. Stable expression of genes interrupting *Plasmodium* development is central to this strategy [9, 14]. The long-term efficacy and stability of gene-drive strains should be thoroughly evaluated across multiple generations to ensure sustained vector population modification. Given the 216 million cases and 445,000 deaths attributed to malaria in

2016, mainly in sub-Saharan Africa, these self-sustaining gene drive methods could serve as vital, cost-effective components of integrated malaria-control approaches [10, 29].

Mobile Health Solutions

Innovations in information and communication technologies (ICTs) can enhance anti-malarial efforts through control applications and early warning systems [4, 11]. Mobile-health (m-health) services have the potential to improve health outcomes and support disease control in developing countries. Mobile-phone-based surveillance systems have been implemented in Sri Lanka and other regions; systematic reviews highlight the potential of mobile phones and text messaging to assist disease-control efforts in developing countries. Mobile phones facilitate rapid communication within surveillance networks and support public-private partnerships to enhance outbreak responses [7, 13]. Following the Millennium Development Goals, mobile technologies have been applied in South Africa to aid malaria-elimination strategies. Conceptual frameworks outline how mobile phones can deliver rich data for risk-mapping and monitoring, enhancing the timeliness of notification and response across the country [30]. Mobile health (m-health) solutions can improve health outcomes and facilitate progress toward malaria eradication. m-Health technologies based on 2G networks are nearly ubiquitous in Uganda, whereas current 3G infrastructure is inadequate for large-scale m-Health deployment [6, 25]. In remote areas with only 2G connectivity, mobile microscopy with automated cell-count software enables on-site malaria diagnosis without remote consultation; patient data are transmitted to health centres when higher-speed connections become available [5, 16]. High-quality data collection is essential to support spatial and decision-support systems built on geographic-information-system platforms; such systems enable real-time location, classification, and monitoring of transmission centres and guide targeted responses, with the quality of performance contingent on the completeness and reliability of case reporting [4, 31].

Future Directions in Malaria Policy

The Sustainable Development Goals adopted by the United Nations in 2015 included a target to end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases by 2030 [7, 18]. A key policy future therefore is the development of strategies and activities for sustainable malaria eradication upon which the overarching objective of infectious disease elimination can be achieved [1, 23]. Comprehensive policy frameworks have been developed to provide an overarching view of how the eradication of malaria might be achieved and to guide further development and revision of policies and strategies as circumstances require and experience accumulates [22, 12]. Malaria control programmes must provide an appropriate level of support, technical assistance and guidance to translation of the policy framework for sustainable malaria eradication into national malaria strategic plans and malaria operations plans for those countries wishing to develop full strategies for elimination of the disease [25, 13]. An effective policy framework must also be sufficiently flexible to suit diverse epidemiological situations, ranging from areas of low and unstable malaria transmission where the disease is a common cause of epidemics to the areas of high and stable transmission where children under 5 years and pregnant women are at greatest risk. Countries will be able to set national goals supported through the guidance or policy framework and draw on the examples of other countries that have succeeded in eliminating malaria such as Sri Lanka and Morocco [2, 19].

Sustainable Development Goals

The US formally endorsed the Sustainable Development Goals (SDGs) in 2016, emphasizing the guiding role of science, technology, and public health investments in attaining these objectives [2]. These goals provide a framework for simultaneous, universally targeted global progress, including worldwide malaria eradication. In March 2018, the WHO launched its Immunization Agenda 2030, which stresses integrating immunization programmes with essential primary health care delivered through resilient health systems aligned with the SDGs [2]. Such comprehensive, long-term agendas require sufficient technological innovation and an intensified global commitment to supporting malaria programmes [24, 32]. The growing recognition of eradication as an achievable goal mandates developing new strategies, frameworks, and approaches that sustain the global movement beyond short-term targets [2]. The global policy framework must remain viable in national settings. In 2018, the WHO established a Strategic Advisory Group on Malaria Eradication (SAGme) to analyse future scenarios reflecting the current epidemiological context, science, technology, policy frameworks, and lessons from historical eradication efforts, thus informing decisions on potential eradication [2].

Integration with Other Health Policies

Malaria eradication and control policies cannot operate in isolation either within the health sector or with other sectors in the economy [1, 32]. The interrelationships between malaria and socio-economic development are extremely complex. Countries with unfavourable socio-economic conditions tend to have higher malaria transmission and, therefore, have the greatest potential health gains from malaria control and eradication [23, 28]. However, generally it is those parts of the community that have the least influence in determining how society develops that suffer the most from the disease [23, 30]. As society develops, in such cases as improved health infrastructure, increased public health services, and deforestation, the incidence of malaria generally tends to

decrease [32]. While the ability of malaria control to stimulate socio-economic development is difficult to define, its contribution is important. Malaria control should, therefore, be considered a necessary adjunct to programmes such as education, water supplies, agricultural development, and others [1, 32]. It is recognized that government objectives of national prosperity, socio-economic development, and equity represent a variety of imperatives in development [32]. They have, therefore, been incorporated in the Consultation on the Development and Control of Malaria (WHO, 1976). Malaria programmes are not in the main responsible for the attainment of all these goals but, through their activities, they can contribute to their realization [20, 31]. Compatibility of malaria eradication and control with other development objectives can be maintained only by the existence of close working relationships between malaria services and other sectors of each country in which malaria is endemic [32]. If close cooperation and co-ordination is not institutionalized, opportunities for achieving mutual benefits may be lost [29, 32].

Ethical Considerations in Malaria Policies

WHO's policies on malaria elimination and eradication highlight the importance of ethical considerations. Specifically, "policies and programmes for the control and eventual elimination of malaria should be based on equity" and respect for informed consent, in order to ensure interventions are "designed and implemented in a way that is both equitable and ethically acceptable" [32].

Equity and Access

Policies addressing the social impacts of malaria normally focus on equitable resource allocation and access to prevention and treatment. Donor assistance plays a central role in providing equitable support [13]. More broadly, equity has been defined as "absence of avoidable or remediable differences among groups of people, whether those groups are defined socially, economically, demographically, or geographically" [13,31]. Related measures therefore seek to determine whether resources are distributed according to need (for example, regional malaria burden) and whether people with similar levels of need receive similar levels of service. Less attention has been devoted to access [32]. Yet malaria can still represent a major economic burden, not least where access to health insurance schemes is unequal [30]. Over-consumption of antimalarial medication and use of incorrect drugs also remain widespread, especially when poor selling, purchase and usage practices are combined with weak enforcement of laws, or when multiple factors such as perceived or actual cost, distance, waiting time, user fees, poor quality, stock-outs or rudeness of health staff discourage people from using formal health-care services [13, 31]. Policies to improve access include reducing or removing fees (while compensating providers for income losses), fast-tracking malaria patients, extending opening times, hiring more staff, intensifying training of health workers, discouraging use of ineffective drugs such as chloroquine, using mass media campaigns and engaging opinion leaders to promote behaviour change, clamping down on counterfeit drugs and strengthening public-private partnerships. Community-based management through home-based treatment by trained volunteers and community health workers is also widely promoted [13].

Informed Consent

Obtaining credible informed consent is often complicated when local languages are under-developed and individuals are illiterate [33, 34]. In such contexts, information is provided verbally during discussions about risks and benefits, but the consent form itself does not confer understanding [33]. Systematic procedures, such as community engagement discussions, organized public meetings and involvement of community leaders, may be of considerable value when seeking to inform vulnerable populations about complex technical issues and in assessing whether voluntary consent is forthcoming [34].

CONCLUSION

The eradication of malaria is a technical and moral imperative requiring coordinated global leadership, scientific innovation, and social inclusion. The study reveals that while global policy frameworks guided by the World Health Organization and aligned with the Sustainable Development Goals, have laid a strong foundation, their effectiveness ultimately depends on national ownership, political will, and adaptive implementation. Persistent barriers such as inadequate financing, weak governance systems, fragmented health policies, and limited local engagement continue to undermine progress. Strong leadership, equitable resource allocation, and transparent governance remain central to maintaining political and community support for eradication programs. Community engagement has proven indispensable in transforming populations from passive recipients of aid into active partners in malaria control, as demonstrated in Sri Lanka and Morocco. Similarly, advances in genetic control technologies, mobile health systems, and molecular surveillance present unprecedented opportunities for accelerating eradication, yet these must be pursued within ethical frameworks that prioritize consent, equity, and access. Effective monitoring and evaluation systems, guided by performance indicators and impact assessments, ensure accountability and allow continuous policy adaptation to evolving epidemiological contexts. Future malaria policies must transcend traditional health-sector boundaries by integrating with broader national development, education, and climate policies. Sustained investment in research, local capacity building, and ethical governance

will be pivotal to achieving malaria eradication by 2030. Ultimately, the path to a malaria-free world lies in harmonizing scientific innovation with justice, inclusivity, and human-centered policymaking.

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