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Gender Dimensions of Malaria Burden

Kansiime Agnes

Department of Clinical Medicine and Dentistry Kampala International University Uganda
Email: agnes.kansiime.2974@studwc.kiu.ac.ug

ABSTRACT

Malaria remains a major global health concern, disproportionately affecting populations in sub-Saharan Africa and other endemic regions. While biological factors determine susceptibility to infection, gender plays a decisive role in influencing exposure, treatment-seeking behavior, and outcomes. This paper examines the gender dimensions of malaria burden, highlighting how social, cultural, and economic inequalities intersect with biological differences to shape vulnerability. Women, particularly pregnant women face elevated risks due to physiological susceptibility, limited mobility, financial constraints, and unequal decision-making power in households. Men, meanwhile, are frequently exposed through occupational activities such as farming and forest work but often delay seeking care due to sociocultural norms surrounding masculinity. The study emphasizes the role of community health workers (CHWs) in bridging access gaps, particularly for women in remote or resource-limited settings. It also explores gender-specific interventions, including tailored awareness campaigns and prevention strategies such as insecticide-treated net (ITN) distribution, which have proven effective in several African and Asian contexts. Despite progress, gaps persist in policy integration, data disaggregation, and gender-sensitive research. Addressing these disparities requires embedding gender analysis in malaria prevention, treatment, and policy frameworks. Through a gender-responsive approach aligned with the Sustainable Development Goals (SDGs) health systems can improve equity, strengthen community resilience, and accelerate the global drive toward malaria elimination.

Keywords: Gender and Malaria, Health Inequality, Community Health Workers (CHWs), Policy Integration and Sustainable Development Goals (SDGs).

INTRODUCTION

Malaria remains one of the major challenges to global health, with a well-established disparity between males and females in terms of incidence and severity prompting a re-exploration of its gender dimensions. The disease is caused by parasites transmitted to humans through the bites of infected female Anopheles mosquitoes. Following an infected mosquito bite, parasites enter the human bloodstream, invade liver cells to mature, then re-enter the bloodstream to infect red blood cells [1]. Globally, in 2018 malaria caused an estimated 405 000 deaths, with the heaviest toll in the World Health Organization (WHO) Africa Region, where most deaths occur among children under 5 years of age [2]. An increasing body of literature recognizes the importance of gender roles in health, with gender014defined as the socially constructed characteristics of women and men14playing an important part in shaping whether, when and where individuals receive treatment [1, 2].

Malaria, a vector-borne disease caused by parasites of the genus Plasmodium, continues to present a major public health challenge globally. It remains the fifth leading cause of preventable death worldwide, with an estimated 228 million cases recorded in 2019 across 87 malaria-endemic countries [2]. The disease has a complex lifecycle that creates an almost infinite number of potential scenarios where gender differentials may arise and become compounded by social and biological processes [1]. Transmission of malaria occurs when an Anopheles mosquito bites a malaria-infected individual and becomes infected. The malaria parasite enters the mosquito's gut along with blood and colonizes the mosquito mid-gut, where it multiplies and develops before invading the salivary glands.

When the mosquito bites a new individual, saliva in the mosquito body is injected containing malaria parasites [2]. In its most severe form, malaria may cause cerebral malaria (featuring coma and convulsions), severe anaemia exacerbated by malarial haemolysis, multi-organ failure, hypoglycaemia, and acute acidosis, all of which may lead to death of the individual or long-term impairment [1]. Globally, women tend to have less access to prevention and treatment for malaria, and consequently carry a greater burden of disease despite, under typical transmission scenarios, expected prevalence and death figures to be lower in women than in men [1]. In children, questions over whether males or females are more exposed to malaria vary according to setting and lead to different conclusions. In areas of unstable transmission, men tend to predominate in incidence and prevalence figures, which generally remain higher for men into adulthood [1].

Malaria Life Cycle

The parasite that causes malaria requires female Anopheles mosquitoes for transmission [4]. A mosquito becomes infected when it bites a person with circulating Plasmodium parasites in their bloodstream. Once infected, the mosquito spread malaria to other people through subsequent blood meals [5]. The ability of mosquitoes to acquire and transmit Plasmodium is influenced by ecological and biological factors such as mosquito density, human biting rates, competition between mosquito species, predation and vegetation presence [9]. The life cycle of Plasmodium occurs in both human and mosquito hosts. In a human host, a female Anopheles mosquito inoculates sporozoites during a blood meal. The sporozoites infect and multiply in liver cells [8]. The liver cells are eventually lysed, releasing thousands of merozoites into the bloodstream where they infect red blood cells and multiply. Some of the merozoites differentiate into sexual forms of the parasite, which can be taken up by mosquitoes. Within the mosquito, the sexual reproduction of the parasites occurs [7]. Fertilized zygotes develop into motile ookinetes that invade the midgut wall where they form oocysts. Oocysts undergo division producing thousands of sporozoites that migrate to the salivary glands of the mosquito and subsequently infect humans when the mosquito feeds again [1].

Global Malaria Statistics

Globally, malaria remains one of the most important health issues. In 2020, an estimated 627,000 people died of malaria, and 241 million new cases were identified. Attempts to reduce the numbers stagnated in 2015, and recently around a quarter less has been achieved than expected [1]. Malaria was responsible for an estimated 241 million cases and 627,000 deaths worldwide in 2020; 95% of cases and deaths occurred in Africa, as well as 79% of deaths among children under 5 years of age [2]. In the WHO South-East Asia Region, there were approximately 5.4 million estimated malaria cases and 8,800 deaths. Globally, 77% of estimated malaria cases and 80% of malaria deaths occurred in children younger than 5 years. While overall sex-disaggregated data on malaria are limited, in almost all settings the impact of malaria in the overall population tends to be greater among men than among women [2].

Impact of Malaria on Health

Malaria is a life-threatening parasitic disease transmitted to humans through the bite of infected female Anopheles mosquitoes. Of the handful of species responsible for human malaria, Plasmodium falciparum is the most prevalent and the most lethal, having been indicted for causing nearly all malaria deaths worldwide [8]. After an incubation period averaging 12 days, P. falciparum causes a wide spectrum of symptoms ranging from mild malaise to headache, muscle ache, chills, and high fever [1]. Without treatment, infection may progress to organ damage, seizure, coma, and death [1]. Throughout the 2000s, major global investments in malaria control helped substantially reduce the worldwide burden of the disease, but after more than two decades, these efforts appear to have stagnated without eradicating the disease. More than 90% of malaria cases and deaths continue to occur in sub-Saharan Africa, and despite the availability of effective treatments, the region bears the highest remaining burden of disease worldwide [2]. As with many other significant health challenges, the interplay between malaria, socioeconomic conditions, and gender is crucial for understanding disparities in disease burden and the development of sustainable interventions[2]. Gender-related disparities are often overlooked as epidemiological analyses focus predominantly on biological sex or disregard these factors altogether. However, female and male experiences with malaria are asymmetric through differences in the intensity of parasite exposure or vulnerability imposed by behavioral and social factors [1]. The existing literature on malaria verse gender indicates that the malaria burden the combined effects of all morbidity, mortality, quality of life, and other socio-economic indicators falls disproportionately on women across many endemic settings[1, 2].

Gender and Health

Malaria remains a major global health concern and a leading cause of maternal and neonatal mortality. In settings with intense, stable transmission, access to treatment or preventive interventions grants women partial immunity, whereas men of similar age exhibit little to no acquired immunity [2]. Case studies indicate higher prevalence

among adult females. Socioeconomic status (SES) acts as a significant determinant of illness, with lower SES groups disproportionately exposed to disease vectors and experiencing poorer access to treatment. Poor housing, proximity to breeding sites, engagement in high-risk occupations, and limited preventive measures elevate vulnerability [1]. Malaria burdens vary by gender and age, with women of reproductive age and children aged 0–5 years exhibiting the highest susceptibility [2]. Gender encompasses social and cultural definitions of expected behaviors among males and females, shaping roles, responsibilities, activities, and constraining livelihood choices within families and communities [7]. Within health systems, men often demonstrate a willingness to pay for services and medication; however, men and boys may have reduced access due to perceptions of strength, whereas women and girls encounter barriers stemming from lower household status, limited decision-making power, and constrained access to resources [6].

Gender Roles in Health Care

Women, particularly young children and pregnant women, have a higher risk of contracting malaria than men. The use of insecticide-treated nets (ITNs) is less prevalent among women, partly because of inequitable access within households. Some studies also indicate a higher mortality rate from malaria among women than men [6]. These disparities cannot be explained solely by biological susceptibility, which in some communities is even lower in women than in men [2]. A comprehensive analysis must therefore consider how gender through socioeconomic and cultural factors influences exposure to infection, access to and use of healthcare services, and prevention measures in different contexts. A detailed overview of gender-specific malaria burdens is provided in the following section [3]. Gender affects roles in healthcare and medical treatment. In Africa and Asia, for example, women often have less access than men to agency and autonomy in decisions regarding their own healthcare and medical treatment, despite accounting for most care within families when ill[9]. In many cultural contexts, men and women hold differing roles with consequent differences in exposure to and treatment of malaria; in particular, men often make healthcare decisions for the entire household, and women's needs are underrepresented in decision-making. Economic policies affect gender differentially, and men and women often react differently to incentives and constraints across a variety of life domains. For instance, even when control is distributed equally, men and women invest discretionary resources differently [1]. Socioeconomic constraints affect women more than men, especially those with children [2]. Surveys conducted during 2000 and 2018 in 19 mostly lower-income countries across Africa, Asia, and the Americas show that across a range of countries, products, and price levels, female-headed households had greater difficulty than male-headed households in making ends meet. Poverty and equity are well-known determinants of health outcomes and impact life expectancy and mortality rates differently for men and women [2].

Socioeconomic Factors Influencing Health

Understanding the relationship between gender and health reveals that this connection is mediated by socioeconomic factors so deeply engrained than an individual's health is also fundamentally affected by socioeconomic position [2]. Indeed, in low-and middle-income countries, socioeconomic inequalities have a substantially stronger effect on women and girls than of men, whose socioeconomic disadvantages remain less impactful on their health [3]. Socioeconomic disadvantage generally limits people's access to material and social resources and exposes them to multiple health hazards, either directly through living or working conditions or indirectly after affecting health-related behaviours [1]. For women, socioeconomic inequalities are also amplified by the fact that being ill limits their ability to cope with their daily roles and responsibilities.

Gender Differences in Malaria Burden

Global estimates of malaria cases approximate 200 million annually with direct consequences on mortality, reproductive health, and childhood development 2. Risk factors differ widely across different populations and groups[2]. Excess cases and deaths occur overall and disproportionately among women and young children in the region of highest endemicity [4]. Malaria-related anaemia during child birth and miscarriage coupled with maternal mortality constitute a major disease burden among pregnant women [1]. Furthermore, sociocultural and environmental factors coalesce and render an increased burden among women beyond biological factors. Gender, as a social construct and determinant of health, distinguishes the burden of disease on men and women due to differences in roles and occupation [4]. Fertility and birth-related conditions coupled with sex-specific exposure patterns often put women at higher risk of malaria. An understanding of how gender influences patterns and processes of malaria-related health outcomes therefore enhances interventions and management strategies against the disease [5]. Malaria is a mosquito-borne parasitic disease that causes high rates of clinical cases and deaths worldwide. The World Health Organization (WHO) African Region bears the highest burden of malaria globally, with approximately 95% of malaria cases and 96% of associated deaths. The number of malaria cases and deaths has decreased since 2010 although progress has seen a slow down between 2015–2019. The COVID-19 pandemic

has contributed to this stagnation of progress which can be reversed with renewed international support and increased funding [6]. In 2020, the WHO African Region contributed 46.1% of the six million populations at risk of malaria in 2000[1]. The region harbours some of the most vulnerable populations due to climate conditions, inadequate access to healthcare, poor housing and sanitation, greater poverty, and higher HIV/AIDS prevalence. Plasmodium infections and the risk of morbidity is highly heterogeneous [7]. High spatial variation also exists in access to healthcare and the potential to deliver interventions [6]. Reviews of more than 50 household surveys, two million hospital death records, and four million individual serological records reveal how infections and clinical case rates decrease with increasing transmission intensity but all cause hospital mortality rates remain flat across all endemicities. Interventions thus effectively reduce infections and overall burden of the disease [7].

Prevalence Rates among Genders

Malaria morbidity and mortality rates differ dramatically between sexes. In malaria endemic settings, adult men report a higher number of cases compared to adult women [1], perhaps due to gender differences in exposure. Mortality rates appear to be higher among women, though this difference may reflect differential access to treatment rather than biological vulnerability [2]. In most countries, transmission is stable among groups, with children and pregnant women facing the brunt of risk due to the complexities of immunity and physiological changes caused by pregnancy. While vulnerability to severe malaria itself is similar for men and non-pregnant adult women, several demographic and socioeconomic factors leave women disproportionately at risk of adverse outcomes [4]. Women's vulnerability to malaria extends well past the comparatively brief window of pregnancy. Malaria cases among pregnant women can only be detected if they attend antenatal clinics; women who do not attend are more likely to develop complicated malaria, including anemia [1]. Post-partum women absorb the protective benefits of pregnancy–associated hormones at a gradual pace, rather than immediately returning to their pre-pregnancy level of vulnerability [2]. Malaria is associated with an increased risk of abortion and low birth weight: in managed health facilities, women with a malaria infection during pregnancy suffered twice the risk of death during delivery [7]. The risk factors are compounded by the potential for socio-economic instability resulting from an infection during pregnancy; in response to pregnancy loss, widowed and abandoned women are at a greater relative risk of poverty [2]. Men face a different set of risk factors. Behavioural determinants, especially patterns of movement associated with work, are the most cited explanation for the disproportionate number of cases reported by men in African and Asian endemic countries [7]. Men exposed to infection in a different transmission regime may lack protective immunity. The general disinclination of men towards seeking treatment is often reported, although this varies substantially between contexts and with individual income [2].

Mortality Rates and Gender Disparities

The transmission characteristics of malaria differ between men and women. Exposure to malaria vectors varies according to the interaction between gender-specific cultural practices and mosquito biting behavior [7]. The seasonal labour migration of men has limited influence on gender roles since male migrants (and female co-wives in the polygynous system) use bednets more often and have fewer infections than other adult men [4]. Occupational exposure of men, often cited as a factor underlying gender differences, appears less important than exposure during evening social and domestic activities, to which women and children are more likely to be exposed. Pregnancy is a major factor in the excess malaria risk of women at ages 15–40 years [1]. The age–sex profiles of malaria prevalence and burden are also likely to be affected by the interactions with other co-infecting pathogens and exposure to particular vectors and transmission settings as well as the effects of control interventions [2].

Vulnerability Factors for Women

Experience in Uganda, confirmed elsewhere, suggests that factors such as pregnancy, gender roles and perceptions of illness may influence women's vulnerability to malaria and the likelihood of seeking treatment once infected. Two specific factors that increase women's exposure to infective bites result from local gender roles [6]. First, women are known to be at risk while carrying out domestic chores after dark, such as collecting firewood [1]. Second, in rural areas, women frequently spend periods before daybreak in outdoor open spaces and at communal wells (sometimes several km from the village) carrying out domestic tasks, including bathing and washing clothes [4]. Such exposures are consonant with the observations of significantly higher malaria prevalence among women during the younger, active-age groups [2]. Combining this with the knowledge that the widespread practice of self-medication for febrile symptoms is typically carried out using antipyretics rather than antimalarial drugs points towards avoidable risks associated with outdoor exposure [3]. Many settings support greater male permeability to malaria exposure through prolonged occupation-related exposure; men are, for example, more likely to endure prolonged exposure in forest settings in the course of economic activities such as hunting, logging or mining [5]. In addition, behavioural factors such as less consistent use of preventative measures (e.g., bed nets),

and more frequent use of self-medication for fever as noted in southern Ghana [1], may contribute to elevated male vulnerability.

Vulnerability Factors for Men

Much of the malaria burden is borne by women, yet men remain vulnerable to malaria through largely unspecified mechanisms [1]. In an urban setting in Ghana, women were more likely to go to open spaces early in the morning, and men were more likely to self-initiate medication after onset of fever [2]. Sex-specific differences in immunity suggest that males are less able to control parasite densities, resulting in higher parasite prevalence, while females are less able to tolerate high parasite densities without fever, increasing their probability of symptomatic infection [2].

Cultural Influences on Malaria

Cultural beliefs influence perceptions of diseases, such as malaria, and are integrated with gender norms and stereotypes that define women's and men's roles, responsibilities, and activities within their communities [1]. The result is a myriad of gender-specific behaviors that shape communities' understanding of and response to illnesses such as malaria [1]. Scholars around the world have shown that evidence-based, gender-sensitive malaria-control interventions can reduce local malaria burden by expanding confidence in the effectiveness of control interventions and by increasing the likelihood that individuals and especially the most vulnerable will utilize that control [1]. If malaria is endemic in a community, the illness will be recognized in terms consistent with cultural beliefs, but "nonexplicable" complications will be interpreted as reflections of community turmoil or unresolved social problems [2]. Both will call for social solutions, but the symptoms will lend some clues as to the matter at issue: malaria-caused reason disorders will provoke explanations related to the acts of ancestors or to the behavior of witches and sorcerers particularly those individuals who have much to gain from the delay of treatment or non-treatment [5]. A malarial fever is not simply a malarial fever in a malarial environment and should be addressed in these terms if a rapid return to productivity is to be achieved [7]. In some places, the prevalence of malaria is perceived as so apparent and universal as to be accepted as a matter of fate. Because it is seen as an illness of inevitability, it often receives considerably less attention than would be expected for a problem of such proportion [6]. A high proportion of malaria patients have spent considerable amounts of time trying to treat the illness with drugs purchased at local stores or with traditional remedies, some of which appear to have antimalarial properties but others of which are of uncertain efficacy [7]. Because of this, late stages of the illness when treatment is sought at public hospitals often do not respond as expected and result in a widespread perception of increasingly resistant strains rather than continued delays caused by reliance on inappropriate regimens[1]. Inasmuch as malaria is a community problem, the presence of a household with a malaria patient also raises a run-a-round of social responsibilities that hinder one's capacity to seek treatment or respond to illness-related opportunities [2]. Other household members will be taking greater loads of work at home, others in care-giving, and some (usually female) members will be going to the market or otherwise filling in financial and social gaps from the patient[1]. The replaced work, the extra work, and the chaotic conditions of a household with a person suffering from a perceived nonproductive illness result in labor displacements those begin with the adult group and quickly reach vulnerable children already at risk when mother and household head do not recognize an illness as clinically serious [2].

Cultural Beliefs and Practices

Cultural beliefs about curability and causation affect behaviour. Biomedically based explanations, for example, of infrared or heat as a symptom of malaria may not be accepted in all cultures, and may be translated as spiritual failure [2]. These beliefs and diverse healer practices are often shaped by gender norms[1]. A spectrum of beliefs emerging from such contexts can influence individual behaviour regarding malaria protection, prevention and treatment [2]. When these notions are embedded in gender norms the behavioural consequences may be more pronounced, and are more likely to display gender differentiation. Gender-specific traditions often shape responses to illness and health care-seeking [1]. Women are more likely to consult a traditional healer for many common ailments; as a result, they also are more likely to consult a traditional healer for malaria even in areas where effective antimalarial treatment is readily available [1]. All groups, regardless of gender, typically relied on malaria prevention methods prescribed by traditional medicine; however, the particular methods used varied according to gender roles. Women more commonly used herbs with antimalarial properties, often administered as a brew or an infusion that could be sourced from local waters and moorlands. Men, on the other hand, largely ignored types of medicinal herbs, favouring faith-based protection, using herbs for protection from spells rather than for malaria per se[1].

Gender Norms and Disease Perception

The highest burden of disease and mortality caused by malaria is found in low- and middle-income countries with fragile health systems and remains a major contributor to poverty and poor development [3]. Across sub-Saharan Africa, malaria is a leading cause of death [2]. Exploring the gender dimensioning of malaria prevalence, diagnosis, and treatment-delays is essential to malaria control, treatment, and prevention [4].

Access to Treatment

Both men and women experience barriers to accessing treatment for malaria. For women, difficult relations with health professionals, an inability to pay for services, and a lack of childcare may discourage or prevent them from receiving appropriate treatment [1]. For men, stigma attached to illness so damaging to their masculinity and masculinity tied to role as the family provider inhibits care seeking [2]. CHWs work to reduce access barriers by providing free testing and treatment, often within their own communities, and help improve access by reaching out to populations in remote areas who are typically underserved by the health system [1, 2].

Barriers to Access for Women

Malaria is a rapidly spreading global health issue that poses a threat to millions of people worldwide [1]. The gender dimensions of malaria should be considered in an attempt to further understand the disease and enhance malaria-related control strategies [2]. Gender is defined as a socially constructed system of classification that conveys power and determines the roles and responsibilities of men and women in society [1]. Transmission of the malaria parasite is primarily influenced by the physiological and behavioural differences between genders; however, in many contexts, gender intersects with socioeconomic, cultural and demographic factors to determine vulnerability and exposure to malaria species [5]. In these contexts, gender inequalities result in greater burden of infection and differential access to and use of care between men and women, resulting in negative health and economic outcomes for both. Goal-oriented gender-based analysis can identify and address those factors that increase the vulnerability of men and women to malaria in order to develop and implement appropriate policies and programmes that adequately address malaria transmission dynamics [3].

Barriers to Access for Men

Socioeconomic and cultural determinants constitute specific barriers to treatment-seeking for men [1]. In the last few years, the number of community health workers has increased and some evidence of reduced mortality has been reported. Some pilot studies also suggest that community health workers could play a greater role in facilitating access to malaria treatment among men, in particular among migrant workers [1]. Further research is needed on the extent to which the uptake of community-level services might differ across genders and on strategies to boost access to formal care for men [1]. Barriers to decision-making and autonomy are rarely illustrated as constraints for men to access treatment [2]. The evidence therefore suggests that men face more barriers to accessing prevention and care services than women, and that the reasons for these appear to be driven more by socioeconomic and cultural factors than by direct gender inequalities such as lack of autonomy in health-care decisions [2].

Role of Community Health Workers

Reported barriers facing women and men in relation to malaria create opportunity for an alternative health services provider: community health workers (CHWs)[5]. The World Health Organization (WHO) recognized the benefit of establishing a community health workforce in 1978, but the Alma Ata Declaration reaffirmed it as a primary principle for community health post-2000 [1]. Given their role, which facilitates treatment administration and education campaigns at a household level, CHWs could assist in countering the obstacles connected to healthcare access [1, 5].

Preventive Measures

Gender-specific outreach targeting men and women with tailored messages represents a promising approach to substantially reduce the malaria burden in endemic countries [3]. For instance, in Nepal, a CDC campaign encouraged men to use insecticide-treated nets (ITNs), whereas in Rwanda, another effort prompted women to increase ITN usage. Nationwide Kenyan campaigns thereby seek to raise awareness among both genders of the importance of malaria prevention [1]. Enhanced male understanding of malaria risk and control measures can contribute to increased use of nets within their households [4]. Similarly, elevating female access to information and mosquito avoidance skills motivates children to adopt protective behaviours at a young age. The resulting reduction in the malaria burden underscores the value of gender emphasis in control efforts [4]. Men and women ultimately require equal access to affordable protection technologies, yet notwithstanding gender-specific outreach, mounting numbers of malaria cases and deaths highlight remaining challenges [3]. Only through the adoption of evidence-based policies that integrate gender concerns can the malaria burden alongside widespread poverty and inequality be significantly reduced worldwide [3].

Gender-Specific Interventions

Gender is a key social determinant of health that is commonly overlooked compared to other socioeconomic and cultural correlates, particularly in malaria interventions [2]. Interventions tailored to the different needs of men and women, instead of uniform standard approaches, are crucial to reduce malaria burden by addressing gender-specific barriers. Many interventions have been adopted to reduce this burden in accordance with differing exposures, behaviors, and specific needs outlined in preceding sections [7]. Awareness campaigns in several countries highlight the importance of wearing long-sleeved clothes and using insect repellent, targeting the higher exposure of male agricultural workers during peak mosquito hours in the evening [1]. Programs in Senegal have introduced education on insecticide-treated net (ITN) management and usage, applying malaria reconnaissance techniques to these gender-related transmission surveys. They also provide notification of new malaria distribution data through surveillances [2]. Lawan et al. summarize the necessity of gender education when conducting interventions to account for the different roles and perceptions of men and women, emphasizing tailored delivery of malaria information and treatment-seeking guidance [4]. Malaria partners and organizations have responded to the demonstrated influence of gender by calling for gender-sensitive interventions [7]. For example, the 2018–2030 National Malaria Strategic Plan of Kenya highlights the need to monitor progress toward gender-specific targets [3]. The Roll Back Malaria (RBM) partnership also recognizes gender as a determinant of malaria exposure to assist control programs in developing gender-focused interventions. The Malaria No More foundation recommends adopting such approaches worldwide to reduce burdens on women in countries like Bo, Sierra Leone [7].

Education and Awareness Campaigns

Music and art festivals attract large crowds, including young adults drawn to specific performers. Many attendees are highly intoxicated due to heavy alcohol use or recreational drug use, and venues are often overcrowded. Loose packing, inadequate ventilation, extreme temperatures, and prolonged physical exertion increase the risk of dehydration, injury, hyperthermia, heat stroke, and rhabdomyolysis [1]. Trauma, panic, and poor crowd control contribute to the risk of crowd crush [2]. Coma and Deaths Arrayed around me, I watched several men collapse to the ground in rutlike states. Almost all of them were black men. Heads rolling, smokepouring, and Oli picking out the wreckage. We never found out what happened to them, but African-American men suffer from a high incidence of rhabdomyolysis[7]. Education and awareness campaigns targeting men, women, and youth have been launched by local ministries of health and international partners [2]. They emphasize personal preventive measures and the importance of seeking prompt treatment for suspected malaria. Malaria awareness-raising and prevention activities are increasingly integrated into antenatal care services. Although evidence from nationally representative data is scarce, nationwide campaigns have contributed to increasing demand for, and use of, insecticide-treated nets [1, 5].

Policy Implications

Malaria control policies frequently incorporate considerations of culture and gender or engage in detailed gender analysis [4]. The World Health Organization's (WHO) Strategic Framework for Malaria Communication at the Country Level emphasizes targeting communication strategies to specific audiences to increase coverage and participation in malaria-control interventions [5]. Since cultural beliefs and norms can significantly influence the acceptability of campaign interventions, communication strategies seek to identify gender-specific messages and appropriate delivery channels [4]. A gender analysis of malaria policies and strategic plans across 11 African countries revealed limited integration of gender concerns [6]. Of the countries that incorporated gender considerations into these documents, a number of best practices were identified [7]. Uganda's malaria control strategy stresses the importance of integrating gender and other issues of social exclusion when designing communication programmes, with a particular emphasis on women's empowerment and gender-based vulnerabilities to malaria [6]. Zambia's malaria strategic framework explicitly commits to mainstreaming gender, equity, and human rights concerns throughout the control programme. Complementing policy frameworks, national guidelines and implementation manuals also provide opportunities for integrating gender considerations. For example, a series of strategic guides and manuals has been developed to support community health workers as they take on an increasing array of malaria activities [2]. Similarly, training materials and manuals equipped with gender strategies can help with the transition from a broad commitment to gender equality to practical gender-sensitive action [6].

Integrating Gender in Malaria Policies

Incorporating a gender perspective is essential for malaria policy formulation, implementation, monitoring, and evaluation. References such as 1 and 4 undergird this assertion [7]. The gendered character of malaria is not a purely biological question. Macrolevel malaria trends do not carry a simple correspondence with either self-

reported malaria or with the aggregate national disease burden [6]. Gender intersects with socioeconomic and cultural factors, however, to shape the disease's health impacts and to intensify malaria's devastating consequences across the globe [5]. A variety of gender-sensitive risk factors discriminate the disease's human and spatial epidemiology, indigenous knowledge of the infection, and patterns of settlement and exposure [6].

International Guidelines and Frameworks

The development of international frameworks and guidelines specific to malaria provides critical support for the integration of gender-relevant approaches into policy and strategy development refining national malaria-control programmes with focus on the equity, capacity, sustainability, and human-rights perspectives underpinned in SDG [5]. Malaria interlinks broadly with other explicit goals including poverty (SDG 1), hunger (SDG 2), health (SDG 3), water (SDG 6), energy (SDG 7), employment (SDG 8), inequality (SDG 10), climate change (SDG 13), and peace (SDG 16) [6]. International guidelines issued by the World Health Organization (WHO), such as Gender, Climate Change and Health, the WHO Gender Responsive Assessment Scale, and Operational Framework for Equitable and Gender Responsive Tuberculosis Programmes, are relevant to malaria as well, with many more specific recommendations outlined in the Gender Perspective in the Response to HIV [6]. The RBM Partnership to End Malaria strategy on building resilient and sustainable health systems that integrates malaria programmes with other health and development priorities is also essential for effective gender mainstreaming [1]. A gender perspective not only categorizes women as a 'vulnerable' group but further underscores the intersectional influence of gender with age, race, and socioeconomic status [3]. This position is conveyed by gender-based recommendations on literacy, stakeholder participation, supply accessibility, sector-specific budgeting, and equity-oriented diffusion [4].

Case Studies

Certain programmes that draw on a gender perspective in tackling malaria can be cited as illustrations[1]. In Nigeria, for example, the distribution of insecticide-treated nets (ITNs) is explicitly gender mainstreamed through the National Malaria Strategic Plan (NMSP). Malaria awareness is further raised through activities during International Women's Day (IWD) and World Malaria Day (WMD) [1]. Similar campaigns have been launched in Ethiopia's Amhara, Oromia, Tigray and Southern Nations, Nationalities and Peoples' (SNNP) regions, and in Dare Salam and Coast Regions of the United Republic of Tanzania [2]. Ghana's Livelihood Empowerment Against Poverty project, meanwhile, focuses on female-headed households, while Ghana's Malaria Volunteer Programme, Mozambique's Community Health Workers Programme and the United Republic of Tanzania's Home Based Management of Malaria Initiative both extend awareness-raising activities to men.In some contexts, however, there remains a lack of coordination between Ministries of Health and Women's Affairs, despite commitment at the highest levels [1]. The limited participation of women at various levels of decision-making also hinders gender mainstreaming, as does insufficient disaggregation of data and lack of dedicated policy documents [3].

Successful Gender-Inclusive Programs

Malaria is a life-threatening vector-borne disease caused by protozoan parasites of the genus Plasmodium. Spread mainly through the bite of infected female mosquitoes, the disease follows a complex life cycle involving both human and mosquito hosts [1]. In 2017, according to the World Malaria Report, there were an estimated 219 million cases of malaria worldwide, with approximately 435,000 deaths. However, due to limitations in data collection, the true number of deaths may well be significantly higher [3]. Previous sections have established that gender differences in malaria burden are well recognized, with women often suffering higher prevalence and mortality rates than men [1]. Geographic, cultural, legal, and societal factors all contribute to the differential vulnerability to malaria observed between women and men [4]. Moreover, the integration of a gender perspective into malaria policies is essential for the effective planning and implementation of malaria control programs [7]. As these factors become better understood and the underlying economics of malaria change more gender-specific policies are likely to emerge in malaria prevention and treatment programs. Several malaria-endemic countries have adapted their programs to account for these differences [2].

Challenges Faced in Implementation

Challenges exist in implementing gender-specific solutions to malaria. Systems used to classify malaria infection and identify those seeking treatment rarely collect or utilize gender-specific data [4]. This oversight is problematic because similar systems elsewhere have shown that individuals assigned female at birth with malaria-related fever are less likely to obtain diagnostic testing compared to those assigned male at birth [4]. Available data also indicate that, in regions such as Nigeria, girls die of malaria at higher rates than boys. Despite Maria Nzomo's definition of culture as the totality of knowledge, belief, and behavior learned and socially transmitted

from generation to generation, there remains scant detailed understanding of the cultural processes by which gender norms evolve in specific settings or influence health behaviors related to malaria [4].

Future Directions

Research on gender and malaria continues to expand, advancing understanding of disease transmission, epidemiology, and social dynamics [6]. New approaches address knowledge gaps and inform strategies to reduce malaria burden. Studies on gender and cultural norms aim to improve dimensions of vulnerability and resilience at local and international levels. Complexities arise with a changing climate, rapidly urbanizing communities, and economic development; future strategies focus on enhancing supportive environments for communities' sustainable development [7]. Understanding the links between education, gender, health, and malaria-focused interventions remains key for policy development [1]. Priorities include understanding intersectionality with age, ethnicity, and culture; routinely incorporating gender considerations into national malaria survey datasets; and designing future monitoring and evaluation systems to capture gender aspects more effectively [2]. Although gaps remain, the World Health Organization has begun embedding these approaches within its technical guidance. Progress is advancing not only conceptual understanding of gender relations and malaria but also operational and programmatic responses designed to address gender-specific exposure and vulnerability [3]. The global research agenda for malaria must now incorporate gender analysis as a key cross-cutting theme, alongside climate change and urbanization [2].

Research Gaps

Malaria is a life-threatening disease caused by parasites transmitted to people through the bites of infected female Anopheles mosquitoes [8]. It remains a major global health challenge, threatening billions and causing millions of deaths each year despite ongoing gains in prevention and control [9]. The burden of malaria varies by demographic and socioeconomic factors, with gender emerging as key dimensions that intersect with both risk and health consequences. Across countries, men have higher reported malaria incidence, while women experience higher mortality [10]. Men tend to face greater exposure related to forest work and carbon-dioxide secretion which attracts mosquitoes [2]. Women's vulnerability is shaped by commodity constraints that inhibit uptake of preventive measures, the overlapping burdens of pregnancy and malaria, and greater exposure within the home. Within-household gender norms shape women's time allocation and limit their mobility, which also influence exposure [6]. Barriers to treatment access arise from economic constraints, restricted mobility, and lack of information, though community health workers can play a critical role in reducing female mortality by mitigating these barriers [4]. Gender-specific preventive activities, such as providing mosquito nets to pregnant women and protective kits for men engaging in high-risk outdoor work, combined with targeted education campaigns, can effectively reduce malaria burden while fostering broader outreach through community workers [7]. Yet, further research is required to address significant gaps including the incorporation of gender perspectives into policies and guidelines [5].

Innovative Approaches to Gender and Malaria

Significant knowledge gaps remain about how gender matters within malaria epidemiology and how gender is embedded within social priorities and structural constraints [2]. Social, economic and cultural changes that challenge traditional gender roles can alter the underlying factors mediating gender-differentiated vulnerability to malaria and other infectious diseases [11]. In particular, additional refinement and development of more practical options bridging overarching epidemiological and sociological insights represent a key area for future work [2]. Novel analytical techniques are available to unpick the socio-politico-economic factors driving vulnerabilities and differential access to healthcare [7], with an opportunity for careful integration with epidemiological modelling to generate scalable approaches specifically addressing gendered vulnerabilities and interactions [12].

CONCLUSION

Malaria continues to pose a severe threat to global health, with gender shaping who is most affected and how effectively the disease is prevented or treated. Across endemic regions, women's heightened biological vulnerability, particularly during pregnancy is compounded by social and economic inequalities that limit access to health information, preventive tools, and medical services. Men, although often more exposed to mosquito bites due to outdoor work, tend to underutilize preventive measures and delay seeking care because of cultural notions of strength and self-reliance. These intersecting challenges underscore the need for gender-responsive malaria control strategies. Community Health Workers (CHWs) remain instrumental in addressing gender barriers by providing essential health services, education, and early diagnosis at the household level. Integrating gender perspectives into malaria programs through equitable access to prevention tools, gender-sensitive training, and participatory community engagement enhances intervention success. Policy frameworks in countries like Kenya, Zambia, and Uganda demonstrate that embedding gender analysis into national malaria strategies fosters

inclusivity, accountability, and sustainability. However, persistent challenges including inadequate data disaggregation, weak inter-ministerial coordination, and limited gender research continue to constrain progress. Future approaches must embrace innovative analytical tools that merge epidemiological and sociological insights, ensuring that gender is not an afterthought but a central pillar of malaria response. Strengthening global and national commitments to gender equity in health will not only reduce malaria's burden but also advance broader development goals under the 2030 Agenda. Ultimately, eliminating malaria demands not just medical solutions but a transformation in how societies address the intersecting forces of gender, poverty, and health inequality.

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