

REVIEW

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Social determinants of malaria in low- and middle-income countries: a mixed-methods systematic review

Edwinah Atusingwize^{1*}, Kevin Deane² and David Musoke¹

Abstract

Background Malaria remains a leading cause of morbidity and mortality in many low- and middle-income countries (LMICs). Factors outside the health sector, including social determinants, such as economic status remain important drivers of malaria in these settings. However, social determinants of malaria generally remain unaddressed in preventing the disease, with the limited existing evidence overly descriptive and fragmented.

Methods A mixed-methods systematic review was conducted to thematically synthesize the current evidence on the social determinants of malaria in LMICs. PubMed, Web of Science, and Scopus were searched to identify English articles on the social determinants of malaria published between January 2013 and December 2023. Search terms such as social determinant, socio-cultural, and socioeconomic factors were used. Articles that did not meaningfully engage with the social determinants were excluded.

Results The 39 articles included in the review were mostly cross-sectional and qualitative studies of moderate quality, in general. Findings indicate a range of social determinants of malaria related to the following overarching themes: environmental factors, access to and use of treatment, preventive interventions use, housing, stakeholder influence, livelihoods and economic development, and poverty. The various social determinants influenced malaria in different ways, including limiting access and use of preventive and treatment interventions and increased exposure to mosquitoes. Poverty and gender intersected with other social determinants such as housing and livelihoods.

Conclusion Different social determinants of malaria are key drivers of malaria in LMICs. The findings emphasize the need for malaria control efforts to consider social determinants at all levels, including funding, implementation, and evaluation.

Keywords Social determinants, Malaria, Uganda, LMICs

Background

Malaria continues to be a significant global health concern and remains amongst the top ten leading causes of morbidity and mortality in Africa, the region that is most impacted by malaria [1]. The latest data shows that in 2023, there were an estimated 597,000 deaths due to malaria, 95% (569,000) of which originated in the African region [2]. The other malaria cases and deaths are primarily concentrated in other low- and middle-income countries (LMICs). This burden remains unacceptably high [3] amidst biological threats of anti-malarial drug

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resistance [4], the resistance of malaria vector mosquitoes to insecticides, changes in patterns of mosquito behaviour, increased outdoor biting, and diagnostics challenges [3, 5, 6].

Despite the significant resources invested in malaria prevention and control over several decades, progress toward eliminating malaria has stagnated [2, 7]. Recent data [7] shows that with some fluctuations, the estimated number of malaria cases in 2023 (263 m) was similar to those in 2000 (238 m). The number of cases decreased gradually between 2000 and 2014, but since then, there has been a steady increase, particularly from 2020 onwards. In terms of malaria deaths, progress has been more encouraging. In 2000, the estimated number of malaria deaths was 861,000. This decreased to 567,000 in 2019, but has since increased to over 600,000, again since 2020. Overall, the data shows that malaria cases and deaths remain persistently high, and more recently, hard-won gains have begun to reverse [2, 7]. This suggests that there is an urgent need to increase funding and prevention efforts as well as to rethink strategies for malaria elimination.

Currently, malaria prevention strategies are dominated by biomedical and behavioural approaches [8]. Biomedical interventions include expanding access to malaria testing and treatment, seasonal chemoprevention for children under 5 years, preventive therapy for pregnant women, investment in the development of more effective and longer lasting insecticides, larvicides and residual spraying, and more recently the new malaria vaccine. Behavioural interventions have primarily focused on efforts to prevent transmission within dwellings, and include the distribution of long-lasting insecticidal nets (LLINs) and education and promotion campaigns to ensure that household members sleep under them every night, the use of indoor residual spray, and encouraging the closing of doors and windows in the early evening [8]. Whilst there are other recognized ways of addressing malaria, such as through environmental management and housing improvements [9], these have either fallen out of favour, are costly and difficult to implement, or do not align with the biomedical/behavioural approach.

One potential explanation for the stagnation in malaria elimination is the failure to engage with the social determinants of malaria. The social determinants of health have been defined by the World Health Organization (WHO) as ‘the circumstances in which people are born, grow up, live, work and age, and the systems put in place to deal with illness. These circumstances are in turn shaped by a wider set of forces: economics, social policies, and politics’ [10]. When applied to malaria, these include a wide range of factors such as environmental quality, social cultural issues, political environmental, as

well as social economic factors [8, 11–13]. It has been long established, for example, that malaria is highly correlated with poverty in repeated malaria indicator surveys conducted in Africa [14–16]. The WHO has made concerted efforts to promote a focus on the social determinants of health, including the influential report ‘Closing the gap in generation [10]’. The WHO has also warned that the ‘failure to recognize the toll of malaria as persistent evidence of inequitable global systems and patterns of resource allocation undermines our ability to reduce the global burden of malaria and sustain those improvements over time’ [11]. On the other hand, these efforts have not led to a significant engagement in relation to malaria. A recent systematic review covering published articles from 1984 to 2017 found only 10 studies that had explicitly engaged with the social determinants of malaria and concluded that little progress has been made in this area [17]. There was also little mention of the social determinants in the influential 2019 Lancet commission report on malaria eradication, which doubled down on the biomedical and behavioural approach [18]. Research on some of the social aspects of malaria exists, although this evidence remains scattered and fragmented. For example, a systematic review by Cardona-Aries et al. mapped 33 different determinants that were rarely presented through a social determinants framing [17]. This may help explain why current evidence has not influenced the policy agenda or the narrative around malaria control efforts in LMIC settings. Therefore, the aim of this systematic review was to thematically synthesize qualitative, quantitative, and mixed studies on social determinants of malaria in low and middle-income countries. This review provides a contemporary summary that may contribute to changes in malaria policy, practice frameworks, and priority setting for global malaria prevention efforts [9, 13, 19].

Methods

Search strategy

This review was conducted and reported in accordance with the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols Guidelines statement (PRISMA-P) [20] and registered in PROSPERO [CRD42023479917]. PubMed, Web of Science, and Scopus were searched to identify articles on social determinants of malaria between January 2013 and December 2023 using search terms such as social determinant, socio-cultural and socioeconomic. To ensure robust search output, the MeSH terms and Boolean operators were used in the search strategy. Appendix S1 has the search terms that were used. Other sources were the reference lists of the included studies which were searched to identify any eligible full-text records for further

screening. The search was updated in December 2024 for any new relevant articles. The key question in this review was what is the current evidence on the social determinants of malaria in LMICs?

Eligibility criteria

Inclusion criteria

The inclusion criteria were defined using the population, concept and context (PCC) framework.

Population: Individuals of all ages and gender, regardless of the location within the LMICs, were considered.

Concept: Social determinants of malaria was the concept under study. Any study (regardless of the design) that focused on the social determinants of health such as environmental factors, socio-cultural conditions and gender was included. All studies addressing social determinants of malaria—whether measured as incidence, prevalence, or malaria control measure/intervention were included. Studies focusing on social determinants related to mosquito presence and behaviours as well as related interventions, were included.

Context: Only articles written in English on any of the social determinants of malaria that were conducted in low and middle-income countries were included. The included LMICs were based on a definition by the World Bank Country and Lending Groups Country Classification as of November 2023 [21].

Exclusion criteria

Systematic and narrative reviews and protocols, editorials, conference abstracts, case reports and theses or other research work not published in peer reviewed journals were excluded. All studies that were not meaningfully engaging with social determinants of health beyond the basic demographic descriptions were excluded.

Study selection

After combining results from the database searches into an endnote library (reference manager), all duplicate articles were removed using the 'find duplicates' function. Different levels of screening were conducted to identify the illegible studies. First, EA assessed the titles of the retrieved articles, and two authors (EA, KD) conducted the abstracts screening. Two authors (EA, KD) screened and evaluated the full texts independently and a third reviewer (DM) resolved any divergency in decisions. Reasons for any exclusions were recorded.

Data extraction

An Excel spreadsheet was used to extract information on study design and methods, study/population characteristics, social determinant in focus, comparator group (s) if applicable, and outcome measures (Appendix S2). To

avoid double counting, the results of studies presented in multiple papers for the same population were included once in the review.

Quality assessment of individual studies

Quality assessment of all included articles was conducted by EA and KD independently. For the quantitative studies, an adapted version of the Effective Public Health Practice Project Tool (EPHPP), which has been used in other reviews including a recent one on the pathways between poverty and malaria in sub-Saharan Africa [22] were used. With this tool (EPHPP), the assessment of risk bias was based on the selection of participants, study design, control of confounders, outcome measurement, exposure assessment, and withdrawals/dropouts (in case of longitudinal studies). Each item was rated as weak, moderate, or strong according to the EPHPP quality assessment criteria which is used to determine an overall score. For qualitative studies, quality assessment was conducted using the Joanna Briggs checklist for qualitative research appraisal tool [23]. The Mixed Methods Appraisal Tool (MMAT) [24] was used for the mixed methods studies (Appendix S3, S4 and S5). Any issues that needed clarification during the quality assessment were checked and resolved in a meeting involving DM.

Data synthesis and analysis

This was a qualitative synthesis, and no meta-analysis was done because majority of the studies were qualitative. Review data was synthesized narratively, and findings are descriptively presented in themes elaborating the different social determinants of malaria and their relationship with the disease. Data in a tabular form highlighting the country, year of study, objective, population, and outcomes among others is available (Appendix S2).

Results

Characteristics of studies included in the review

A total of 2913 peer-reviewed articles were retrieved by the search strategy from all the databases (PubMed, n=2592; Scopus, n=146; and Web of Science, n=175) and grey literature on social determinants of malaria in LMICs. After removing duplicates (n=129), 2,786 articles remained. After screening titles, 303 studies were retained and screened at the abstract level. Screening for relevance of the articles based on the full-text (n=82) followed by retaining a total of 39 articles [8, 25–62] that were included in the review. Details of the screening process are diagrammatically represented in the PRISMA diagram (Fig. 1).

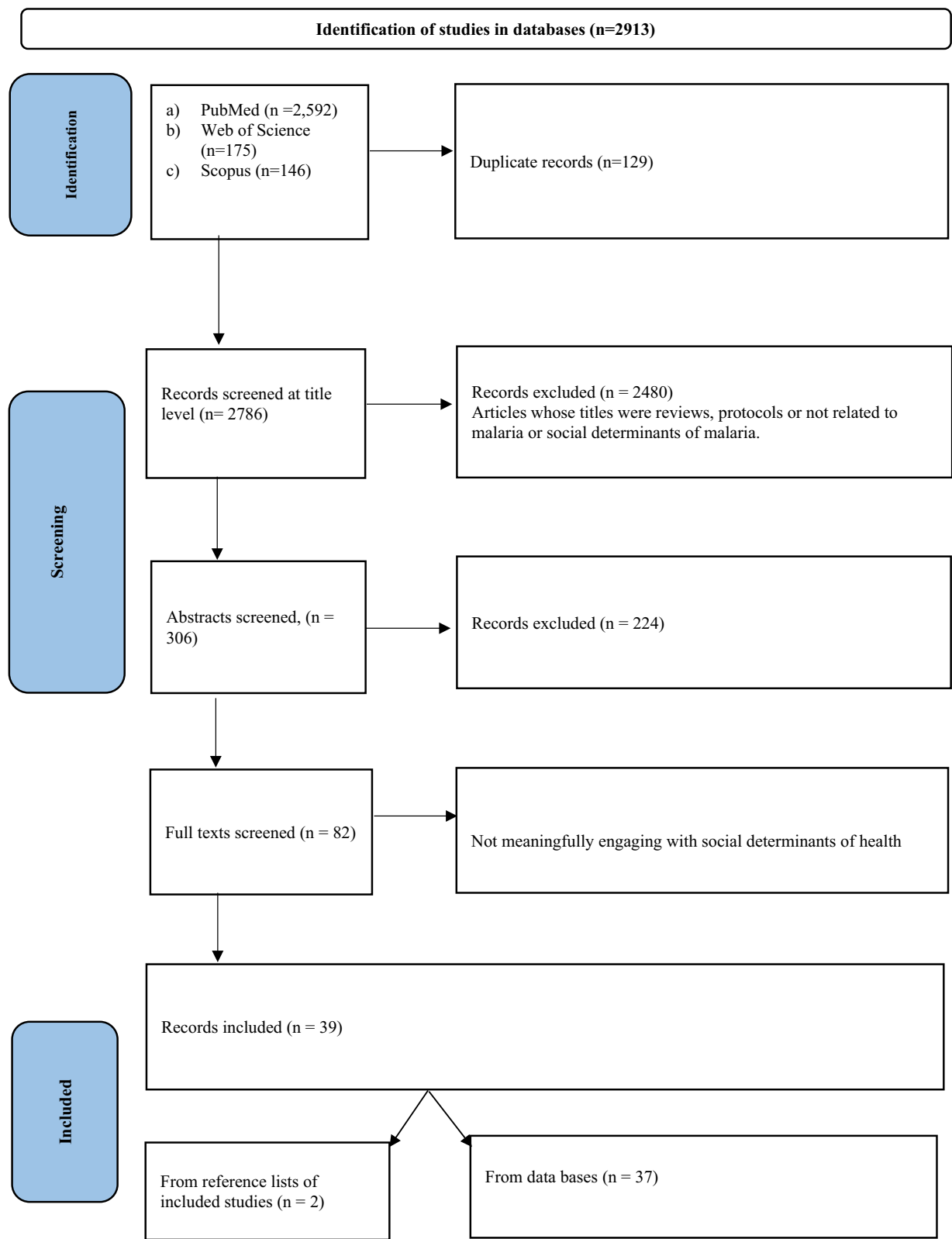


Fig. 1 Flow diagram showing records selection

Study setting

Of all the 39 studies [8, 25–62], the majority (n=4) originated from Ghana [25, 26, 38, 42], followed by Uganda (n=3) [34, 47, 56], Kenya (n=2) [35, 40], Ethiopia (n=2) [36, 43], The Gambia (n=2) [39, 41], the Brazilian Amazon (n=2) [29, 46], Nigeria (n=2) [50, 62], Cameroon (n=2) [51, 52], and Peru (n=2) [59, 60]. Other articles were from; Nepal [30], Haiti [37], Venezuela [31], Rwanda [32], Chad [45], Northern Borneo (Sabah) [48], South Africa [27], Malaysia [49], Madagascar [53], French Guiana [54], Odisha in India [55], Namibia [57], Vietnam [61]. A few studies were conducted in different countries including Sri Lanka and England [33], China-Vietnam border [58], Madagascar, Mozambique, Nigeria and the Democratic Republic of the Congo [28], Vietnam, Laos, and Cambodia [44] and Sub-Saharan Africa [8]. The Appendix S6 is a map that highlights the countries where the studies included in this review were conducted.

Study designs and methods

The majority of studies were cross sectional (n=27), followed by longitudinal (n=7) [27–29, 31, 34, 40, 52], ecological (n=3) [29, 51, 58], and cluster-randomized trial (n=2) [39, 41]. Most studies (n=33) were qualitative [8, 25–28, 30–34, 36, 37, 39, 41–46, 48–50, 53–57, 59–62], followed by quantitative (n=13) [30, 31, 34, 35, 38, 40, 45, 47, 51, 52, 55, 57, 61] and mixed methods (n=7).

Study population/participants

The majority of participants in the included studies were community members/household data [25, 30, 31, 34–37, 39, 43–45, 49–52, 56, 57], including pregnant women [28, 38, 41, 42], gold miners [54], nomadic groups [45], forest workers [44] and indigenous populations [34]. Patients [27, 45, 46, 55], health workers [25, 26, 28, 37, 44, 46, 47, 57], and other key informants including traditional healers or religious leaders [28, 36, 37, 44] were involved. Some studies used population data [8, 29, 32, 33, 40, 51] including mathematical models [8, 32, 33] and evidence across sub-Saharan countries [8]. Mosquito (entomological indices) and environmental data [31, 40, 52] were also included.

Quality of studies

The qualitative studies subjected to quality assessment [25, 26, 28, 30, 31, 36, 37, 39, 41–46, 48–50, 53–57, 59, 60, 62] using the JBI Critical Appraisal Checklist for qualitative research were not scored, but generally performed poorly on questions/items 1, 6, and 7. With the exception of 3 studies [8, 32, 33] that were more of commentary, other studies were subjected to quality assessment using the effective public health tool/checklist for quantitative

studies and the Mixed Methods Appraisal Tool (MMAT) for the mixed methods studies [24]. Most of the quantitative studies were of ‘moderate quality’ and only 3 studies [47, 51, 52] were ranked ‘strong quality’. The mixed methods studies scored poorly especially regarding the item on adherence to the quality criteria of each tradition of the methods involved. The details of quality assessment with scores on each item of the tools are indicated in Appendix S3, S4 and S5. All studies were included in the review regardless of the quality.

The social determinants in the included studies

The included studies [8, 25–62] covered different social determinants of malaria in relation to different outcomes including malaria prevention and control including healthcare access and utilization of anti-malarial treatment; malaria transmission and incidence or prevalence; as well as social, environmental, and community factors. Outcome information is summarized in Table 1 with specifics of different studies in Appendix S2. The social determinants of malaria have been grouped and described within the following different themes: environmental determinants; access to and use of treatment; preventive interventions use; housing; stakeholder influence; and livelihoods economic development (Table 2).

Environmental determinants

The environmental determinants (n=13) include factors that create favourable conditions for mosquito breeding [8, 26, 27, 31, 32, 37, 40, 42, 46, 48, 49, 58, 59, 62], summarized in terms of water, sanitation and hygiene; environmental nature; water bodies; and weather conditions.

Water, sanitation and hygiene

Studies showed that water, sanitation and hygiene (WASH) influenced mosquito breeding and malaria. Poor waste management, and bushy environments increased the malaria transmission, incidence, and prevalence [8]. The need to consider improved personal, home, and environmental hygiene and access to water in the effort to reduce the socioeconomic disparities that influence malaria transmission was emphasized [8, 48, 62].

Water bodies increasing mosquito breeding grounds

Water bodies were critical in mosquito breeding and malaria transmission [27, 32, 40, 48, 59]. Ponds/stagnant water were common even on streets, greatly concerning and reduced mosquito net efficacy [27, 59]. Malaria risk not only increased with decreasing distance to water bodies but also irrigated areas and was generally elevated in the intensely irrigated areas [27, 40].

Table 1 Outcomes in the included studies (Malaria, malaria related outcome)

Outcome	Malaria transmission and incidence or prevalence	Malaria prevention and control	Social, environmental, and community factors
	Malaria incidence	Uptake of intermittent preventive treatment of malaria	Malaria and the environment
	Annual municipal incidence of malaria	Acceptability, delivery, and uptake of C-IPTp	Social vulnerability to Malaria
	Malaria causes	Uptake of ITNs	Social cohesion as expressed by the trial population
	Malaria prevalence	Availability of antimalarial drugs in general public hospitals	Neighbourhood level intervention
	Malaria occurrences	Ownership and/or use of bed nets in pregnant women	Strategy of community and private sector engagement
	Malaria burden—malaria incidence	Practices for malaria prevention	Inequities to health relating to <i>P. knowlesi</i> malaria exposure
	Malaria transmission	Prevention of mosquito bites	
	Mosquito density	Malaria control measures	
		Efficacy of LLINs	
		Persistent long-lasting insecticidal nets utilization	
		LLINs misuse	
		LLIN use	
		Prevention of malaria	
		Malaria elimination	
		Pregnant women's adherence to anti-malarial treatment	
		Malarial treatment	

Environmental nature

The nature of the environment such as forested landscapes [31, 37, 42, 46, 48, 49, 58] was a risk factor for malaria creating favourable environmental conditions for vector breeding [31, 37, 46]. The social and biophysical environment/ecological factors [48, 49, 58] including environmental degradation, influenced malaria prevention and incidence, while neighbourhood characteristics, such as shaped access to health care and interventions [42, 58]. For instance, a study in Ghana indicates that the community's views on the neighbourhood's effect on health, including perceptions on the effect of poor sanitation on malaria, can influence the effect of neighbourhood interventions, including malaria interventions [42].

Weather conditions

A few studies indicated that weather conditions impacted malaria incidence [32, 40]. Rainfall and other weather events such as El-Nino were significant in driving up malaria [40] and drought and related famines increased social vulnerability to malaria [32]. The use of mosquito nets was influenced by the seasons, with the cold (versus warm) periods promoting more net use [26].

Access to and use of treatment

Access and use of malaria treatment including mass drug administration (MDA), and intermittent preventive treatment of malaria in pregnancy was another theme described under these sub-themes: social cultural barriers and traditional medicines/ethnomedical medicines.

Social cultural barriers to access to and use of malaria treatment

Most studies (n=11) reported that social and cultural factors impacted access to and use of malaria treatment, including malaria in pregnancy, and MDA [25, 28, 30, 37, 41, 45–47, 50, 59, 62]. Social norms and traditions that prohibited disclosure of a pregnancy in its early stages (to avoid generating envy, witchcraft, and misfortune) scared and delayed women from accessing and using health services [28]. Attitudes from friends and family (caregivers, relatives especially sisters, husbands and mothers-in-law) [25, 28, 37, 39, 41, 62] impacted pregnant women's decision-making for care seeking [28, 41]. Such attitudes were related to discontinued anti-malarial treatment [41], preference for traditional or faith-based birth attendants for antenatal care choices [62], and adverse outcomes such as miscarriages, premature births, impaired foetal growth, and neonatal deaths [62]. In another study, social cohesion influenced the coverage of an MDA trial [39].

Table 2 Social Determinants of Malaria from the studies included in the review

No	Theme	Sub-theme
1	Environmental determinants	Water, sanitation, hygiene Environmental nature Water bodies Weather conditions
2	Access to and use of treatment	Social/cultural barriers Traditional medicines Economic factors
4	Preventive interventions Use	Gender roles/power relations Social networks Cultural beliefs
5	Housing	Poor housing conditions Household size/density
6	Stakeholder influence	Community complacency Political commitment
7	Livelihoods/economic development	Livelihood activities Economic development dynamics Poverty

Traditional/ethnomedical medicines use

Reliance on traditional /ethnomedical medicines, beliefs, and healers was common in several studies [25, 30, 41, 45, 50, 59, 62]. Use of traditional medicine was facilitated by various factors, including remoteness [59], negative perceptions about existing malaria control measures [41, 62] and limited financial status [45]. Pregnant women's perceived ineffectiveness and risk of the anti-malarial treatment made them discontinue it [41], pushing them to seek alternative services, including traditional birth attendants [62]. Combining antenatal care visits with spiritual care, traditional remedies including herbal medicine and traditional birth attendants affected adherence to antenatal care and intermittent preventive treatment of malaria in pregnancy [25], highlighting the need for social structure considerations for improving intervention uptake [62].

Other studies showed cultural beliefs about what causes malaria [37, 41, 45, 46, 50]. For instance, beliefs about malaria as a magical phenomenon and its social representation altogether influenced people's behaviour, and practices, including treatment-seeking decisions [37, 45]. Relatedly, the influence of ethnomedical beliefs was

evident in the preference for home-based treatment of malaria using ethnomedical therapies in south-coastal Nigeria [50].

Preventive interventions use

Preventive intervention use was another theme that highlighted how the social determinants influenced malaria prevention (n=15) [25, 26, 30, 35, 36, 38, 43, 46, 49, 53, 56, 57, 60–62]. These include gender roles and power relations (n=5) [26, 30, 35, 36, 62], and social networks (n=4) [25, 38, 49, 56] in relation to malaria prevention interventions.

Gender roles and power relations with preventive interventions

Gender roles and power relations in homes (between husbands and wives) influenced women's use of prevention interventions, especially LLINs [26, 30, 35, 36, 53, 62]. Gender roles and positions influenced access to preventive services differently. For instance, engagement in some business and social activities, including conversations that required women to stay out late, exposed pregnant women to mosquito bites [26]. Further, in terms of care giving, males provided transport fees while the female's role related to encouragement for adherence to antenatal care, medications, and insecticide-treated nets [62]. Gender considerations such as seclusion of women during post-partum periods and menstruation (also known as menstrual exile either inside the house or in a separate hut) limited females' access to LLINs in some communities [30].

Female-headed households were less likely to adopt preventive measures compared to their counterparts/ male-headed households due to limitations in access to health information, formal education, and livestock value [35]. Males were also leading in decision-making regarding net use, care, and repurposing and were most likely to misuse nets (by selling nets or converting them into ropes) [36]. Another gender aspect was highlighted in sleeping arrangements, particularly the separation of siblings of opposite sexes when sleeping. This caused net inadequacies in the houses extending to neighbourhoods or poor-quality nets from private suppliers [53].

Social values and networks influence on interventions

Malaria prevention interventions were influenced by social norms and values [25, 28, 38, 46, 49, 56] including social networks and interpersonal connections [25, 38, 49, 56]. Myths regarding maternity and pregnancy hindered access and uptake of preventive interventions for pregnant women, such as intermittent preventive treatment of malaria in pregnancy with sulfadoxine-pyrimethamine [25, 28] as well as sensitization of the

population on use of elimination strategies [46]. Personal interconnectedness with people that the pregnant women go to during pregnancy [25], and social support within the community (such as households, neighbours) and healthcare workers were influential for interventions such as mosquito net use [49, 56]. In some settings, mosquito nets were feared because of how they were culturally used during key life events such as births, marriage, and deaths [53].

Housing

Housing was another social determinant reported in most studies [26, 32, 33, 36, 42, 43, 49, 51, 52, 55, 59, 61] described under two sub-themes: poor housing conditions; and household size and density.

Poor housing conditions

Generally, housing structure and household conditions [26, 32, 33, 42, 43, 49, 51, 52, 55, 56, 59, 61] influenced malaria transmission, and interventions including LLINs use [26, 42, 43, 56]. For instance, persistent net use was limited by net shape (round versus square) preference and suitability in reference to taboos, congested sleeping space [36, 43, 53, 56], grass thatched houses (versus corrugated iron sheets) and bed sharing and sleeping on floors [36, 53, 56]. Furthermore, poor housing conditions such as mud and wattle houses, open eaves and windows, as well as lack of ceilings and screening reduced net efficacy by enabling mosquito entry and exposure [32, 33, 49, 51, 52, 55, 59, 61]. On the other hand, improved housing and living environment reduced transmission including indoor residual anopheline density [33, 52]. Furthermore, districts with a profile typical of a conventional urban area and housing quality were less vulnerable to malaria compared to their counterparts [51].

Household size and density

Other housing factors were related to household size and density [32, 40, 51, 61]. Inadequate (in terms of number) net distribution versus number of people in the household [32, 61], high number of people per dwelling affected net use. Studies also showed that high average number of persons per bedroom, high population density increased social vulnerabilities to malaria occurrence [32, 40, 51].

Stakeholder Influence

Stakeholder influence ($n=6$) is a theme that focused on complacency and commitment at both political and community levels regarding malaria [37, 44, 46, 47, 58, 60] as described below.

Community complacency

Complacency displayed through negative community views about prospects for malaria elimination including comments that indicate that having malaria was normal was reported [37, 46, 60]. For instance, malaria, although reported as a severe disease, was ranked lower in priority than other health problems [37] described as a normal disease to have and impossible to eliminate [46, 60]. Findings from some studies indicated perceptions that malaria was intrinsically associated with certain environments such as forest landscapes [46] and that the mosquitoes would always be present [60].

Political commitment

Political factors including inadequate political commitment for malaria control was also reported in four studies [37, 44, 47, 58]. Findings indicate that socio-economic-political environment was critical in ensuring trust and uptake of interventions in different settings [37, 44]. Previous experience with malaria campaigns under dictatorial regimes were linked to distrust about malaria interventions including pills and tests [37]. In another study, while malaria incidence was influenced by socio-economic development which is key for financial and human resources, political and governmental commitment reduced socio-economic constraints to malaria control [58]. Legal issues were some of the significant macro-environments with a significant impact on availability of artemisinin-based combination therapy in hospitals [47]. However, one study showed that political factors had no influence on the availability of malaria drugs in a hospital setting [47].

Livelihoods and economic development

Another theme focused on economic development and livelihoods and how they increase malaria transmission as indicated in majority of studies ($n=16$) [26, 27, 30–32, 42–44, 48, 49, 51, 54–56, 58, 60]. The theme is presented under sub-themes of patterns of livelihood activities; and economic development dynamics.

Patterns of livelihood activities

Some livelihood activities limited community engagement and uptake of interventions [26, 27, 30, 32, 43–45, 48, 49, 51, 54–56, 60, 61]. Some patterns of farming such as shifting cultivation, and swidden agriculture practices limited net use enabling transmission and exposure to mosquitoes [27, 51, 55, 61]. Irrigation and urban agriculture were key in increasing social vulnerabilities to malaria especially among people living close to cultivated [51] and irrigated areas [27, 32, 40].

Migration and mobility related to some livelihoods [30, 32, 45, 56] was also a risk for malaria. Seasonal hardships and economic constraints influenced migration to malaria-endemic areas or transmission of malaria to areas with less malaria prevalence [30, 45]. Fishing activities and migrant populations including refugees, and pastoralists were also related to inconsistent net use [56]. Sensitivity and complex social inequalities around some economic activities such as forest-work and illegal mining enhanced vulnerability to malaria, negatively affecting health-seeking and effectiveness of interventions including treatment uptake [44, 54]. Some studies also indicated age and gender presentations of livelihoods [26, 27, 49, 60], for instance malaria risk was generally high in the economically active age groups in the intensely irrigated areas [27].

Economic development dynamics

Generally, the socio-economic development dynamics can increase malaria transmission ($n=8$) [42–44, 48, 49, 51, 56, 58]. Socio-economic development was not only key for financial and human resources [58], but also health-care access, and malaria control interventions [42, 44]. Many economic factors promoted the human–vector contact and were key in increasing vulnerabilities to malaria in populations (both rural and urban) [31, 49, 51]. One study emphasized the importance of local perspectives in the social and economic issues regarding malaria control considering the interlinkage between health disparities, injustices in the social economic environment and community health, livelihoods, and exposure to mosquitoes [48].

Poverty

Poverty ($n=21$) [8, 25, 28–31, 36, 37, 41, 43–48, 50, 53, 57, 59, 61, 62] was a cross-cutting issue in relationship to livelihoods, housing, and access and use of interventions such as nets [8, 29, 36, 42, 43, 45, 46, 53, 57, 61]. Net use, including the ability to buy, care for, as well as decisions to misuse the nets, were influenced by financial challenges [36, 43, 53, 61] including the lack of beds and blankets as well as an inadequate number of nets in households [61]. Similarly, the costs of interventions discouraged people from accessing them including going for antenatal care early [25].

Several socio-economic factors limited access and use of malaria treatment including uptake of testing and treatment interventions ($n=14$) [25, 28, 30, 37, 41, 44–48, 50, 57, 59, 62]. Limited financial capacity to cover costs for treatment and transport to health facilities [37, 44, 48, 57, 59, 62] had significant delays in reach and uptake in remote and distant communities [44, 57, 59,

62]. Financial challenges were a great concern especially during shortages in medical supplies in public health facilities resulting, in the use of informal drug sellers for self-medication [45, 57, 62]. On the other hand, increases in cash transfer programme coverage were associated with reductions in malaria incidence [29] and malaria in sub-Saharan Africa was highly linked to poverty [8] while malaria and poverty enhanced each other [8, 46].

Discussion

In summary, the findings indicated several social determinants of malaria that have been grouped into themes covering environmental determinants, access to and use of treatment, preventive interventions use, housing, stakeholder influence, poverty as well as livelihoods and economic development. The environmental factors, including WASH, environmental nature, water bodies, and weather conditions, create favourable conditions for mosquito breeding in various ways. Access and use of malaria treatment were described under the sub-themes on social cultural barriers and traditional medicines/ethnomedical medicines. The theme of preventive interventions use highlighted how the social determinants, including gender roles, power relations, and social networks, influenced malaria prevention. Poor housing conditions (household size and density), as well as poverty and economic development and livelihoods, were the other common social determinants. The final theme was on stakeholder influence showing complacency and limited commitment at both political and community levels regarding malaria. All these social determinants influenced malaria either by enabling mosquito breeding or exposure and transmission process.

The findings enable several key observations about the social determinants of malaria. Studies show that poverty is clearly the main underlying driver of malaria. Poverty intersects with a wide range of the other social determinants covered in the review, such as the quality and conditions of housing, livelihoods, community and political commitment, and WASH, emphasizing that malaria is a disease of poverty [8, 63]. The findings highlight that poverty overlaps with issues such as social, cultural beliefs, gender, housing, and economic activities to not only increase exposure to mosquitoes (mosquito breeding as well as contact with humans), but also play a role in limiting the effectiveness of malaria prevention interventions and treatment amongst poor communities [45]. Poverty also limits access to safe water and sanitation facilities forcing people to resort for instance to water sources and storage practices that expose them to mosquitos or increase mosquito breeding grounds and densities around households [64].

However, poverty is conceptualized in a limited way across the studies in the review, referring primarily to household-level or individualized poverty, rather than thinking about poverty in a structural way or poverty that reflects more general low-income settings. This is a common limitation in other studies [16, 65]. The multiple vulnerabilities with respect to malaria that poor households experience emphasizes the need for poverty reduction to be at the core of malaria programming. Indeed, the central role of poverty reduction and increasing living standards in other countries that have achieved malaria elimination underscores this importance [66, 67]. As it stands, many core malaria control interventions do not engage enough with this issue, and when they do, they do so in a limited way. Further yet evidence indicates that poverty and malaria enhance each other [8, 22, 46]. For instance, the malaria burden has several economic impacts—ranging from the economic consequences of reduced labour, diverted household expenditure, and loss of income and engagement in livelihood activities, as well reduced school attendance, due to morbidity [68–72].

Furthermore, whilst the social determinants direct attention to a wide range of social drivers of poor health, there was still a large focus in the studies that were included on mosquito net use [25, 28, 30, 37, 41, 45–47, 50, 59, 62] and access to treatment [25, 28, 30, 37, 41, 45–47, 50, 59, 62]. This reflects the dominance of biomedical and behavioural approaches to malaria prevention. Mosquito net distribution and related information and communication campaigns, either implemented by the state or other stakeholders, continue to be a cornerstone of malaria control efforts in low and middle-income countries, and are the focus for most external funders [8]. However, this focus is at the expense of a wide array of interrelated factors that also shape patterns of malaria transmission. Further, the findings emphasize the limitations of this focus by governments and stakeholders in low and middle-income settings, especially since most livelihoods involve engagements outside the household at times when mosquitoes are present, thus exposing people to mosquitoes despite net use at night. Similar occupational or livelihood-related exposures to malaria have been reported elsewhere [73]. Alongside a need for more incorporation of poverty reduction programming, the findings suggest that this needs to be accompanied by more engagement by policy makers with the broader social determinants.

Reflecting on the WHO definition of the social determinants of health, the search strategies used returned many studies that focused on ‘the circumstances in which people are born, grow up, live, work and age, and the systems put in place to deal with illness’, factors which can be seen as the more immediate/proximate social

determinants. However, studies that explicitly focused on the ‘wider set of forces: economics, social policies, and politics’ that the WHO also highlighted as important were not found. The political and commercial dimensions of the social determinants (two emerging strands of literature) of malaria [74–76] were entirely missing in the included studies; only four studies provided a limited mention of politics [37, 44, 47, 58]. This may be in part explained by the search terms that were used, and (as discussed in more detail below) the fact that some researchers focusing on these broader systemic processes may link these with terms including political economy or systemic processes such as neoliberalism rather than grounding their studies explicitly within the social determinants’ framework. For example, recent work linking neoliberalism, marketing, and the narrowing of interventions that are implemented (and thus shape access) [74] links these systemic processes and the role of actors with the services available but was not picked up in the review as the article itself does not mention the social determinants. In addition, some theorists are critical of the social determinants framework and would not consider themselves working in that field [77, 78].

Additionally, most studies that were generally addressing themselves as articles on the social determinants of malaria, although often not explicitly using social determinants of health approach, lacked in-depth, theory-driven evidence about the topic. For example, ‘socio-cultural’ factors were mentioned frequently [25, 28, 30, 37, 41, 45–47, 50, 59, 62], but were not clearly articulated in several studies, and often resulted in vague and imprecise statements. In other cases, key factors such as housing quality were linked with the social determinants of health, but in a very limited way with less work linking poor housing quality to broader systemic processes beyond a cursory link to poverty [26, 32, 42, 43, 49, 51, 55, 56, 59, 61]. A deeper understanding of housing quality and/or the need for housing improvement that engaged with the systemic processes would link this with processes of urbanization, circular rural to urban migration, the development of informal settlements, land rights, tenancy security, and infrastructure development projects, and the literature on the wide range of enablers and barriers to housing improvement [79, 80]. Using a social determinants lens can thus shed light on alternative ways to address malaria, for example a housing improvement programme that addresses the underlying drivers of poor-quality housing development (such as land tenure security) in contrast to centralized programmes of housing improvement by external actors.

Finally, and most concerning, the review highlights the gap between what is known about malaria transmission, and what makes it onto the policy agenda. Some factors,

such as the role of environmental quality, water management and sanitation, are well understood [64, 81, 82] and yet fail to make it onto the policy agenda and are less prioritized with inconsistencies in the financing for WASH in LMICs [81, 83–86]. Other key drivers of malaria transmission, such as engaging in specific livelihoods, remain poorly addressed by current policies and interventions. It is unclear to what extent these aspects are a priority, despite the role that livelihoods play in perpetuating malaria transmission. These will need to be addressed if malaria elimination is the aim. On the other hand, the findings emphasize that there is an opportunity for a new research agenda on the social determinants of malaria that can generate new insights and evidence that can be used to develop alternative approaches.

Limitations

There are several limitations and challenges related to the attempt to provide a comprehensive mapping of the evidence. Firstly, as noted earlier, there is no agreed definition of the social determinants of health [87], making it difficult to search the literature. There are multiple definitions and multiple ways that the core idea has been operationalized, from the Latin American focus on the social determination of health, the Dahlgren and Whitehead conceptual map, to the more recent WHO definition [88, 89]. The framework is also open to very different interpretations. Increasingly, the social determinants (and related terms such as the social drivers or structural drivers) are viewed as a public health term and primarily linked to social epidemiological approaches that produce statistical evidence about the relationship between the social determinants and health inequalities [77]. Many authors who address the more systemic, wider set of forces, would not identify their work with the social determinants. For example, O’Laughlin distinguishes between a social drivers approach and a bio-social political economy approach [90]. This, in part, explains the focus of the evidence that was found through the search terms, though the intention was to uncover work that provided critical, systemic assessments of the social determinants of malaria. The lack of a unified and theory-driven definition presents an ongoing challenge for systematic reviews on the social determinants of health [87].

A second issue to note is that we searched only 3 key databases and studies were included only if they were framed or linked to the social determinants of health. The review aimed to map the current evidence, but for some factors, not all of the current literature was included, for example in cases where the social determinants were not explicitly mentioned. For example, there is an increasingly large body of work on housing quality and housing

improvements, including randomized controlled trials that aim to assess the impact of various forms of housing improvement on either vector density or malaria outcomes [91, 92] and studies that provide cost–benefit analyses of these interventions [93, 94]. However, as noted above, in many cases, these studies did not relate themselves to the social determinants [95] and so were not included in the review. Therefore, the review does not include all studies on a given topic and should not be interpreted as providing a complete overview of all the relevant literature. This would entail more focused systematic reviews, for example, the one conducted by Tusting et al. which also included a meta-analysis [96]. With most of the existing studies drawing from a qualitative approach, we provide a qualitative synthesis, acknowledging that a meta-analysis will be needed in future reviews especially when quantitative evidence beyond basic descriptive statistics on the social determinants of health emerge.

A final challenge was related to the large number of studies that use data from the malaria indicator surveys that have been conducted in many African countries. These studies present the determinants of malaria and include key variables from the demographic surveys such as household wealth, housing quality, and the gender of household members. It was decided not to include these studies in the review, primarily because they are descriptive and do not provide much information on explanations of, for example, how poverty influences vulnerability to malaria. Indeed, these studies are used as a point of departure, given how well-established the relationship between poverty and malaria is.

Research and policy implications

Overall, these findings emphasize the need to consider not only the biomedical and behavioural aspects but also the social determinants of disease models in malaria control [8]. The lack of deeper evidence on these social determinants indicates the need to explore further these issues in future studies in order to provide comprehensive evidence needed for effective and responsive malaria programs that go beyond the core offering. This review also highlights issues with how the social determinants of health are inadequately conceptualized, given there is no agreed definition, and this is a framework/approach that does not have a unified theory or set of theories through which it can be operationalized, and in general is agnostic with respect to methods.

This review further demonstrates that it requires policy makers and researchers to explicitly engage with the underlying social determinants, including the ecological, social, cultural, political, and economic dynamics of communities [8, 97]. Whilst many of these

determinants will be familiar to the global community working on malaria, there is a gap between what is known about the social determinants, the extent to which they make it onto the policy agenda and later on what is actually implemented. Many have been deprioritized over time for a focus on more biomedical and behavioural approaches, which, whilst important, have only taken us so far. There is an urgent need for more research in general on the social determinants of malaria, especially the role that broader systemic processes play in shaping the dynamics of transmission and responses, given research of this nature was under-represented in the review. Further, future studies and reviews could also explore in depth the overall effect pathways within the different social determinants and outcomes highlighted in this review.

Conclusion

Overall, this review mapped a wide range of social determinants that need to be addressed if malaria elimination is to be achieved. The review has highlighted future research efforts and the necessity of malaria programming that addresses the social determinants if malaria elimination is to be achieved. Higher quality evidence that goes beyond social epidemiological approaches is needed to inform innovative, cross-sectoral approaches to malaria control.

Abbreviations

EPHPP	Effective Public Health Practice Project Tool
LMICs	Low- And Middle-Income Countries
LLINs	Long-Lasting Insecticidal Nets
MDA	Mass Drug Administration
PCC	Population, concept and context framework
PRISMA-P	Preferred Reporting Items for Systematic Review and Meta-Analysis Protocol
WHO	World Health Organization
WASH	Water, Sanitation and Hygiene

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12936-025-05407-5>.

Additional file 1: Appendix S1: List of the search terms used

Additional file 2: Appendix S2: Excel spreadsheet with extract information summarizing study methods and results. Appendix S6: A map that highlights the countries where the studies included in this review were conducted

Additional file 3: Appendix S3, S4 and S5: Study Quality Assessment details.

Author contributions

All authors contributed to the study conception, design, and implementation. EA led the searching and data abstraction, and EA and KD led data synthesis. DM provided evaluations and harmonisation of any discrepancies at any step of the review. All authors provided oversight and evaluation of all the review process—article searching, screening, data abstraction, synthesis and writing process until the final manuscript.

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Availability of data and materials

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Declarations

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Competing interests

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