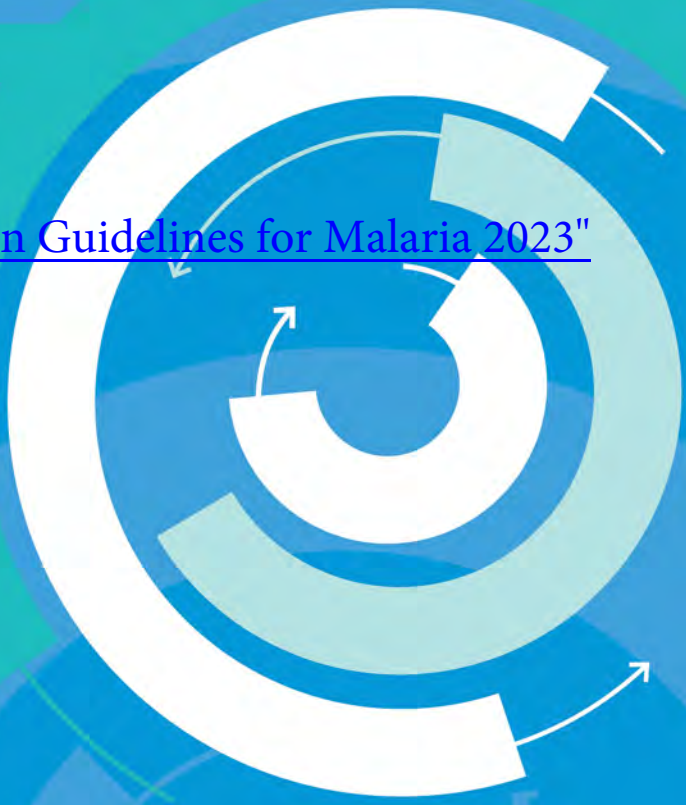

WHO GUIDELINES for malaria

16 October 2023

World Health Organization

Summary of recommendations

1. Abbreviations

2. Executive summary

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3. Introduction

4. Prevention

4.1 Vector control

4.1.1 Interventions recommended for large-scale deployment

Strong recommendation for , High certainty evidence

Pyrethroid-only nets (2019)

Pyrethroid-only long-lasting insecticidal nets (LLINs) should be deployed for the prevention and control of malaria in children and adults living in areas with ongoing malaria transmission.

Remark:

- WHO recommends ITNs that have been prequalified by WHO for deployment in protecting populations at risk of malaria.
- ITNs are most effective where the principal malaria vector(s) bite predominantly at night after people have retired under their nets.
- ITNs can be used both indoors and outdoors, wherever they can be suitably hung (though hanging nets in direct sunlight should be avoided, as sunlight can affect insecticidal activity).

Conditional recommendation for , Moderate certainty evidence

Pyrethroid-PBO ITNs (2022)

Pyrethroid-PBO ITNs instead of pyrethroid-only LLINs can be deployed for the prevention and control of malaria in children and adults in areas with ongoing malaria transmission where the principal malaria vector(s) exhibit pyrethroid resistance.

Remark:
The conditionality of this recommendation is largely driven by the current higher unit cost of pyrethroid-PBO ITNs compared to pyrethroid-only LLINs and therefore the uncertainty of their cost-effectiveness. Furthermore, as PBO is less wash-resistant than pyrethroids, its bioavailability declines faster over the three-year estimated life of an ITN; therefore, the added impact of pyrethroid-PBO ITNs over that of pyrethroid-only LLINs may decline over time. The evidence comes from two sites in eastern Africa with pyrethroid resistance and not from other geographies where transmission levels and vector characteristics may vary. PBO acts by inhibiting certain metabolic enzymes, primarily oxidases, and so are likely to provide greater protection than pyrethroid-only LLINs where mosquitoes display mono-oxygenase-based insecticide resistance mechanisms.

In deciding whether pyrethroid-PBO ITNs may be appropriate in their context, malaria programmes should:

- consider the deployment of pyrethroid-PBO ITNs in areas where resistance to pyrethroids in local vectors has been detected;
- determine whether resources are adequate to cover the extra cost of pyrethroid-PBO ITNs, while ensuring that coverage of populations at risk of malaria is not affected;
- note that WHO recommends that ITNs prequalified by WHO be selected for deployment.

Strong recommendation for , Moderate certainty evidence

Pyrethroid-chlorfenapyr ITNs vs pyrethroid-only LLINs (2023)

Pyrethroid-chlorfenapyr ITNs should be deployed instead of pyrethroid-only LLINs for prevention of malaria in adults and children in areas with pyrethroid resistance.

Remark:
Note: Recommendations on deployment of pyrethroid-chlorfenapyr nets were separated into two distinct recommendations for better clarity, but share the same evidence to decision, justification, practical info and research needs. Please refer to the following section.

Conditional recommendation for , Moderate certainty evidence

Pyrethroid-chlorfenapyr ITNs vs pyrethroid-PBO ITNs (2023)

Pyrethroid-chlorfenapyr ITNs can be deployed instead of pyrethroid-PBO ITNs for prevention of malaria in adults and children in areas with pyrethroid resistance.

Remark:
The conditionality of the recommendation to deploy pyrethroid-chlorfenapyr ITNs instead of pyrethroid-PBO ITNs is based on the GDG's judgement that the balance of desirable and undesirable effects probably favours pyrethroid-chlorfenapyr ITNs over pyrethroid-PBO ITNs. However, the evidence for this recommendation is from only one trial in Africa.

In deciding whether to deploy pyrethroid-chlorfenapyr ITNs instead of pyrethroid-only LLINs or pyrethroid-PBO ITNs, malaria programmes should:

- determine whether resources are adequate to cover the extra costs compared to pyrethroid-only LLINs or pyrethroid-PBO ITNs, while ensuring optimal coverage of populations at risk of malaria;
- generate additional information or conduct analyses with the aim of maximizing impact through targeted deployment (e.g. stratification of malaria risk, assessment of the characteristics of local vectors, such as pyrethroid resistance mechanisms). ITNs for prevention of malaria in adults and children in areas with pyrethroid resistance; and
- note that WHO recommends that ITNs prequalified by WHO be selected for deployment.

Conditional recommendation for , Moderate certainty evidence

Pyrethroid-pyriproxyfen ITNs vs pyrethroid-only LLINs (2023)

Pyrethroid-pyriproxyfen ITNs can be deployed instead of pyrethroid-only LLINs for prevention of malaria in adults and children in areas with pyrethroid resistance.

Remark:
The conditionality of the recommendation to deploy pyrethroid-pyriproxyfen ITNs instead of pyrethroid-only LLINs is based on the GDG's concerns that the available evidence indicates poor cost-effectiveness of pyrethroid-pyriproxyfen ITNs compared to pyrethroid-only LLINs. Poor cost-effectiveness is a result of both the higher cost compared to a pyrethroid-only net, which would require extra resources to maintain the same coverage, and the relatively short-lived (12 months) additional impact obtained by deploying pyrethroid-pyriproxyfen nets over pyrethroid-only nets.

In deciding whether pyrethroid-pyriproxyfen ITNs should be deployed instead of pyrethroid-only LLINs, malaria programmes should:

- determine whether resources are adequate to cover the extra cost compared to pyrethroid-only LLINs, while ensuring optimal coverage of populations at risk of malaria;
- generate additional information or conduct analyses with the aim of maximizing impact through targeted deployment (e.g. stratification of malaria risk, assessment of the characteristics of local vectors, such as pyrethroid resistance mechanisms); and
- note that WHO recommends that ITNs prequalified by WHO be selected for deployment.

Note: Recommendations on deployment of pyrethroid-pyriproxyfen nets were separated into two distinct recommendations for better clarity, but share the same evidence to decision, justification, practical info and research needs. Please refer to the following section.

Conditional recommendation against , Moderate certainty evidence

Pyrethroid-pyriproxyfen ITNs vs pyrethroid-PBO ITNs (2023)

Pyrethroid-pyriproxyfen ITNs are not recommended for deployment over pyrethroid-PBO ITNs for prevention of malaria in adults and children in areas with pyrethroid resistance.

Remark:
The conditionality of the recommendation **against** the deployment of pyrethroid-pyriproxyfen ITNs instead of pyrethroid-PBO ITNs is based on the GDG's judgement that the balance of effects favours pyrethroid-PBO ITNs over pyrethroid-pyriproxyfen ITNs and that, based on current cost and efficacy data, pyrethroid-PBO ITNs are more cost-effective. The GDG acknowledged that evidence to support this recommendation is derived from only a single trial in Africa.

Strong recommendation for , High certainty evidence

Insecticide-treated nets: Humanitarian emergency setting (2022)

Insecticide-treated nets (ITNs) should be deployed for the prevention and control of malaria in children and adults in areas with ongoing malaria transmission affected by a humanitarian emergency.

Remark:
This recommendation is limited to classes of ITNs currently recommended by WHO. As with ITNs deployed in more stable settings, WHO recommends that ITNs that are prequalified by WHO be selected for use in humanitarian emergencies.

When considering deployment of ITNs in humanitarian emergencies, the infrastructure, access, logistical capacity and resources available must be taken into account, as these may influence the feasibility and cost of procuring and deploying nets.

Good practice statement

Achieving and maintaining optimal coverage with ITNs for malaria prevention and control (2019)

To achieve and maintain optimal ITN coverage, countries should apply mass free net distribution through campaigns, combined with other locally appropriate delivery mechanisms such as continuous distribution using antenatal care (ANC) clinics and the Expanded Programme on Immunization (EPI).

Recipients of ITNs should be advised (through appropriate communication strategies) to continue using their nets, irrespective of the condition and age of the net, until a replacement net is available.

Good practice statement

Management of old ITNs (2019)

Old ITNs should only be collected where there is assurance that: i) communities are not left without nets, i.e. new ITNs are distributed to replace old ones; and ii) there is a suitable and sustainable plan in place for safe disposal of the collected material.

If ITNs and their packaging (bags and baling materials) are collected, the best option for disposal is high-temperature incineration. They should not be burned in the open air. In the absence of appropriate facilities, they should be buried away from water sources and preferably in non-permeable soil.

Recipients of ITNs should be advised (through appropriate communication strategies) not to dispose of their nets in any water body, as the residual insecticide on the net can be toxic to aquatic organisms (especially fish).

Strong recommendation for , Very low certainty evidence Updated

Indoor residual spraying (2023)

IRS should be deployed for the prevention and control of malaria in children and adults living in areas with ongoing malaria transmission.

Remark:
WHO recommends that products from insecticide classes indicated under the WHO recommendation, and that have been WHO-prequalified, be selected for IRS use and that these be selected based on the insecticide susceptibility of the local malaria vector(s). IRS is considered to be an appropriate intervention where:

- the majority of the vector population feeds and rests indoors;
- people mainly sleep indoors at night;
- the malaria transmission pattern is such that the population can be protected by one or two rounds of IRS per year; and
- the majority of structures are suitable for spraying.

Conditional recommendation for , Very low certainty evidence

Indoor residual spraying: Humanitarian emergency setting (2022)

IRS can be deployed for the prevention and control of malaria in children and adults in areas with ongoing malaria transmission affected by a humanitarian emergency.

Remark:
The conditionality of this recommendation is largely driven by the very low certainty of the evidence that IRS reduces malaria in such settings and due to concerns around feasibility and cost.

When deciding whether IRS may be appropriate for prevention and control of malaria in humanitarian emergency settings, programmes should consider:

- whether the structures are suitable for spraying. Some shelters provided in emergency settings may not be suitable for application of insecticides, such as open-sided structures and those built from materials that affect the residual nature of the insecticides;
- whether the target coverage of IRS can be feasibly achieved in the setting;
- whether there are sufficient resources to cover the relatively high costs associated with an IRS programme. In such settings, transport of commodities to hard-to-reach areas, coupled with the need to quickly procure items and establish human capacity to deliver the intervention, is likely to incur higher costs than when deploying IRS in more stable settings.

As with the deployment of IRS in more stable settings, WHO recommends that products from insecticide classes indicated under the WHO recommendation, and that have been WHO-prequalified be selected for IRS use in humanitarian emergencies. It is important to ensure that the vector population is susceptible to the insecticide selected for spraying.

4.1.2 Co-deploying ITNs and IRS

Conditional recommendation against , Moderate certainty evidence

Prioritize optimal coverage with either ITNs or IRS over combination (2019)

The co-deployment of ITNs and IRS is not recommended for prevention and control of malaria in children and adults in areas with ongoing malaria transmission. Priority should be given to delivering either ITNs or IRS at optimal coverage and to a high standard, rather than introducing the second intervention as a means to compensate for deficiencies in the implementation of the first intervention.

Remark:
In settings where optimal ITN coverage, as specified in the strategic plan, has been achieved and where ITNs remain effective, additionally implementing IRS may have limited utility in reducing malaria morbidity and mortality. Given the resource constraints across malaria-endemic countries, it is recommended that effort be focused on good-quality implementation of either ITNs or IRS, rather than deploying both in the same area. However, the combination of these interventions may be considered for resistance prevention, mitigation or management should sufficient resources be available.

Good practice statement

Access to ITNs or IRS at optimal coverage levels (2019)

Access to effective vector control using ITNs or IRS at optimal coverage levels should be ensured for all populations at risk of malaria in most epidemiological and ecological settings.

Good practice statement

No scale-back in areas with ongoing local malaria transmission (2019)

In areas with ongoing local malaria transmission (irrespective of both the pre-intervention and current level of transmission), vector control interventions should not be scaled back. Ensuring access to effective malaria vector control at optimal levels for all inhabitants of such areas should be pursued and maintained.

4.1.3 Supplementary interventions

Conditional recommendation for , Low certainty evidence

Larviciding (2019)

Insecticides can be regularly applied to water bodies (larviciding) for the prevention and control of malaria in children and adults as a supplementary intervention to ITNs or IRS in areas with ongoing malaria transmission where aquatic habitats are few, fixed and findable.

Remark:
The conditionality of this recommendation is due to the low certainty of evidence, the impact being limited to non-extensive habitats, and concerns about feasibility.

When considering larviciding, programmes should note the following:

- Larviciding only reduces vector density and so does not have the same potential for health impact as ITNs and IRS; ITNs provide protection from biting vectors and both ITNs and IRS reduce adult longevity.
- Larviciding should not be seen as a substitute for ITNs or IRS or a means to fill a coverage gap in areas with significant malaria risk; rather, larviciding represents a potential supplementary strategy for malaria control.
- Feasibility and cost-effectiveness should be taken into account; larviciding will generally be most cost-effective in areas where larval habitats are few, fixed and findable, and likely less feasible in areas where the aquatic habitats are abundant, scattered and variable.

The following settings are potentially the most suitable for larviciding as a supplementary measure implemented alongside ITNs or IRS:

- urban areas: where breeding sites are relatively few, fixed and findable in relation to houses (which are targeted for ITNs or IRS);
- arid regions: where larval habitats may be few and fixed throughout much of the year.

Larval habitat modification and/or larval habitat manipulation (2021)

No recommendation can be made because the evidence on the effectiveness of a specific larval habitat modification and/or larval habitat manipulation intervention for the prevention and control of malaria was deemed to be insufficient.

Larvivorous fish (2019)

No recommendation can be made because no evidence on the effectiveness of larvivorous fish for the prevention and control of malaria was identified.

Conditional recommendation against , Low certainty evidence Updated

Topical repellents (2023)

The deployment of topical repellents in areas with ongoing malaria transmission is not recommended if the aim is to prevent and control malaria at the community level.

Remark:
The panel recommended against the implementation of topical repellents if the main aim is to control malaria at the community level, given the lack of evidence of significant impact. To achieve community-level impact, it is likely that a high level of individual compliance would be needed. The panel noted that topical repellents may, however, offer protection for individuals and for high-risk groups who do not benefit from other vector control interventions; however, studies demonstrating impact against malaria at the individual level or in specific risk groups are required to support a formal recommendation.

Conditional recommendation against , Low certainty evidence

Insecticide-treated clothing (2019)

Deployment of insecticide-treated clothing is not recommended for the prevention and control of malaria at the community level in areas with ongoing malaria transmission; however, insecticide-treated clothing may be beneficial as an intervention to provide personal protection against malaria in specific population groups.

Remark:
The GDG recommended against the deployment of insecticide-treated clothing due to the lack of evidence of an impact in the general population. In the absence of ITNs, there is some evidence that insecticide-treated clothing may reduce the risk of malaria infection in specific populations such as refugees and military personnel.

Spatial/Airborne repellents (2019)

No recommendation can be made because the evidence on the effectiveness of spatial/airborne repellents for the prevention and control of malaria was deemed to be insufficient.

Conditional recommendation against , Very low certainty evidence

Space spraying (2019)

Space spraying is not recommended for the prevention and control of malaria in children and adults in areas with ongoing malaria transmission; IRS or ITNs should be prioritized instead.

Remark:
The panel recommended against the deployment of space spraying to control malaria, given the lack of evidence of impact against malaria. Due to the short-lived nature of the insecticides used, space spraying is generally costly and wasteful of resources.

Conditional recommendation for , Low certainty evidence

House screening (2021)

Screening of residential houses can be used for the prevention and control of malaria in children and adults in areas with ongoing malaria transmission.

Remark:

The GDG determined that a conditional recommendation should be given for house screening because of the low- to moderate-certainty evidence of an impact against malaria. Furthermore, programmes would need to consider a number of local contextual factors when considering screening of residential houses as a public health strategy, such as:

- how the intervention will be delivered and maintained;
- whether the structure and condition of the residential houses in the community allow for the installation of screening;
- the feasibility and resources needed for implementation, especially if deployed on a large scale.

Programmes should note that this recommendation addresses the use of screening of windows, ceilings, doors and/or eave spaces, and does not cover other ways of blocking entry points into houses.

4.1.4 Research needs

4.2 Preventive chemotherapies

4.2.1 Intermittent preventive treatment of malaria in pregnancy (IPTp)

Strong recommendation for , Moderate certainty evidence

Intermittent preventive treatment of malaria in pregnancy (2022)

In malaria-endemic areas, pregnant women of all gravidities should be given antimalarial medicine at predetermined intervals to reduce disease burden in pregnancy and adverse pregnancy and birth outcomes.

Remark:

- Sulfadoxine-pyrimethamine (SP) has been widely used for malaria chemoprevention during pregnancy and remains effective in improving key pregnancy outcomes.
- IPTp-SP should start as early as possible in the second trimester and not before week 13 of pregnancy.
- Doses should be given at least one month apart, with the objective of ensuring that at least three doses are received.
- Antenatal care (ANC) contacts remain an important platform for delivering IPTp. Where inequities in ANC service and reach exist, other delivery methods (such as the use of community health workers) may be explored, ensuring that ANC attendance is maintained and underlying inequities in ANC delivery are addressed.
- IPTp is generally highly cost-effective, widely accepted, feasible for delivery and justified by a large body of evidence generated over several decades.

4.2.2 Perennial malaria chemoprevention (PMC) - formerly intermittent preventive treatment of malaria in infants (IPTi)

Conditional recommendation for , Moderate certainty evidence

Perennial malaria chemoprevention (2022)

In areas of moderate to high perennial malaria transmission, children belonging to age groups at high risk of severe malaria can be given antimalarial medicines at predefined intervals to reduce disease burden.

Remark:

- Perennial malaria chemoprevention (PMC) schedules should be informed by the age pattern of severe malaria admissions, the duration of protection of the selected drug, and the feasibility and affordability of delivering each additional PMC course (see “Practical info”).
- Sulfadoxine-pyrimethamine (SP) has been widely used for chemoprevention in Africa, including for PMC. Artemisinin-based combination therapies (ACTs) have been effective when used for PMC, but evidence is limited on their safety, efficacy, adherence to multi-day regimens, and cost-effectiveness in the context of PMC.
- Previously, PMC was recommended in infants (<12 months of age) as intermittent preventive treatment in infants (IPTi). Since the initial recommendation, new data have documented the value of malaria chemoprevention in children aged 12 to 24 months.
- The Expanded Programme on Immunization (EPI) platform remains important for delivering PMC. Other methods of delivery can be explored to optimize access to PMC and integration with other health interventions.
- Moderate to high perennial malaria transmission settings are defined as areas with *P. falciparum* parasite prevalence greater than 10% or an annual parasite incidence greater than 250 per 1000 *[29]*. These thresholds are indicative and should not be regarded as absolutes for determining applicability of the PMC recommendation.

4.2.3 Seasonal malaria chemoprevention (SMC)

Strong recommendation for , Moderate certainty evidence

Seasonal malaria chemoprevention (2022)

In areas of seasonal malaria transmission, children belonging to age groups at high risk of severe malaria should be given antimalarial medicines during peak malaria transmission seasons to reduce disease burden.

Remark:

- Eligibility for seasonal malaria chemoprevention (SMC) is defined by the seasonality of malaria transmission and age groups at risk of severe malaria. Thresholds for assessing these criteria change over time and location. Malaria programmes should assess the suitability of SMC based on the local malaria epidemiology and available funding (see “Practical info”). The added value of a seasonally targeted intervention is likely to be greatest where transmission is intensely seasonal.
- Monthly cycles of sulfadoxine-pyrimethamine plus amodiaquine (SP+AQ) have been widely used for SMC in African children under 5 years old and have been shown to be efficacious, safe, well tolerated, available and inexpensive (Thwing *et al unpublished evidence*).

4.2.4 Intermittent preventive treatment of malaria in school-aged children (IPTsc)

Conditional recommendation for , Low certainty evidence

Intermittent preventive treatment of malaria in school-aged children (2022)

School-aged children living in malaria-endemic settings with moderate to high perennial or seasonal transmission can be given a full therapeutic course of antimalarial medicine at predetermined times as chemoprevention to reduce disease burden.

Remark:

- Intermittent preventive treatment in school-aged children (IPTsc) has been evaluated in children aged 5–15 years. The burden of malaria and benefits of IPTsc may vary across this age range, but evidence is limited.
- National malaria programmes can consider IPTsc if resources allow for its introduction among school-aged children without compromising chemoprevention interventions for those carrying the highest burden of severe disease, such as children < 5 years old.
- Schools may provide a low-cost means to deliver chemoprevention to school-aged children. However seasonal variation in malaria transmission and the timing of school terms, as well as equity concerns, may mean alternative delivery channels are needed to maximize impact.
- First- and second-line malaria treatments should not be used for IPTsc if safe and effective alternatives are available (see “Practical info”).
- The dosing schedule for IPTsc should be informed by the local malaria epidemiology and timed to give protection during the period of greatest malaria risk (see “Practical info”).
- Moderate to high malaria transmission settings are defined as areas with *P. falciparum* parasite prevalence greater than 10% or an annual parasite incidence greater than 250 per 1000 *[29]*. These thresholds are indicative and should not be regarded as absolutes for determining applicability of the IPTsc recommendation.

4.2.5 Post-discharge malaria chemoprevention (PDMC)

Conditional recommendation for , Moderate certainty evidence

Post-discharge malaria chemoprevention (2022)

Children admitted to hospital with severe anaemia living in settings with moderate to high malaria transmission can be given a full therapeutic course of an antimalarial medicine at predetermined times following discharge from hospital to reduce re-admission and death.

Remark:

- Post-discharge malaria chemoprevention (PDMC) should be given to children following admission with severe anaemia *[156]* that is not due to blood loss following trauma, surgery, malignancy or a bleeding disorder.
- PDMC implementation should be tailored to admissions of children with severe anaemia and consider the duration of protection of the selected antimalarial, and the feasibility and affordability of delivering each additional PDMC course (see “Practical info”).
- Moderate to high perennial malaria transmission settings are defined as areas with a *P. falciparum* parasite prevalence greater than 10% or an annual parasite incidence greater than 250 per 1000 *[29]*. These thresholds are indicative and should not be regarded as absolute for determining applicability of the PDMC recommendation.

4.2.6 Mass drug administration (MDA)

4.2.6.1 MDA for burden reduction

Conditional recommendation for , Low certainty evidence

MDA for burden reduction (2022)

Antimalarial medicine can be given as chemoprevention through mass drug administration (MDA) in areas of moderate to high transmission of *P. falciparum* to provide short-term reductions in disease burden.

Remark:

- MDA may quickly reduce clinical malaria incidence in settings with moderate to high *P. falciparum* transmission, but the effect wanes within 1–3 months. Therefore, if MDA is implemented, it should be one of several components of a robust malaria control programme (including good coverage of effective case management and appropriate prevention tools and strategies).
- Malaria programmes should judge the suitability of using MDA in their context based on the desired impact, level of endemicity, and resources required. MDA for burden reduction should be targeted at moderate to high transmission settings, regardless of seasonality (see “Practical info”).
- Moderate to high malaria transmission settings are defined as areas with *P. falciparum* parasite prevalence greater than 10%, or incidence greater than 250 *P. falciparum* cases per 1000 population per year *[29]*. These thresholds should not be regarded as absolutes for determining applicability of MDA implementation. It is biologically plausible that MDA in intermediate transmission settings may reduce both disease burden and transmission intensity.

4.2.6.2 MDA for burden reduction in emergency settings

Conditional recommendation for , Low certainty evidence

MDA for burden reduction in emergency settings (2022)

During emergencies or periods of health service disruption, antimalarial medicine can be used for mass drug administration (MDA) in defined geographical areas to provide short-term reductions in the burden of disease caused by *P. falciparum*.

Remark:

- MDA may quickly reduce clinical malaria incidence in settings with moderate to high *P. falciparum* transmission, but the effect wanes within 1–3 months. As far as possible, MDA should be implemented as part of a package of malaria control measures (including effective case management and appropriate prevention tools and strategies).
- Malaria programmes should judge the suitability of using MDA in their context based on the desired impact, level of endemicity, and resources required (see “Practical info”).
- There is very limited evidence on the impact of MDA on disease in emergency settings. However, the biological effects of MDA on disease in non-emergency settings are likely to translate to MDA recipients in emergency settings. The size of effect will vary according to the type of emergency and level of disruption to health services, as well as underlying transmission intensity, choice of drug, delivery method and other factors.

4.2.6.3 MDA to reduce transmission of *P. falciparum* in very low to low transmission settings

Conditional recommendation for , Low certainty evidence

MDA to reduce transmission of *P. falciparum* in very low to low transmission settings (2022)

In areas with very low to low levels of *P. falciparum* transmission, antimalarial medicine can be given as chemoprevention through mass drug administration (MDA) to reduce transmission.

Remark:

- MDA may quickly reduce transmission of *P. falciparum* in very low to low transmission areas, but the effect wanes within 1–3 months. Therefore, if MDA is implemented, it should be one of several components of a robust malaria elimination programme (including, at minimum, good coverage of case-based surveillance with parasitological diagnosis, effective antimalarial treatment, and appropriate prevention tools and strategies) in order to reduce the risk of resurgence after the MDA programme has ended.
- MDA should be considered only for geographical areas where there is limited risk of importation of malaria either from adjacent communities or through travel of the population to endemic areas.
- Malaria programmes should consider whether sufficient resources are available to implement MDA without affecting other components of a robust malaria elimination programme.
- Very low to low transmission settings are defined as areas with *P. falciparum* parasite prevalence less than 10%, or *P. falciparum* incidence less than 250 cases per 1000 population per year *[29]*. These thresholds should not be regarded as absolutes for determining applicability of MDA implementation for transmission reduction. MDA implemented in areas with levels of transmission near these cut-offs may reduce both disease burden and transmission intensity.

4.2.6.4 MDA to reduce transmission of *P. falciparum* in moderate to high transmission settings

Conditional recommendation against , Very low certainty evidence

MDA to reduce transmission of *P. falciparum* in moderate to high transmission settings (2022)

In areas with moderate to high levels of *P. falciparum* transmission, providing antimalarial medicine through mass drug administration (MDA) to reduce transmission is not recommended.

Remark:

- The studies included in the systematic review did not demonstrate evidence that MDA has either a short- or long-term effect on *P. falciparum* transmission in moderate to high transmission settings.
- Recommendations on MDA to reduce the burden of malaria in moderate to high transmission settings can be found in section *4.2.4.1 MDA for burden reduction*. Moderate to high transmission settings are defined as areas with *P. falciparum* parasite prevalence greater than 10%, or *P. falciparum* incidence above 250 cases per 1000 population per year *[29]*. These thresholds should not be regarded as absolutes for determining applicability of MDA.

4.2.6.5 MDA to reduce transmission of *P. vivax*

Conditional recommendation for , Very low certainty evidence

MDA to reduce transmission of *P. vivax* (2022)

In areas with *P. vivax* transmission, antimalarial medicine can be given as chemoprevention through mass drug administration (MDA) to reduce transmission.

Remark:

- MDA may quickly reduce transmission of *P. vivax,* but the effect wanes within 1–3 months. Therefore, if MDA is implemented, it should be one of several components of a robust malaria elimination programme (including, at minimum, good coverage of case-based surveillance with parasitological diagnosis, effective antimalarial treatment including treatment for hypnozoites, and appropriate prevention tools and strategies) in order to reduce the risk of resurgence after the MDA programme has ended.
- MDA should be considered only for geographical areas where there is limited risk of importation of malaria either from adjacent communities or through travel of the population to endemic areas.
- Malaria programmes should consider whether sufficient resources are available to implement MDA without affecting other components of a robust malaria elimination programme.
- Programmes considering implementing MDA for *P. vivax* should carefully reflect on how to safely and feasibly administer treatment to prevent relapses.

4.2.6.6 Mass relapse prevention (MRP) to reduce transmission of *P. vivax*

Conditional recommendation against , Very low certainty evidence

Mass relapse prevention (MRP) to reduce transmission of *P. vivax* (2022)

Mass treatment with an 8-aminoquinoline medicine alone to reduce the transmission of *P. vivax* is not recommended.

Remark:

- Without testing for G6PD deficiency, the GDG noted the potential for severe harm from the use of a therapeutic dose of an 8-aminoquinoline for radical cure of *P. vivax* hypnozoites. However, conducting G6PD testing for a large population would significantly add to the complexity and cost of the intervention.
- The GDG noted that there may be highly exceptional circumstances under which mass relapse prevention (MRP) may be appropriate, such as during a small focal outbreak of *P. vivax* in a temperate area. However, under such circumstances the GDG considered that an MDA programme providing a schizonticide in addition to an 8-aminoquinoline would likely be a better strategy.

4.3 Vaccine

Strong recommendation for , High certainty evidence

Malaria vaccine (2021)

The RTS,S/AS01 malaria vaccine should be used for the prevention of *P. falciparum* malaria in children living in regions with moderate to high transmission as defined by WHO.

Remark:

- The RTS,S/AS01 malaria vaccine should be provided in a four-dose schedule in children from 5 months of age.
- Countries may consider providing the RTS,S/AS01 vaccine seasonally, with a five-dose strategy, in areas with highly seasonal malaria or with perennial malaria transmission with seasonal peaks.
- Countries that choose to introduce the vaccine in a five-dose seasonal strategy are encouraged to document their experiences, including adverse events following immunization.
- RTS,S/AS01 malaria vaccine should be provided as part of a comprehensive malaria control strategy.

5. Case management

5.1 Diagnosing malaria

Good practice statement

Diagnosing malaria (2015)

All cases of suspected malaria should have a parasitological test (microscopy or RDT) to confirm the diagnosis.

Both microscopy and RDTs should be supported by a quality assurance programme.

5.2 Treating malaria

5.2.1 Treating uncomplicated malaria

5.2.1.1 Artemisinin-based combination therapy