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## Malaria Prevention Guideline



## Malaria Prevention Guideline Navigation menu

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## 1 INTRODUCTION

### 1.1 Purpose of Guidelines

The purpose of this guideline is to assist healthcare providers in evaluating the risk of malaria to an individual traveller and recommending suitable preventive measures.

### 1.2 Pre-travel Health Risk Assessment Overview

Before embarking on an overseas journey, it is advised that Australian and New Zealand travellers undergo a pre-travel consultation, which includes detailed information on malaria, where relevant.

When conducting a risk assessment and providing advice for malaria, healthcare providers should consider the following:

- **Malaria epidemiology at travel destinations(s):** Determine whether the traveller is visiting malaria-endemic areas and the level of risk at the destination
- **Risk of exposure and disease severity:** Conduct an individualised assessment of the traveller's health status, planned or possible itinerary, activities during the trip, willingness to consistently use

personal protective measures, and budget to identify individual factors that may influence exposure risk, disease severity and practicality of recommendations

- **Optimal malaria prevention approach:** Consideration of general preventative measures. Determine the most suitable approach for malaria prevention based on an individual assessment of risk and consideration of the traveller's preferences in terms of prophylaxis
- **Diagnosis and treatment in the event of illness:** Educate the traveller on the importance of seeking medical attention promptly if they become ill during their journey or on return to Australia or New Zealand

## 2 MALARIA EPIDEMIOLOGY

### 2.1 Infectious agent

- Malaria is a life-threatening parasitic disease spread to humans through mosquito bites
- Malaria is caused by parasites from the genus *Plasmodium* (Table 1)
- Globally, most malaria cases and deaths are caused by *P. falciparum* and occur in Africa
- Most of the global *P. vivax* burden is found in the Asia-Pacific region

**Table 1. Characteristics of malaria species that commonly infect humans**

Species	Host species	Estimated number (%) of human cases in 2022 <sup>^</sup>	Geographical distribution
<i>Plasmodium falciparum</i>	Human only	168.2 million (68%)	Global, highest burden in sub-Saharan Africa
<i>Plasmodium vivax</i>	Human only	6.9 million (3%)	Global, more prevalent in Asia

			and Latin America
<i>Plasmodium malariae</i>	Human only	<500,000 (<0.2%)	Global
<i>Plasmodium ovale</i> *	Human only		Global
<i>Plasmodium knowlesi</i>	Zoonotic (human, monkey)	<3,000 (<0.002%)	Southeast Asia
<i>Unspecified/mixed</i>	n/a	73.4 million (29%)	n/a

\*Ovale malaria is now considered to be caused by two closely related but distinct species of malaria parasite, *Plasmodium ovale curtisi* and *Plasmodium ovale wallikeri*; ^Based on 2022 data from WHO(2).

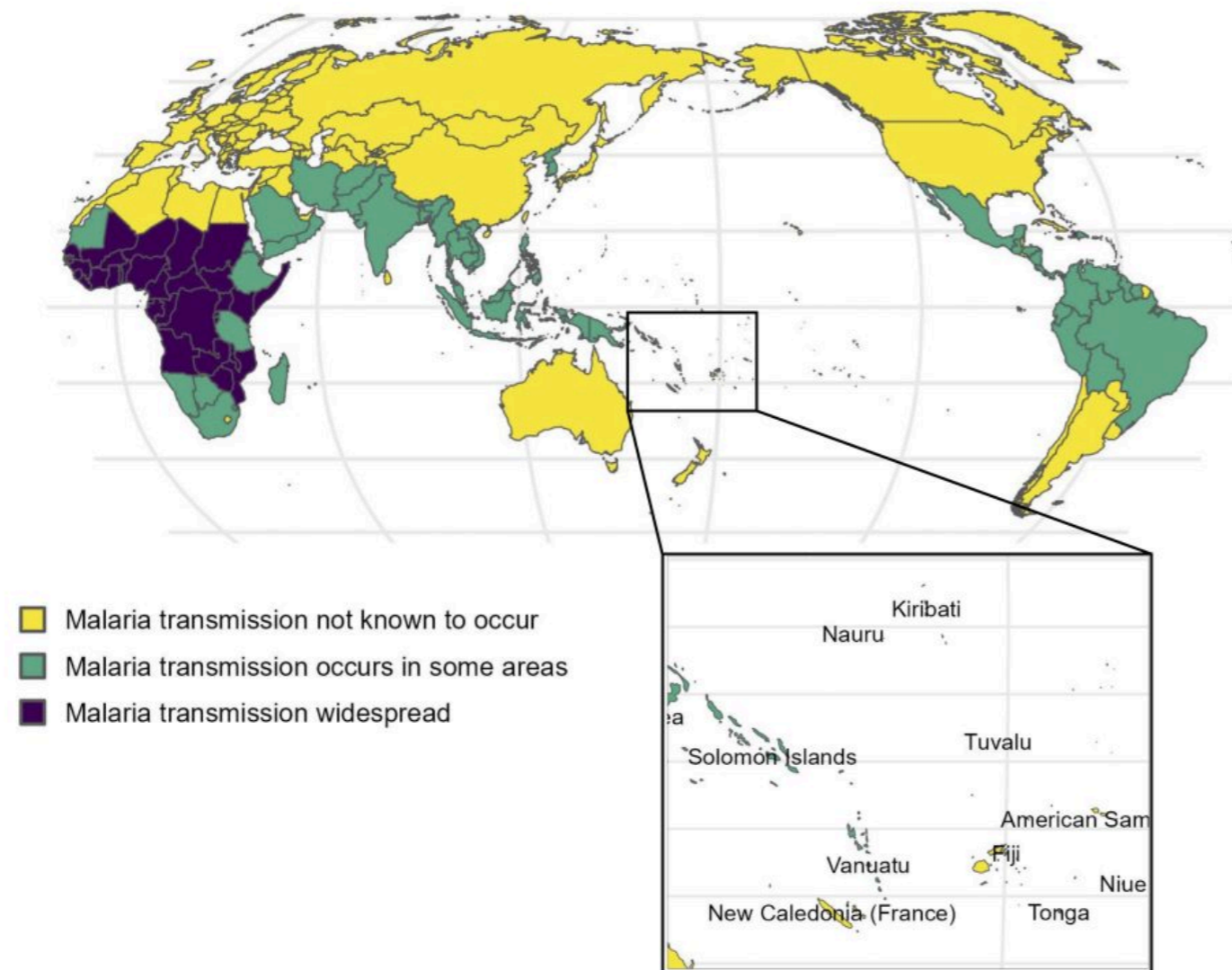
References<sup>1,2</sup>

## 2.2 Global epidemiology of malaria

- Malaria remains a major global health challenge, with 85 countries and areas endemic for malaria in 2022 (Figure 1)
- In 2022, there were around 249 million malaria cases and 608,000 malaria deaths worldwide, with most occurring in the WHO African Region<sup>2</sup>
- Despite progress, such as the WHO certifying new countries as malaria-free (including China in 2021 and Sri Lanka in 2016), progress against malaria has stalled since 2015, partly due to disruptions caused by the COVID-19 pandemic<sup>1</sup>

**Figure 1: Malaria transmission status by country in 2022**



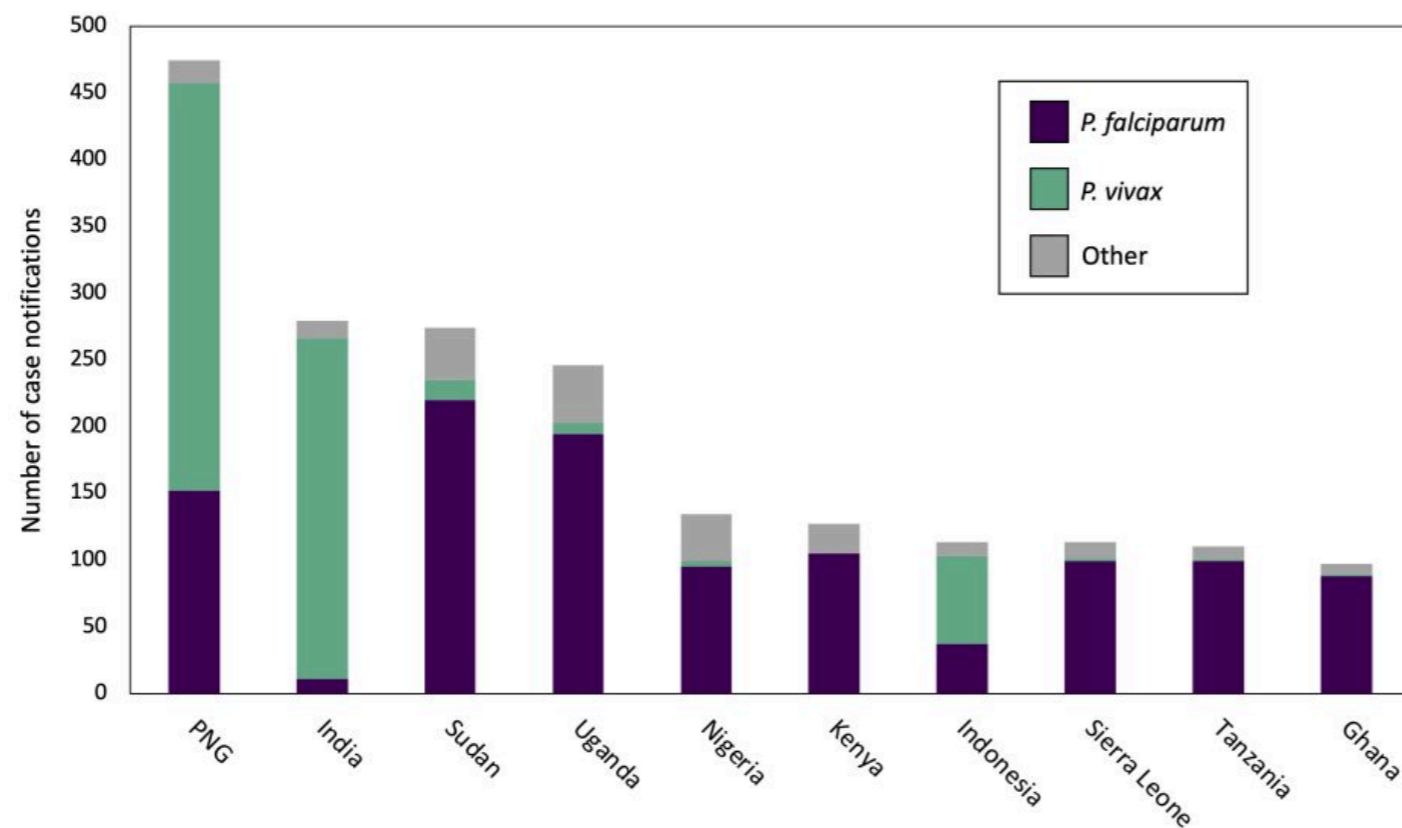


The inset provides a detailed view of malaria transmission in the Pacific (note: malaria transmission is not known to occur south or east of Vanuatu). Classification based on World Health Organization's International Travel and Health Country List, 2022, available from: <https://cdn.who.int/media/docs/default-source/travel-and-health/vaccination-requirements-and-who-recommendations-ith-2022-country-list.pdf> (accessed 24 June 2024). Countries classified as "Malaria transmission not known to occur" include those certified malaria free after 2000, such as China, Argentina and Sri Lanka. For further details, see <https://www.who.int/teams/global-malaria-programme/elimination/countries-and-territories-certified-malaria-free-by-who> and <https://www.who.int/data/gho/data/themes/malaria>. Map created using RStudio (2024.04.1 Build 748).

## 2.3 Malaria epidemiology in Australia and New Zealand

- Australia has been malaria-free since 1981, but the risk of reintroduction remains in the tropical north due to the presence of *Anopheles* mosquito vectors<sup>3</sup>
- Malaria has never been endemic in New Zealand
- On average, Australia reports between 300 and 400 malaria cases per year, while New Zealand reports between 20 and 50 cases<sup>4,5</sup>
- Travellers visiting friends and relatives (VFR) are at particular risk<sup>6</sup>
- Over half of all cases reported in Australia are caused by *Plasmodium falciparum*, and around one-third are due to *Plasmodium vivax*
- While almost half of the cases reported in Australia are acquired in sub-Saharan Africa, Papua New Guinea and India are among the most common acquisition countries (Figure 2)

**Figure 2: Top ten countries of malaria acquisition for Australian travellers, 2012-2022, by species.**



The inset provides a detailed view of malaria transmission in the Pacific (note: malaria transmission is not known to occur south or east of Vanuatu). Classification based on World Health Organization's International Travel and Health Country List, 2022, available from:

<https://cdn.who.int/media/docs/default-source/travel-and-health/vaccination-requirements-and->

[who-recommendations-ith-2022-country-list.pdf](#) (accessed 24 June 2024). Countries classified as “Malaria transmission not known to occur” include those certified malaria free after 2000, such as China, Argentina and Sri Lanka. For further details, see <https://www.who.int/teams/global-malaria-programme/elimination/countries-and-territories-certified-malaria-free-by-who> and <https://www.who.int/data/gho/data/themes/malaria>. Map created using RStudio (2024.04.1 Build 748).

The “other” category includes cases caused by *P. ovale*, *P. malariae*, *P. knowlesi*, unspecified and mixed infections. Adapted from Sohail et al,<sup>4</sup> based on data from the National Notifiable Diseases Surveillance System.

## 2.4 Malaria transmission

- Malaria is transmitted to humans by the bite of infected female *Anopheles* mosquitoes
- *Anopheles* mosquitoes breed in freshwater environments in warm and humid climates and typically bite during the evening and night<sup>1</sup>
- Though uncommon, malaria transmission can also occur through blood transfusion, organ transplantation or vertically from mother to foetus<sup>7</sup>
- Symptoms of malaria can appear as early as 7 days after being bitten by an infected mosquito and as late as several months or more after exposure (this is known as the incubation period)
- In infections caused by *vivax* and *P. ovale*, dormant parasites in the liver (hypnozoites) can cause relapses weeks to years later (Figure 3)

**Figure 3**



in defined pockets. Factors influencing malaria transmission include:

- Human (and animal) host susceptibility
- Mosquito (vector) behaviour
- Intervention coverage (e.g. use of bed nets)
- Climate (e.g. temperature, humidity and rainfall) and season
- Altitude (malaria is rare above 2000m elevation)

Individual traveller risk depends on personal and itinerary-related factors (Table 2). When assessing risk, healthcare providers should consider:

- Where the traveller is going (destination)
- When the traveller is going (season of travel)
- Planned activities, accommodation and duration of travel
- Who the traveller is (reason for travel and health status)
- The traveller's capacity and willingness to follow recommended strategies, taking into account their preferences and any logistical or practical constraints

**Table 2: Factors to consider in a risk assessment and when making decisions around recommended prevention approaches.**

Adapted from McGuinness SL et al. (8) and informed by existing literature. (1, 9, 10)

Domain	Factor	Explanation
<b>Factors affecting likelihood of exposure</b>	Destination	Risk varies globally; regions with highest incidence are sub-Saharan Africa and parts of Oceania (e.g. Papua New Guinea)
	Season of travel	Mosquito breeding increases with rainfall, and malaria is highly seasonal in some areas

	Rural travel	Incidence may be higher in rural areas
	Altitude	Malaria is rare above 2000 metres elevation, but can occur up to 2500 m in some countries
	Travel duration	Likelihood of exposure increases with time spent in endemic area
	Accommodation type	Staying in well-sealed accommodation with windows and door screens reduces exposure risk
	Activities	Outdoor activities during peak mosquito biting times (dusk till dawn) increase exposure risk
<b>Factors affecting risk of severe malaria</b>	Age	Children under 5 years and adults over 65 years are at greater risk for severe disease
	Spleen function	People with no spleen or impaired splenic function are at greater risk for severe disease
	Pregnancy	Pregnant individuals are at greater risk for severe disease
	HIV infection	HIV infection can increase parasitaemia and risk of severe infection
	Sickle cell trait	Heterozygotes for HbS (sickle cell trait) are at lower risk of severe infection
	Acquired partial immunity	Recent migrants from endemic areas may have acquired partial immunity due to repeated malaria infections; this is associated with lower risk of severe disease, but is lost very quickly
	<i>Plasmodium</i> species	Risk of severe malaria is higher with <i>P. falciparum</i> and <i>P. knowlesi</i> infections

<b>Factors affecting risk perception and adherence to preventive measures</b>	Visiting friends and relatives (VFR) travel	VFR travellers are less likely to seek out or adhere to preventive measures and represent a significant proportion of imported malaria cases to non-endemic areas
	Long-term travellers and expatriates	Adherence to chemoprophylaxis and risk perception reduce over time, and travel duration influences the choice of agent and cost of chemoprophylaxis
<b>Other considerations</b>	Access to medical care	Consider access to medical care, including reliable malaria diagnostics and non-counterfeit antimalarial drugs at destination within a suitable time (24-48h)
	Medical history and medications	Consider any contraindications and potential drug-drug interactions
	G6PD testing	Consider availability and results from glucose-6-phosphate dehydrogenase (G6PD) testing (relevant for primaquine and tafenoquine)
	Traveller's preference	Consider previous experience with antimalarials, side effect profiles and cost of different options

## 4 MALARIA PREVENTION APPROACHES

Malaria prevention in travellers includes a range of preventive measures, often referred to as the ABCD of protection (Table 3).<sup>11</sup> The A (Awareness), B (Bite prevention) and D (early Diagnosis and treatment) components are universally recommended for travellers to malaria-endemic areas, whereas decisions around C (chemoprophylaxis) should be individualised based on risk and personal circumstances (Table 2). While the WHO has approved two malaria vaccines for use in endemic settings, there is currently no vaccine available for travellers.<sup>12</sup>

**Table 3. The ABCD of malaria prevention**

Component	Healthcare provider's role
Awareness of risk	Ensure patients understand the risk of malaria and are informed about key symptoms and the potential timing of onset
Bite prevention	Provide guidance on mosquito bite prevention strategies (e.g. protective clothing, repellents, treated bed nets)
Chemoprophylaxis	Evaluate the need for chemoprophylaxis based on individual risk. If chemoprophylaxis is indicated, discuss options, appropriate dosing and potential side effects
Diagnose promptly and treat without delay	Advise patients to seek immediate medical attention for diagnosis and treatment if they develop a fever 1 week or more after entering a malaria-endemic area, particularly if exposure occurred within the past 3 months

## 4.1 Bite prevention

Travellers should be aware of personal protective measures to reduce the risk of malaria and other vector-borne diseases during their trip. These measures include:

- Covering up with protective clothing, such as long-sleeved shirts and long pants
- Applying insect repellent to any exposed skin
- Treating clothing and gear with an insecticide such as permethrin
- Staying in screened rooms or under an insecticide-treated bed net

The most effective insect repellents contain one of the following active ingredients:

- DEET (N,N-Diethyl-M-Toluamide)

- Picaridin (icaridin)
- PMD (*p*-Menthane-3,8-diol), also known as oil of lemon eucalyptus (OLE)

Repellents are available in the form of a lotion, spray or gel, and in different concentrations of the active ingredient. Higher concentrations providing longer-lasting protection. For travellers to malaria-endemic areas, it is recommended to use repellents with concentrations of at least 20% DEET, 20% picaridin, or 30% PMD.<sup>13</sup> Insect repellents with up to 30% DEET are safe to use in children over two months of age. Australian travellers should use insect repellents approved by the Australian Pesticides and Veterinary Medicines Authority (APVMA). Approved products are scientifically assessed as safe and effective when used according to label instructions. The APVMA's database lists approved products:

<https://portal.apvma.gov.au/pubcris>

## 4.2 Chemoprophylaxis

Chemoprophylaxis involves taking medication to prevent disease. It is recommended for most travellers to high-risk areas such as Papua New Guinea and much of sub-Saharan Africa. Recommendations for other destinations depend on individual travel plans and personal factors. Groups at high risk of severe disease, such as pregnant women, should avoid malaria-endemic areas if possible. If travel is necessary, chemoprophylaxis is generally recommended. For further information about chemoprophylaxis recommendations, see the next section. No antimalarial drug is 100% protective, so it's important to combine medication with education and other preventive measures.

In Australia and New Zealand, several antimalarial drugs are available for chemoprophylaxis (Table 4). All recommended regimens involve taking medication before, during, and after travel to a malaria-affected area. The duration of the regimen depends on how the drug works. (14) Atovaquone-proguanil and tafenoquine act early in the parasite's lifecycle (liver-stage schizonts) and require shorter courses. Atovaquone-proguanil also acts on the blood stage of the parasite's lifecycle (by interrupting the formation of schizonts within red blood cells). Doxycycline and mefloquine are only effective on the blood stage form, so they need to be taken for four weeks after leaving the malaria area. Tafenoquine is the only drug available for chemoprophylaxis in Australia that kills the dormant form of the parasite (hypnozoites) and can prevent *P. vivax* and *P. ovale* relapses.

**Table 4. Drugs available for malaria chemoprophylaxis\***

Drug	Site of activity	Dosing	Start (before entering)	Cease (after leaving)
Atovaquone-proguanil	Blood and liver stage schizonts	Daily	1-2 days	7 days
Doxycycline	Blood stage schizonts	Daily	1-2 days	28 days
Mefloquine	Blood stage schizonts	Weekly	2-3 weeks	28 days
Tafenoquine*	Liver stage schizonts and hypnozoites	Daily for three days before travel, then weekly during travel	3 days	7 days after last during travel dose

\*Tafenoquine is currently not available in New Zealand

References<sup>14-16</sup>

The choice of medication should be tailored to each individual, considering their itinerary, medical history, current medications, and personal preferences. Table 5 provides some factors to consider when choosing a drug for prophylaxis. Detailed dosing information can be found in the “Prophylaxis of Malaria” chapter of the Therapeutic Guidelines.<sup>15</sup> Before prescribing tafenoquine, it is important to rule out G6PD deficiency (see “Testing for G6PD deficiency”).

**Table 5. Considerations when choosing a drug for prophylaxis, adapted from (7, 15)**

Drug and dosing	Reasons for prescribing	Reasons for avoiding
<b>Atovaquone-proguanil</b>	<ul style="list-style-type: none"> <li>Suitable for shorter trips (shorter</li> </ul>	<ul style="list-style-type: none"> <li>Not recommended for severe renal impairment</li> </ul>

<p>Adult: 250/100mg daily</p> <p>Children 11kg and over: weight-based dosing</p>	<p>duration)</p> <ul style="list-style-type: none"> <li>• Can be used longer term if budget permits</li> </ul>	<p>(eGFR&lt;30mL/min)</p> <ul style="list-style-type: none"> <li>• Not recommended in pregnancy (insufficient safety data)</li> <li>• Not suitable for children &lt;5kg</li> <li>• Tends to be more expensive than some other options (especially for longer trips)</li> </ul>
<p><b>Doxycycline</b></p> <p>Adult: 100mg daily</p> <p>Children 8 years and older: weight-based</p>	<ul style="list-style-type: none"> <li>• Tends to be least expensive</li> <li>• Can prevent a range of other infections, including rickettsial infections, leptospirosis, and some sexually transmitted infections (e.g. syphilis and chlamydia). May be preferred for travellers engaging in hiking, camping, or activities in fresh water</li> </ul>	<ul style="list-style-type: none"> <li>• Not recommended in pregnancy</li> <li>• Not suitable for children aged &lt;8 years</li> <li>• Longer duration of therapy (including 28 days after leaving endemic area)</li> <li>• Women prone to vaginal yeast infections may prefer a different medicine</li> <li>• Patient concerns about increased risk of sun sensitivity or gastrointestinal upset</li> </ul>
<p><b>Mefloquine</b></p> <p>Adult: 250mg weekly</p> <p>Children 5kg and over: weight-based</p>	<ul style="list-style-type: none"> <li>• Suitable for longer trips (weekly dosing)</li> <li>• Can be used in pregnancy and breastfeeding</li> </ul>	<ul style="list-style-type: none"> <li>• Not suitable for travellers to the Greater Mekong area, where mefloquine resistance is reported</li> <li>• Not recommended for patients with cardiac conduction abnormalities, seizure</li> </ul>

		<ul style="list-style-type: none"> <li>disorders or a history of psychiatric conditions</li> <li>• Patient concerns about neuropsychiatric side effects</li> <li>• Caution advised in first trimester of pregnancy</li> </ul>
<p><b>Tafenoquine</b></p> <p>Adult: 200mg daily for 3 days before entering the endemic area, then 200mg weekly, with final dose given in the week after leaving the endemic area</p> <p>Children: n/a</p>	<ul style="list-style-type: none"> <li>• Suitable for shorter trips (shorter duration)</li> <li>• Also prevents <i>P. vivax</i> and <i>P. ovale</i> relapses</li> </ul>	<ul style="list-style-type: none"> <li>• Potential costs and delays associated with Quantitative G6PD testing</li> <li>• Not recommended during pregnancy or breastfeeding</li> <li>• Not for use in children aged &lt;18 years (safety not established)</li> <li>• Not suitable for those with psychotic disorders</li> </ul>

Adapted from <sup>7,15</sup>

### 4.3 Standby emergency self-treatment (SBET)

Standby emergency self-treatment (SBET) is a strategy recommended in some international malaria prevention guidelines, though not universally endorsed. It involves providing travellers with a reliable supply of antimalarial drugs to self-administer in an emergency when malaria is suspected but medical care is not readily available. The role of SBET in malaria prevention is controversial, with experts presenting arguments both for and against its use (Table 6).<sup>4</sup> Studies suggest that travellers prescribed SBET rarely use it (<3%), and many do not follow usage guidelines.<sup>17-19</sup> SBET is generally considered most suitable for travellers going to remote areas where diagnosis and treatment is not accessible within 48 hours. In some cases, travellers are also supplied with a rapid diagnostic test (RDT) kits and instructions for self-testing. Travellers should be advised to seek medical attention in the event of a febrile illness, even if SBET is used.

**Table 6. Reasons for and against standby emergency self-treatment (SBET) for malaria**

Reasons for	Reasons against
Can prevent life-threatening illness	Clinical symptoms of malaria can't be reliably distinguished from other diseases
Ensures access to reliable medication	Travellers may not use it correctly
Preferred by travellers wary of side effects who wish to avoid taking chemoprophylaxis	Could delay proper diagnosis and treatment

## 4.4 Testing for G6PD deficiency

Tafenoquine and the related antimalarial drug primaquine can cause severe haemolysis in people with Glucose-6-phosphate dehydrogenase (G6PD) deficiency. Effects range from mild and self-limited to life-threatening.<sup>20</sup> G6PD deficiency is an X-linked genetic disorder with variable frequency in different populations and considerable geographical overlap with malaria-endemic areas.<sup>21</sup> National and international guidelines recommend assessing all patients for G6PD deficiency before prescribing tafenoquine.<sup>15,16</sup> Patients with <70% of normal G6PD activity (based on local population standards) should not receive tafenoquine.<sup>22</sup> Conventional qualitative tests, like the fluorescent spot test and rapid diagnostic tests (RDTs), can identify severe deficiency (<30% normal activity) but may not identify female heterozygotes with intermediate deficiency (30-70%).

Before prescribing tafenoquine, a **quantitative G6PD test** that provides a continuous measure of enzyme activity (e.g. spectrophotometry) should be used to rule out severe or intermediate G6PD enzyme activity.<sup>20</sup> Patients may be advised that only one test is necessary as the results do not change over a lifetime.

## 4.5 Global landscape of malaria prevention recommendations for travellers

Various global, national, and professional bodies provide guidance to assist healthcare providers in advising travellers on malaria prevention (Table 7). While these groups rely on similar data sources, such as the WHO's annual World Malaria Report, they use different approaches. There is generally close alignment on guidance for higher-prevalence destinations like sub-Saharan Africa and Papua New Guinea, with chemoprophylaxis recommended for most travellers. However, for destinations with lower prevalence or limited data, recommendations vary, ranging from bite avoidance alone, to combinations of bite avoidance, standby emergency self-treatment (SBET), or chemoprophylaxis. These differences reflect variations in health systems, medicolegal climates and risk tolerance levels among countries.<sup>8</sup> Other factors include differences in the availability and approved uses of antimalarial drugs, as well as the availability of malaria diagnostics and treatment for returning travellers.

**Table 7. Existing malaria prevention guidelines for travellers. Adapted from McGuinness SL et al.\***

Country / body (language(s))	URL(s)
Belgium (Dutch, English, French)	<a href="https://www.wanda.be/en/a-z-index/malaria">https://www.wanda.be/en/a-z-index/malaria</a> (traveller) <a href="https://artsen.wanda.be/en/a-z-index/malaria">https://artsen.wanda.be/en/a-z-index/malaria</a> (health professional)
Canada (French, English)	<a href="https://www.canada.ca/en/public-health/services/catmat/canadian-recommendations-prevention-treatment-malaria.html">https://www.canada.ca/en/public-health/services/catmat/canadian-recommendations-prevention-treatment-malaria.html</a>
United Kingdom (English)	<a href="https://www.gov.uk/government/publications/malaria-prevention-guidelines-for-travellers-from-the-uk">https://www.gov.uk/government/publications/malaria-prevention-guidelines-for-travellers-from-the-uk</a>
United States (English)	<a href="https://wwwnc.cdc.gov/travel/yellowbook/2024/preparing/yellow-fever-vaccine-malaria-prevention-by-country">https://wwwnc.cdc.gov/travel/yellowbook/2024/preparing/yellow-fever-vaccine-malaria-prevention-by-country</a> ; <a href="https://wwwnc.cdc.gov/travel/yellowbook/2024/infections-diseases/malaria">https://wwwnc.cdc.gov/travel/yellowbook/2024/infections-diseases/malaria</a>

World Health Organization  
(English)

<https://www.who.int/publications/m/item/vaccination-requirements-and-recommendations-for-international-travellers-and-malaria-situation-per-country-2022-edition>

\*The guidelines listed in this table are limited to those that are publicly available and available in English language.

References <sup>8</sup>

## 4.6 Malaria prevention recommendations in Australia and New Zealand

In Australia and New Zealand, there are no official national guidelines for malaria prevention. The Australian Government's Smartraveller website (<https://www.smartraveller.gov.au/>) offers information about malaria risk on individual country pages, but this is limited to basic details about whether malaria is present and a general overview of affected areas. For example, regarding Thailand, Smartraveller states that malaria is a risk throughout the year in rural areas, and the worst affected areas are near the borders with Cambodia, Laos and Myanmar. Additionally, the "prophylaxis of malaria" chapter in the Therapeutic Guidelines: Antibiotic provides an overview of general indications, dosing information and available antimalarial options. However, it directs readers to CDC and WHO resources for detailed information on malaria risk, drug resistance and chemoprophylaxis recommendations.<sup>15</sup>

Healthcare providers in Australia and New Zealand often refer to malaria prevention guidelines from the WHO, US or UK, due to their familiarity and availability in English. Destination-specific guidance is easily accessible through the related US Travelers' Health (<https://wwwnc.cdc.gov/travel/>) and UK Travel Health Pro (<https://travelhealthpro.org.uk/>) websites. Some providers also subscribe to clinical decision support tools which provide more detailed regional information.

While recommendations for sub-Saharan Africa and Oceania are generally consistent across these guidelines, discrepancies arise for other regions, especially in Asia. The US and WHO guidance tends to be more conservative, recommending chemoprophylaxis for a broader range of destinations compared to the UK guidance. Regardless of the guidelines used, it is crucial that recommendations are based on an individual risk assessment, considering factors that affect a travellers' likelihood of exposure to malaria or risk of severe disease.

## 5 RETURNING TO AUSTRALIA AND NEW ZEALAND

### 5.1 Seeking medical attention

When preparing for travel, ensure travellers understand that if they develop a fever lasting more than 24 hours during or after visiting a malaria-endemic area, malaria should be considered until proven otherwise. Advise them to seek immediate medical care and request malaria testing.

### 5.2 Diagnosis and treatment

Healthcare providers must consider malaria as a potential diagnosis in patients presenting with a febrile illness who have travelled to a malaria-endemic area, especially if the visit occurred within the preceding year.<sup>15</sup> While malaria typically presents within weeks of infection, symptoms can occasionally be delayed for many months.<sup>23</sup>

To diagnose malaria, a blood sample should be collected in an EDTA tube and sent to a qualified laboratory for microscopy (thick and thin blood films). Microscopy remains the gold standard for diagnosing malaria, as it allows for species identification and quantifies parasite density, an important marker of disease severity. However, a single negative blood film does not rule out malaria, particularly if the patient has recently taken antimalarial medication.

Rapid diagnostic tests (RDTs) can sometimes provide a quick diagnosis but are less sensitive and must be followed by microscopy. Some laboratories offer nucleic acid amplification tests (NAAT) such as polymerase chain reaction (PCR) as an alternative to microscopy. These tests are at least as sensitive as microscopy but may be less useful for diagnosing acutely ill patients due to longer turnaround times. NAAT can sometimes be used to confirm the species of the malaria parasite once a diagnosis has been made with microscopy or a RDT.

Treatment of malaria cases is beyond the scope of this document. Severe malaria is a medical emergency and requires intravenous antimalarial therapy in a hospital setting.

### 5.3 Public health management

Malaria is a nationally notifiable disease in Australia and New Zealand, and healthcare providers are required to report cases to the relevant health authorities.

Although Australia is considered malaria-free, *Anopheles* mosquitoes that can transmit the disease are still present in parts of northern Australia.<sup>3</sup> If infected individuals travel to these areas, there is a risk of onward local transmission and potential re-establishment of the disease. Management of malaria cases in areas with *Anopheles* mosquitoes may require additional public health measures<sup>24</sup> beyond routine treatment, including:

- Administering a gametocidal drug (primaquine) to sterilise the sexual forms (gametocytes) of the parasite and prevent transmission to local mosquitoes
- Physically separating the patient from the mosquito environment until they are no longer able to transmit the parasite, to prevent transmission to local mosquitoes
- Implementing mosquito control measures around the patient's residence and other places they visited at night, such as mosquito trapping, fogging and enhanced surveillance, along with community awareness activities in the local area

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## 7 FURTHER RESOURCES

- Australian Notifiable Diseases Dashboard (includes cases of malaria by year, age group, sex and jurisdiction): <https://nindss.health.gov.au/pbi-dashboard/>
- New Zealand Notifiable Diseases Dashboard (includes cases of malaria by year, sex and age group): <https://www.esr.cri.nz/digital-library/notifiable-disease-dashboard/>
- CDC's Choosing a drug to prevent malaria: <https://www.cdc.gov/malaria/hcp/drug-malaria/index.html> (note that primaquine is not available in Australia for chemoprophylaxis)
- Guidance for safe use of insect repellents in children: [https://www.rch.org.au/kidsinfo/fact\\_sheets/Insect\\_repellents\\_guidelines\\_for\\_safe\\_use/](https://www.rch.org.au/kidsinfo/fact_sheets/Insect_repellents_guidelines_for_safe_use/)
- World Health Organization World Malaria Report: <https://www.who.int/publications/i/item/9789240086173>

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