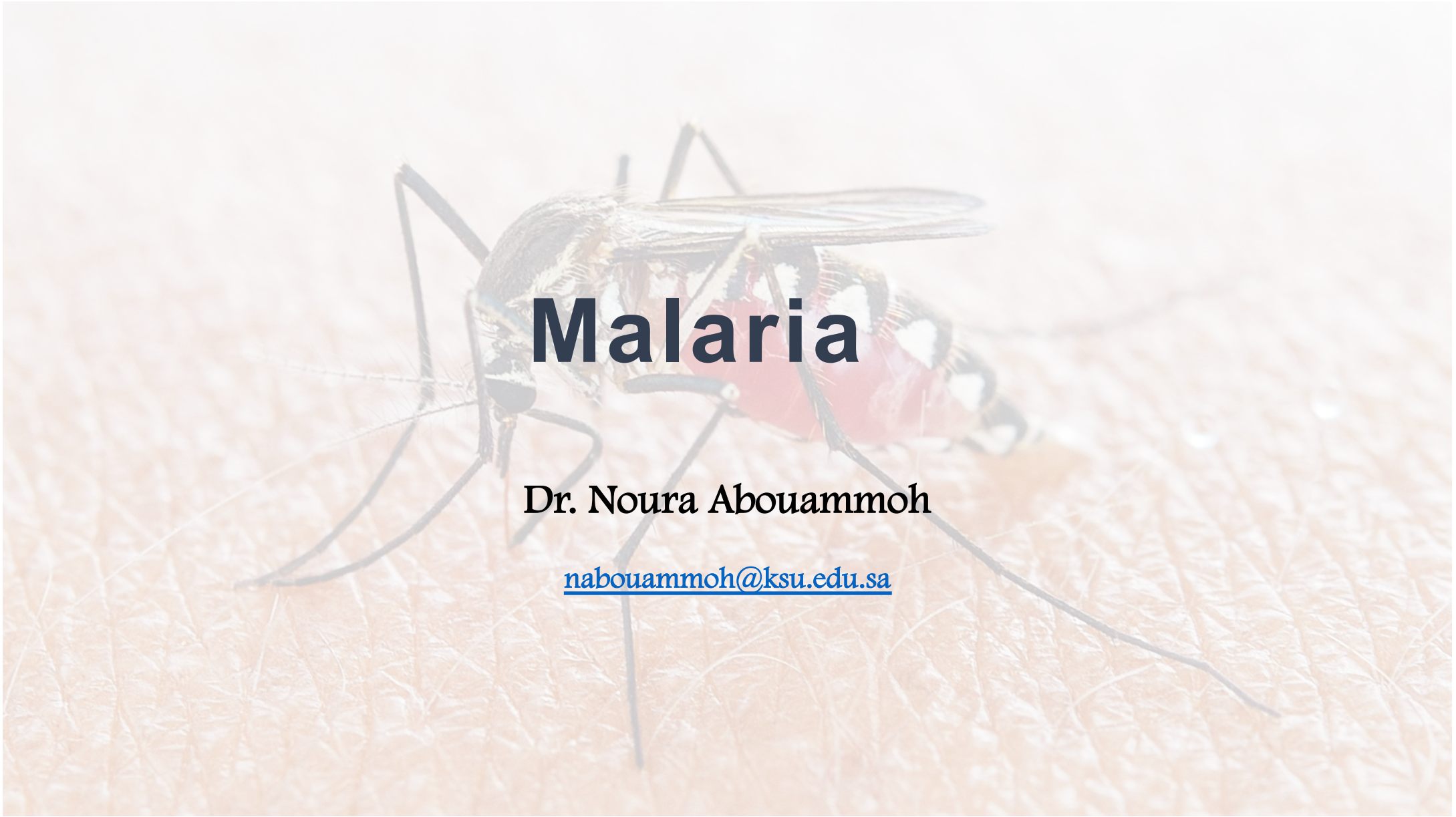

Malaria

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Objectives:

1. Understand the epidemiology and global burden of malaria
2. Understand the cycle of infection of malaria
3. Define modes of transmission, clinical features, risk factors, community diagnosis and treatment of malaria
4. Outline how to take history of Malaria patient, and how to give preventive advise
5. Enlist factors responsible for antimalarial drug resistance
6. Understand the role and measures taken by WHO to combat the burden of Malaria globally
7. Enlist the global measures of prevention and elimination for Malaria
8. Understand the epidemiology and risk factors related to Malaria in KSA

Malaria

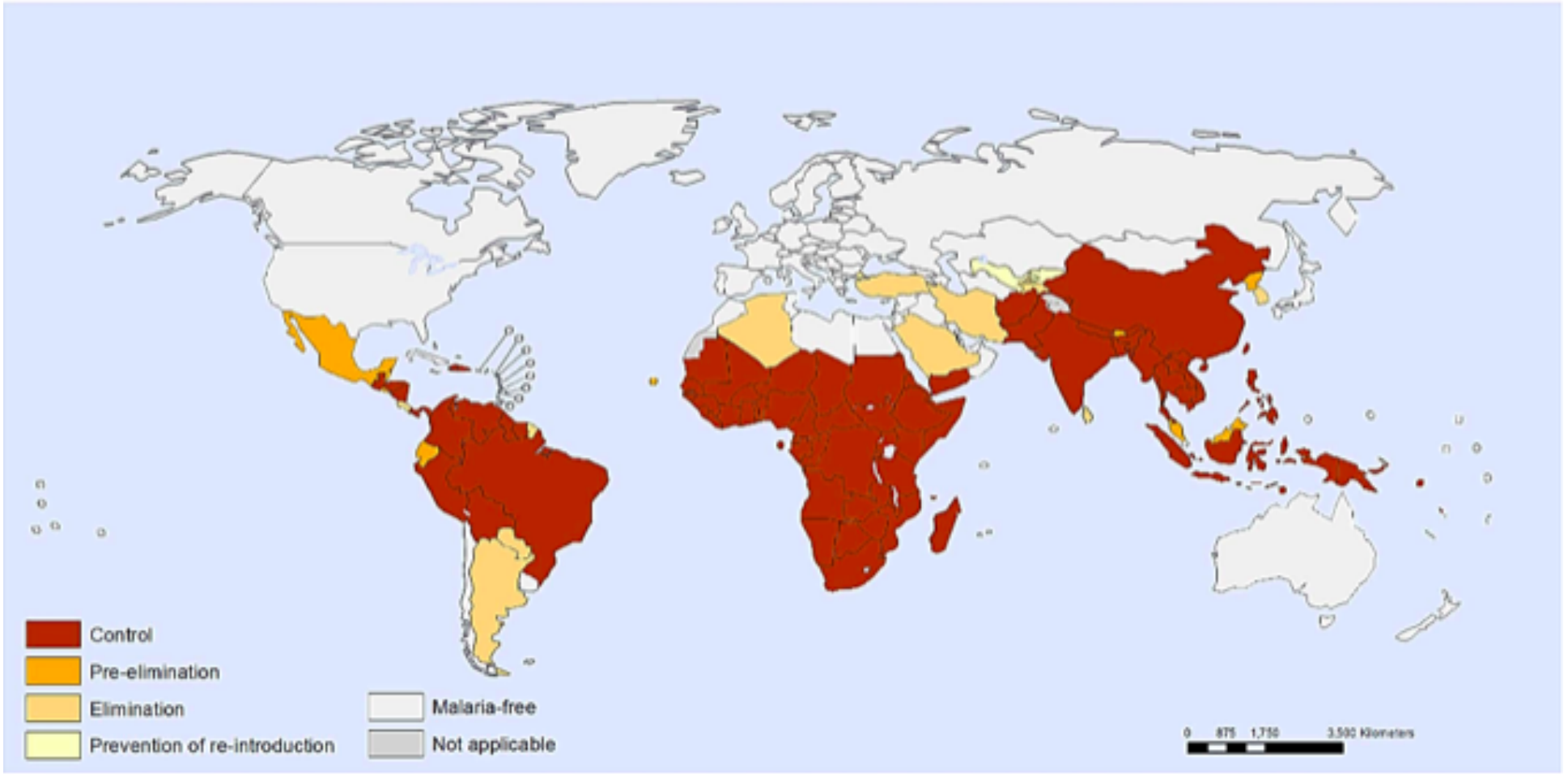
- Malaria is a life-threatening disease caused by **Plasmodium parasites** that are transmitted to people through the **bites of infected mosquitoes.**

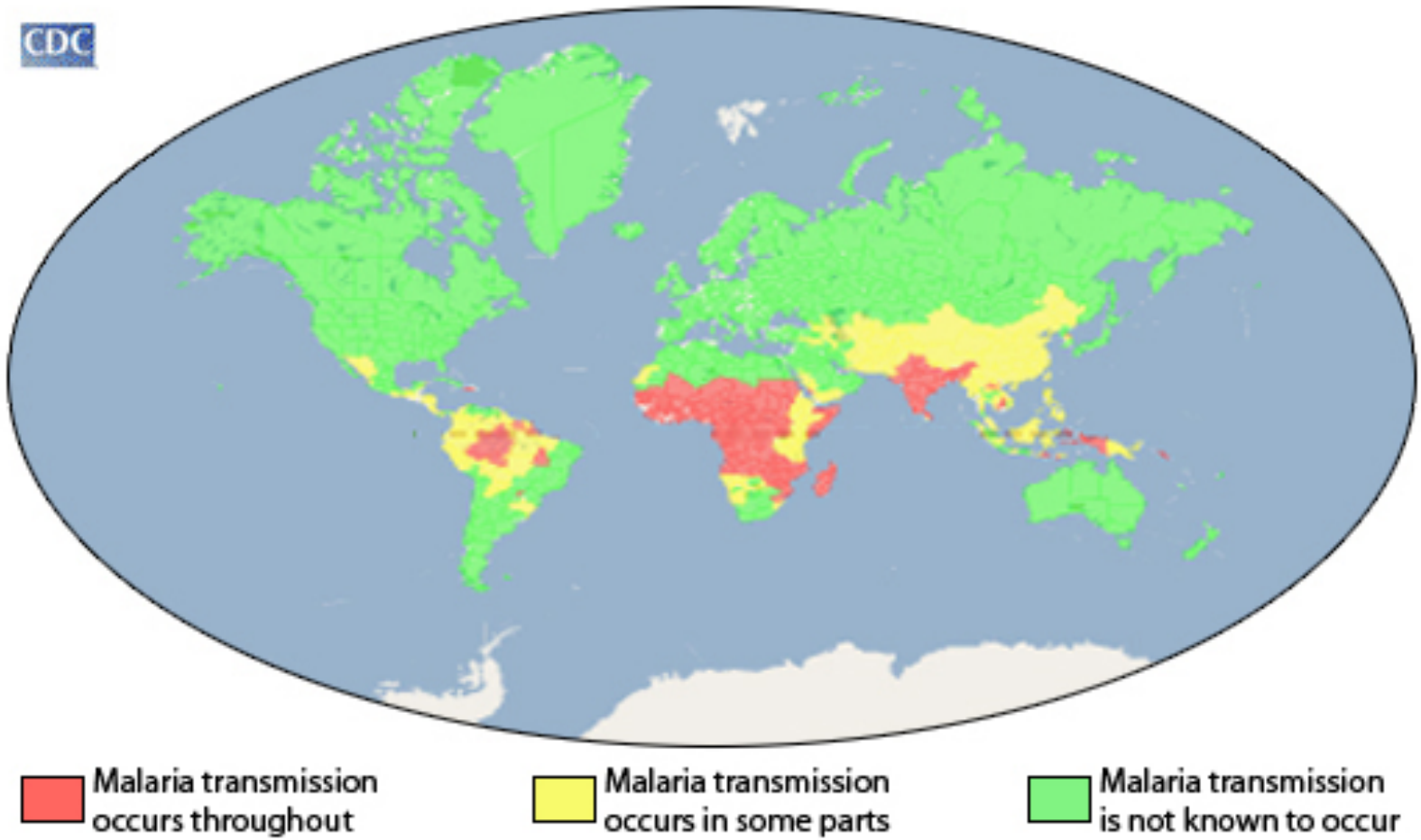
- Malaria is responsible for approximately 1-3 million deaths per year

Epidemiology

- In 2016, there were 216 million cases and 445,000 deaths caused by malaria worldwide.
- Between 2000 and 2015, malaria **incidence** fell by 37% globally.
- During the same period, malaria **mortality** rates decreased worldwide by 60% among all age groups, and by 65% among children under 5.
- In 2014, 13 countries reported zero cases of the disease and 6 countries reported fewer than 10 cases.

Classification of countries by stage of malaria elimination, as of December 2014





An approximation of the parts of the world where malaria transmission occurs.

Malaria in Saudi Arabia

- Areas at the **southern region** are at risk of malaria transmission, specifically Asir and Jizan. The dominant Malaria parasite in Saudi Arabia is **P. Falciparum** .
- Saudi Arabia achieved a decrease in malaria cases and case incidence rates of ≥65%.

Saudi Arabia-World Health Organization

I. Epidemiological profile

Population (UN Population Division)	2017	%
Number of active foci	64	-
Number of people living within active foci	173.3K	1
Malaria free (0 cases)	32.8M	99
Total	32.8M	

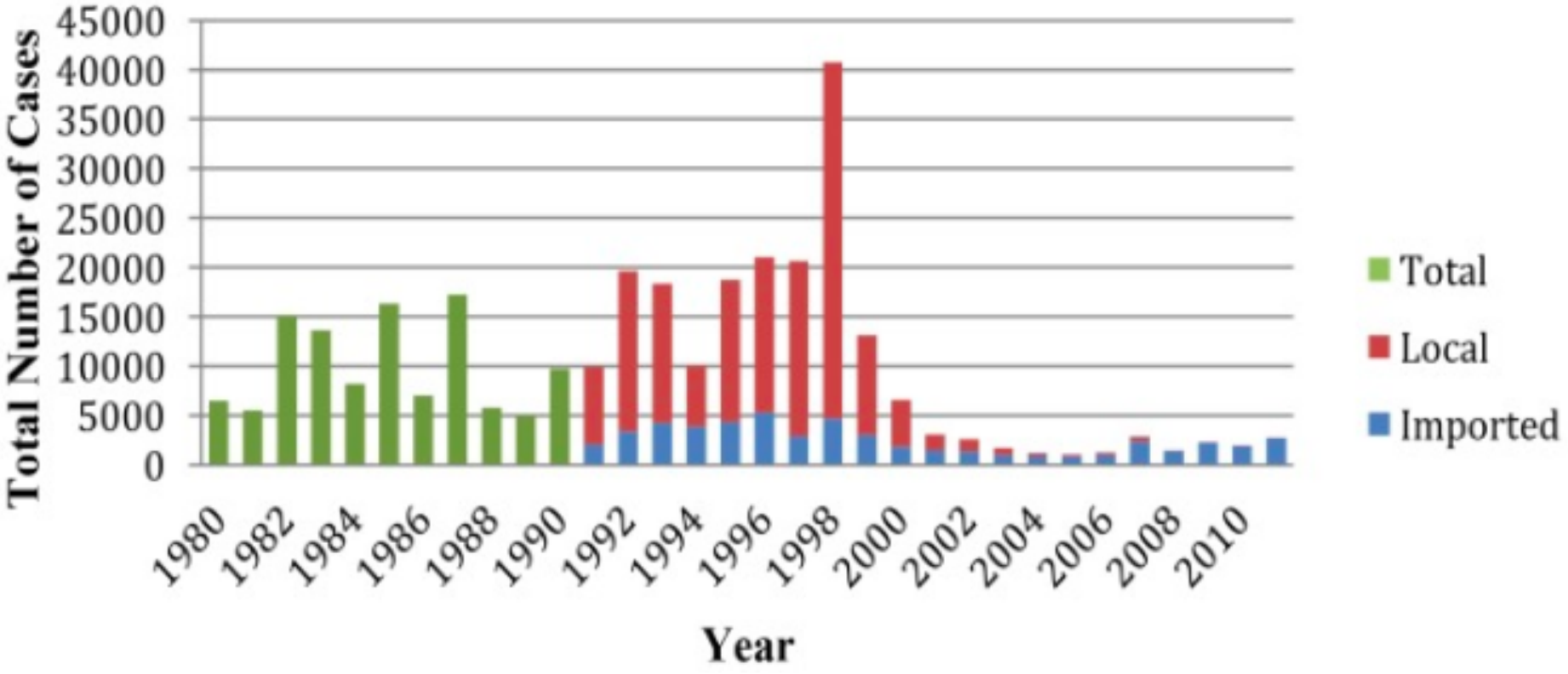
Parasites and vectors	
Major plasmodium species:	P.falciparum: 97 (%) , P.vivax: 2 (%)
Major anopheles species:	*An. arabiensis, An. sergentii, An. stephensi, An. fluviatilis, An. multicolor*

Reported cases and deaths	
Reported indigenous confirmed cases (health facility):	177
Confirmed cases at community level:	-
Confirmed cases from private sector:	-
Indigenous deaths:	0

Malaria in Saudi Arabia

- Malaria outbreak in 1998.
- Since then, only a few cases were reported
- In 2012 , only 82 cases of malaria were reported.
- The proportion of imported malaria has increased from 23% to 99% of total detected cases.

Indigenous cases of malaria Saudi Arabia 2014 :



Imported malaria in Saudi Arabia 1999-2010 :

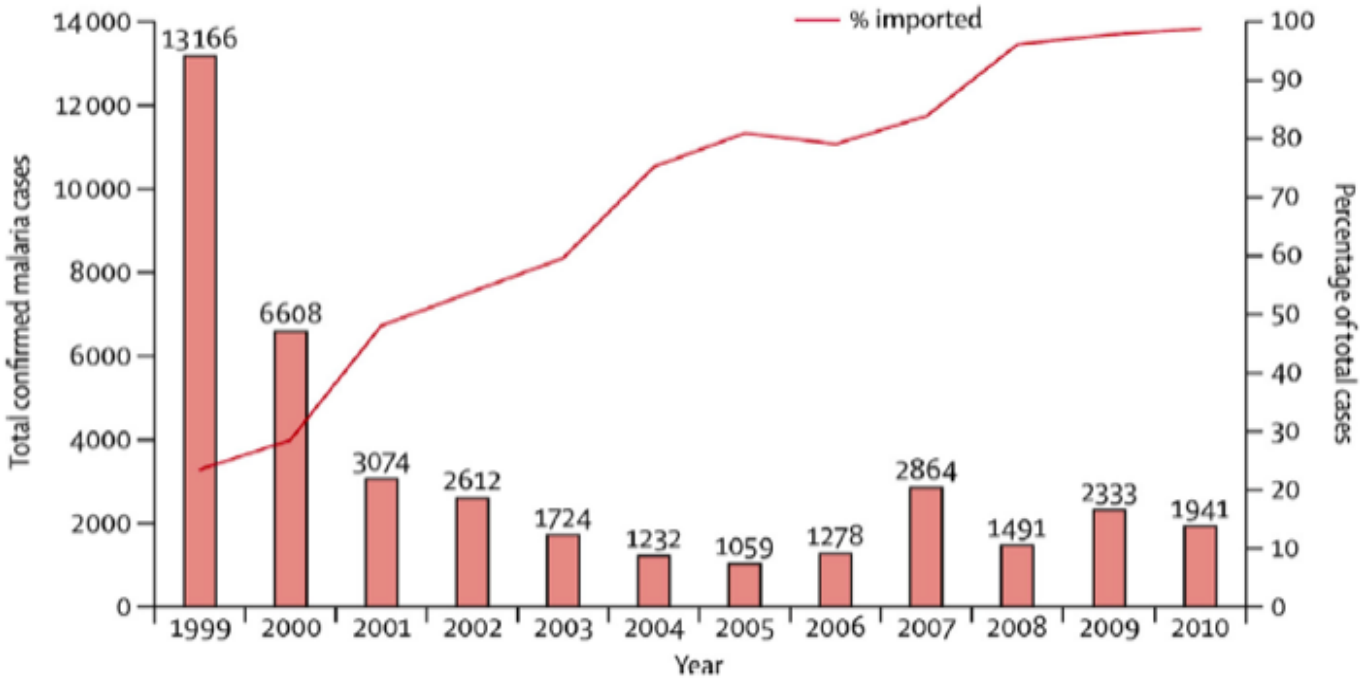


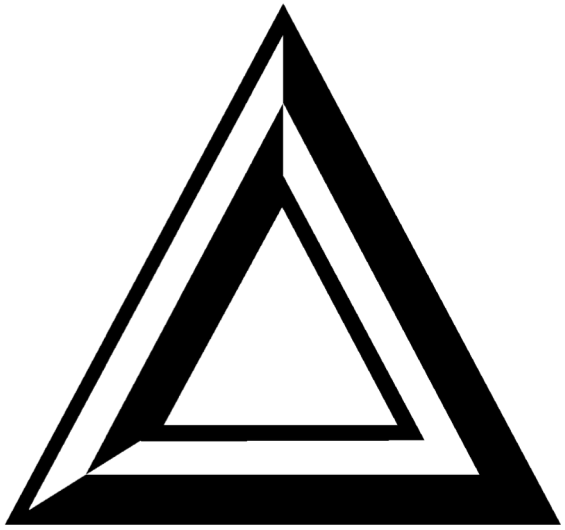
Fig. 1. Indigenous and imported malaria in Saudi Arabia, 1999–2010 (Cotter et al., 2013).

- **Imported malaria:** via asymptomatic travelers from malaria endemic areas, sustains a threat for possible resurgence of local transmission:

  Workers, immigrants, pilgrims.

Analytical Epidemiology Triad:

HOST



AGENT

ENVIRONMENT

Plasmodium Parasites

- **Five** species cause malaria in humans:

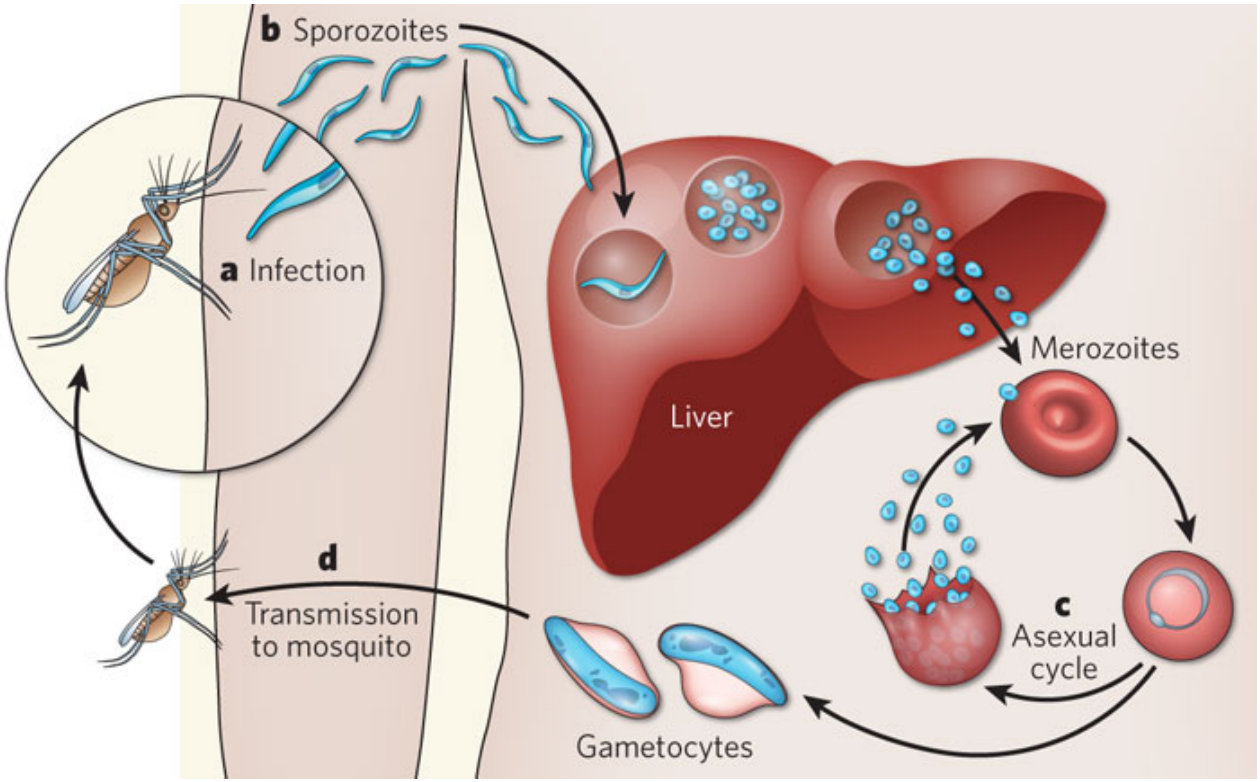
Plasmodium falciparum, P. vivax, P. ovale, P. malariae and P. knowlesi

- **P. falciparum and P. vivax** pose the greatest threat.

Plasmodium Parasites

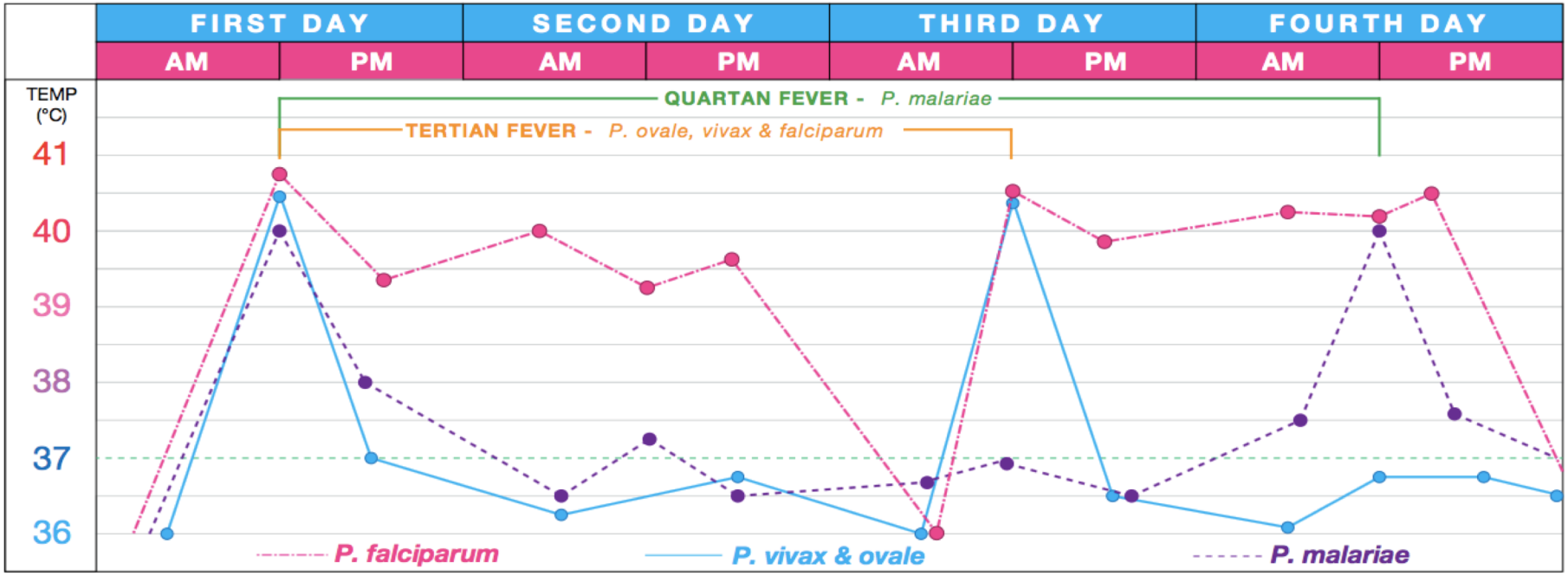
- **Transmitted** through **the bites of infected female Anopheles mosquitoes (vector)**.
- **Other modes of transmission:**
- From mother to unborn child
- Blood transfusion

Plasmodium Parasites transmission and lifecycle:



Clinical features

Paroxysmal fever



Cold stage: lassitude, headache, nausea, chills. (¼ -1 h) skin cold then hot

Hot stage: skin hot and dry (2 -6 h)

Sweating stage: fever subsides, sweating (2 -4 h)

Symptoms

Early symptoms

Fever

Headache

Chills

If not treated early might progress to

Severe illness

Severe anemia

Respiratory distress

Cerebral malaria

Multiorgan failure

Risk factors

No or little immunity against the disease in areas with high transmission

- **Young children**, who have not yet developed partial immunity to malaria
- **Pregnant women**, whose immunity is decreased by pregnancy.
- **Travelers or migrants** coming from areas with little or no malaria transmission, who lack immunity.
- People with low immunity such as HIV patients
- Poverty
- Environmental: rain seasons

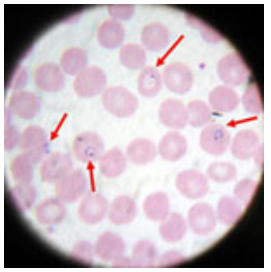
history of Malaria patient and preventive advise

- Proper History
- Risk factors
- Clinical features
- Fever characteristics
- Treatment
- Prophylaxis
- Control

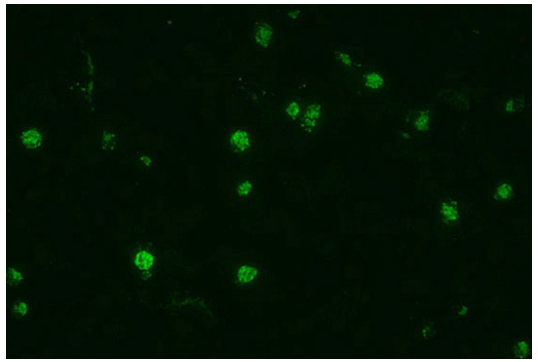
Immunity against malaria (protection)

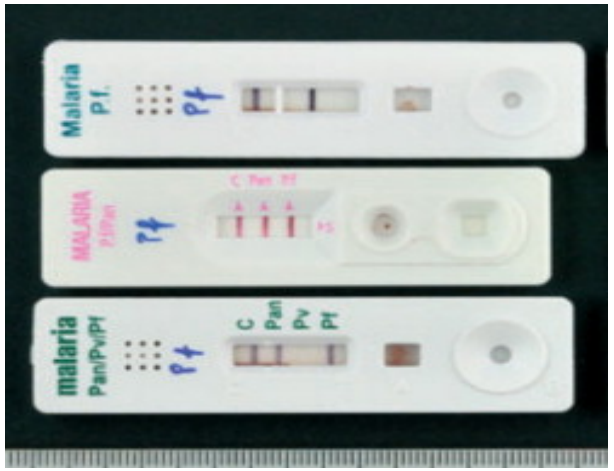
- **Genetic Factors:** Biologic characteristics present from birth can protect against certain types of malaria: (having the **sickle cell trait**)
- **Acquired Immunity:** newborns in endemic areas will be protected during the first few months by maternal antibodies.
- **Repeated attacks of malaria**

Diagnosis



- Microscopy: thin film, thick film.
- Serology: two weeks after infection.
- Rapid diagnostic test (RDT)





Community diagnosis

- Pre-eradication: spleen rate, parasite rate,…..
- Eradication: microscopic diagnosis
  - Parasite incidence
  - Blood examination rate
- Vector indices
  - Human blood index (proportion of blood meals)
  - Sporozite rate (Oocyst Rates obtained using DNA extracted either from heads thoraxes or abdomens of females)
  - Mosquito density
  - Man biting rate ((of Anopheles species in seasons)
  - Inoculation rate (is a measure of exposure to infectious mosquitoes)

Treatment

Choice of treatment line depends on:

- Type of plasmodium species and stages of malaria parasites.
- Clinical status of patient: Uncomplicated or Severe, or pregnancy.
- Drug sensitivity of the infected parasite (area)
- Previous exposure to anti-malarial drugs.

Artemisinin combination therapy (ACT): (3days)

- Monotherapy is not recommended for malaria treatment to prevent drug resistance

For uncomplicated malaria:
First line: (ARTESUNATE + SP); alternative (ARTESUNATE + MEFLOQUINE)
Second Line: (ARTEMETHER + LUMEFANTRINE)
Third Line : (oral QUININE + DOXYCYCLINE)

World Health Organization

وزارة الصحة
Ministry of Health

Kingdom of Saudi Arabia
Ministry of Health
Public Health Agency
Infectious Diseases Control General Directorate
Malaria Department

Antimalaria treatment policy	Medicine	Year adopted
First-line treatment of unconfirmed malaria	-	-
First-line treatment of P. falciparum	AS+SP+PQ	2012
For treatment failure of P. falciparum	AL	2007
Treatment of severe malaria	AS; AM; QN	2015
Treatment of P. vivax	CQ+PQ(14d)	-
Dosage of primaquine for radical treatment of P. vivax	0.25 mg/Kg (14 days)	
Type of RDT used	P.f + P.v specific (Combo)	

Therapeutic efficacy tests (clinical and parasitological failure, %)

Medicine	Year	Min	Median	Max	Follow-up	No. of studies	Species

Resistance status by insecticide class (2010-2017) and use of class for malaria vector control (2017)

Insecticide class	Years	(%) sites[1]	Vectors[2]	Used[3]
Carbamates	-	-	-	No
Organochlorines	-	-	-	No
Organophosphates	2017-2017	0% (1)	-	No
Pyrethroids	2012-2017	0% (8)	-	Yes

[1]Percent of sites for which resistance confirmed and total number of sites that reported data (n)

[2]Principal vectors that exhibited resistance

[3]Class used for malaria vector control in 2017

A single dose of Primaquine is added to the first day as a gametocidal medication.

- Primaquine is contraindicated in:
  - G6PG deficiency,
  - pregnancy,
  - children < 6m,
  - lactating mothers for babies <6m or
  - hypersensitivity

Treatment failure

- Failure to resolve or recurrence of fever or parasitemia:

- Early (1-3 days of treatment)
- Late: (4days – 6 weeks after treatment)

- Causes:
- Low or incomplete dose
- Poor adherence to treatment
- Abnormal individual pharmaokinetics
- Drug resistance

Antimalarial drug resistance

- The ability of the parasite to survive and/or multiply despite the administration and absorption of medication.

- **Reason:**
- Exposure of the parasite to insufficient amount of the drug.
    - Low dose prescribed
    - Lesser amount dispensed
    - Incomplete treatment
    - Vomiting
    - Low absorption

WHO efforts in malaria control

- **Global technical Strategy for Malaria 2016–2030**

1. Ensure universal access to malaria prevention, diagnosis and treatment
2. Accelerate efforts towards elimination and attainment of malaria-free status
3. Transform malaria surveillance into a core intervention

Control:

The main way to reduce malaria transmission at a community is **vector control**

- Decrease human-mosquito contact
- Destruction of adult mosquitoes
- Destruction of larvae
- Environmental control
- Chemoprophylaxis
- Vaccination

Decrease human-mosquito contact

- Insecticide-treated mosquito nets (ITNs)
- For **all at-risk persons**
- Provision of **free LLINs**
- **Everyone sleeps under a LLIN every night.**
- **Insect repellant to skin and clothing**

Destruction of adult mosquitoes

- Indoor spraying with residual insecticides
- **At least 80%** of houses in targeted areas are sprayed
- Protection depends on type of insecticide.

Destruction of mosquito larvae

- Larviciding of water surfaces, intermittent irrigation, biological control

Source reduction

- Environmental sanitation, water management, drainage

Social participation

- Health education , community participation

Chemoprophylaxis

- To travelers
- Pregnant women
- Infants in endemic areas
- Seasonal chemoprevention

Vaccination

- **Still under trial**

Risk factors in Saudi Arabia

- Heavy rainfall season
- Army personnel and employees working at the Southern borders
- Travelers to countries with active malaria transmission
- Pilgrimage from regions with active malaria transmission

Prevention and control of malaria in KSA

The current elimination strategy in Saudi Arabia focuses mainly on:

1. Targeting **high risk areas** for sustained preventative measures such as (Long lasting insecticide treated nets, Indoor residual spraying)
2. **Management of infection** through rapid confirmed diagnosis and treatment.
3. Individual case follow up and reactive **surveillance** with appropriate treatment and vector control.
4. Active case detection **at borders** with screening and treatment.

KSA-WHO

II. Intervention policies and strategies

Intervention	Policies/Strategies	Yes/ No	Year adopted
ITN	ITNs/LLINs distributed free of charge	Yes	1980
	ITNs/LLINs distributed to all age groups	Yes	1980
IRS	IRS is recommended	Yes	1963
	DDT is used for IRS	No	-
Larval control	Use of Larval Control	Yes	2004
IPT	IPT used to prevent malaria during pregnancy	-	-
Diagnosis	Patients of all ages should receive diagnostic test	Yes	-
	Malaria diagnosis is free of charge in the public sector	Yes	1963
Treatment	ACT is free for all ages in public sector	Yes	1963
	The sale of oral artemisinin-based monotherapies (oAMTs)	has never been allowed	-
	Single dose of primaquine (0.25 mg base/kg) is used as gametocidal medicine for P. falciparum	Yes	1985
	Primaquine is used for radical treatment of P. vivax	Yes	-
	G6PD test is a requirement before treatment with primaquine	Yes	1985
	Directly observed treatment with primaquine is undertaken	No	-
	System for monitoring of adverse reaction to antimalarials exists	Yes	1990
Surveillance	ACD for case investigation (reactive)	Yes	1980
	ACD at community level of febrile cases (pro-active)	Yes	1980
	Mass screening is undertaken	No	-
	Uncomplicated P. falciparum cases routinely admitted	No	-
	Uncomplicated P. vivax cases routinely admitted	No	-
	Case and foci investigation undertaken		1990
	Case reporting from private sector is mandatory	No	-

Malaria and Hajj season

Measures applied before inlet of Pilgrims:

- Spray health care facilities pilgrims camps with residual insecticides.
- Surveillance at Hajj Entry ports (suspected cases/ necessary measures).

Measures applied during Hajj season:

- Epidemiology investigation malaria cases (proper diagnosis/treatment).
- Secure malaria drugs and treatment policy for all health care facilities.

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