Long-lasting insecticidal nets in malaria prevention

Health Technology assessment
Health Care Evaluation and Infection Prevention Interventions
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Photo:Wordbank

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Photo: Richard Nyberg/ USAID

Malaria

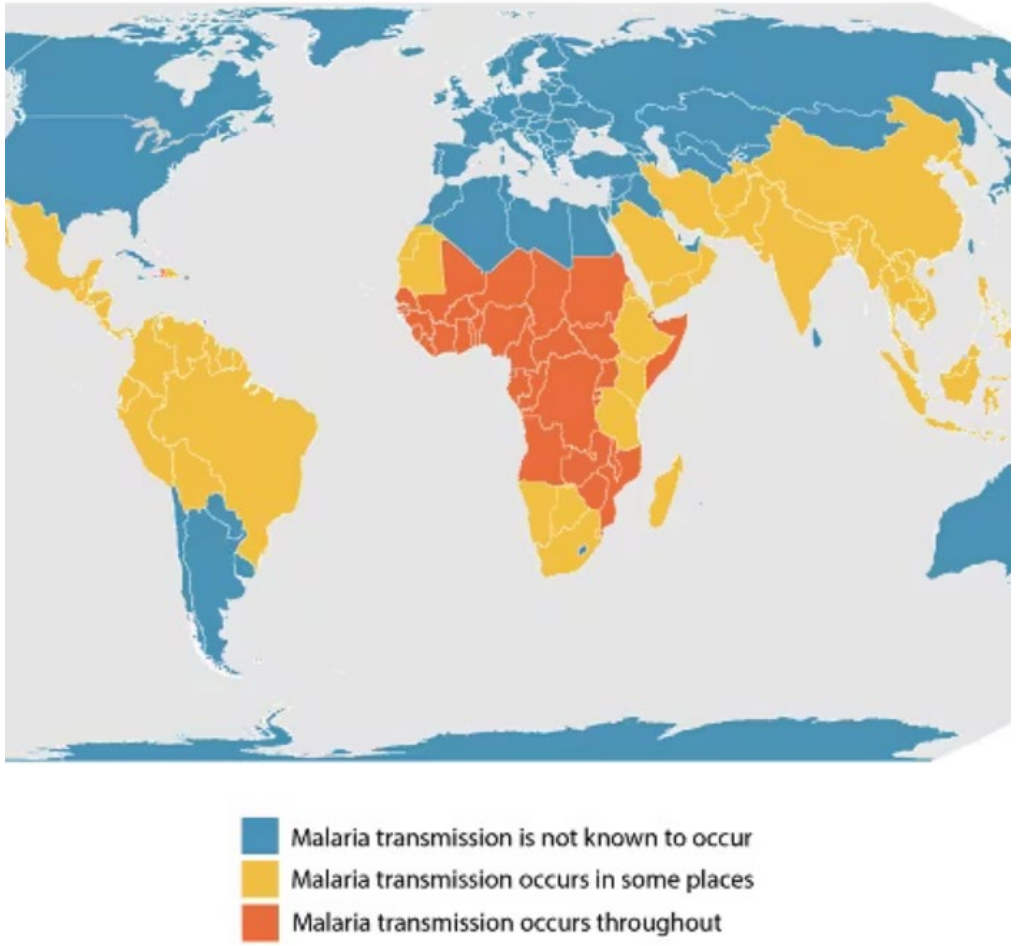
- Malaria is a life-threatening disease transmitted to people through the bites of infected female Anopheles mosquitoes.
- 600,000 deaths in 85 countries and an estimated 250 million malaria cases yearly.
- Five species of Plasmodium (P. falciparum, P. vivax, P. malariae ,P. ovale, P. knowlesi) most commonly infect humans.
- P. falciparum and P. vivax are the most prevalent and P. falciparum is the most dangerous.

Photo: Pixapay

References: WHO 2022; WHO 2023

Nearly half of the world's population at risk of malaria

- **Malaria is prevalent in low-income countries, most global malaria burden remained in sub-Saharan Africa.**
- **Children under 5 years, and pregnant women are at higher risk of severe infection.**
- **Differences in transmission rates due to**
  - Geographical characteristics
  - Vector species and distribution
  - Socio-demographic characteristics
  - Access to antimalarial treatment
  - Coverage with vector control
- **The expansion of interventions has reduced malaria mortality by 36% between 2010 and 2020.**



References; CDC 2020; CDC 2021; WHO 2023

Malaria prevention

Malaria is preventable and treatable, and the global priority is to reduce the burden of disease and death while retaining the long-term vision of malaria elimination.

Main prevention methods:

- **Vector control**
- **chemoprophylaxis drugs, malaria chemoprevention**
- **Vaccine**

Vector control interventions recommended

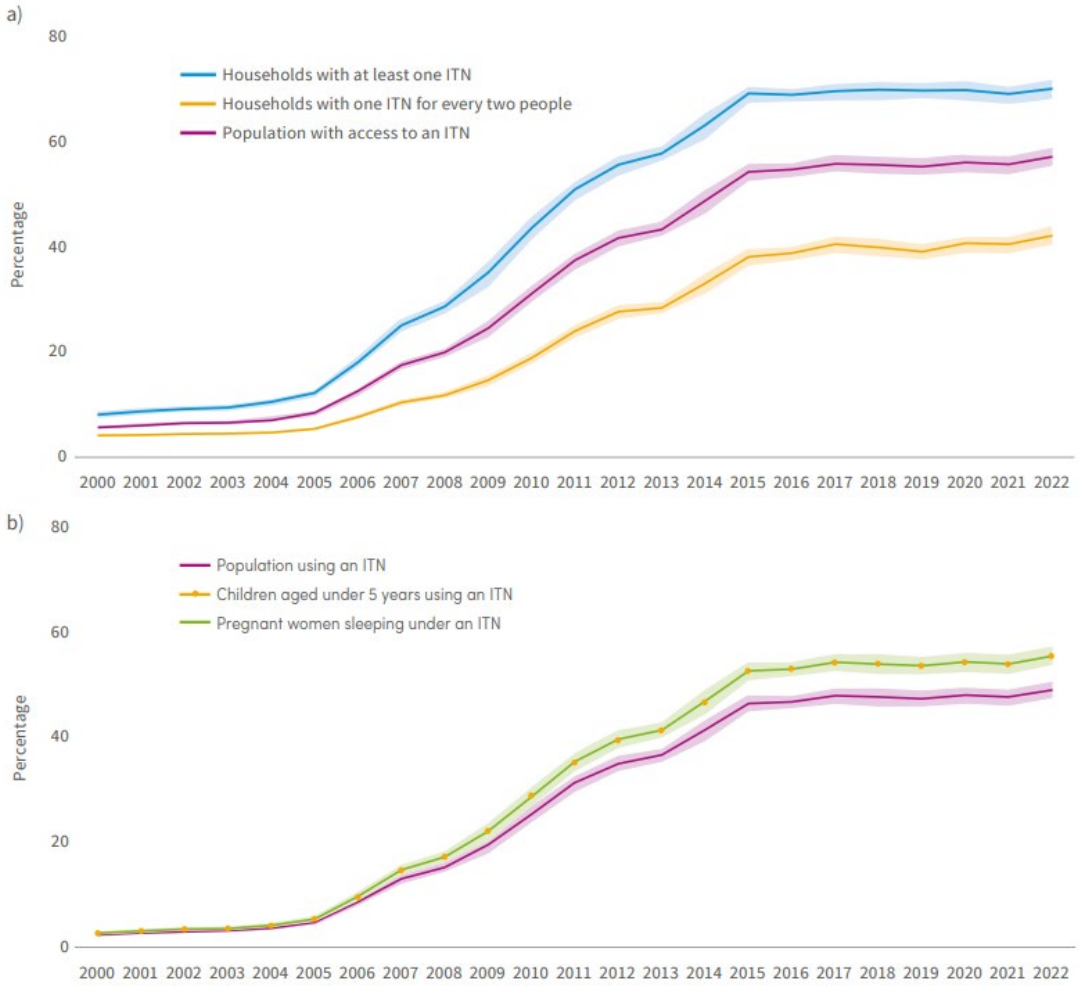
- **WHO-prequalified insecticide-treated nets (ITNs), often consisting of pyrethroid-only long-lasting insecticidal nets (LLINs)**
- **Indoor residual spraying (IRS) using a WHO-prequalified product**

Photo: Valentina Puj. Distribution of Insecticide treated nets (ITNs)

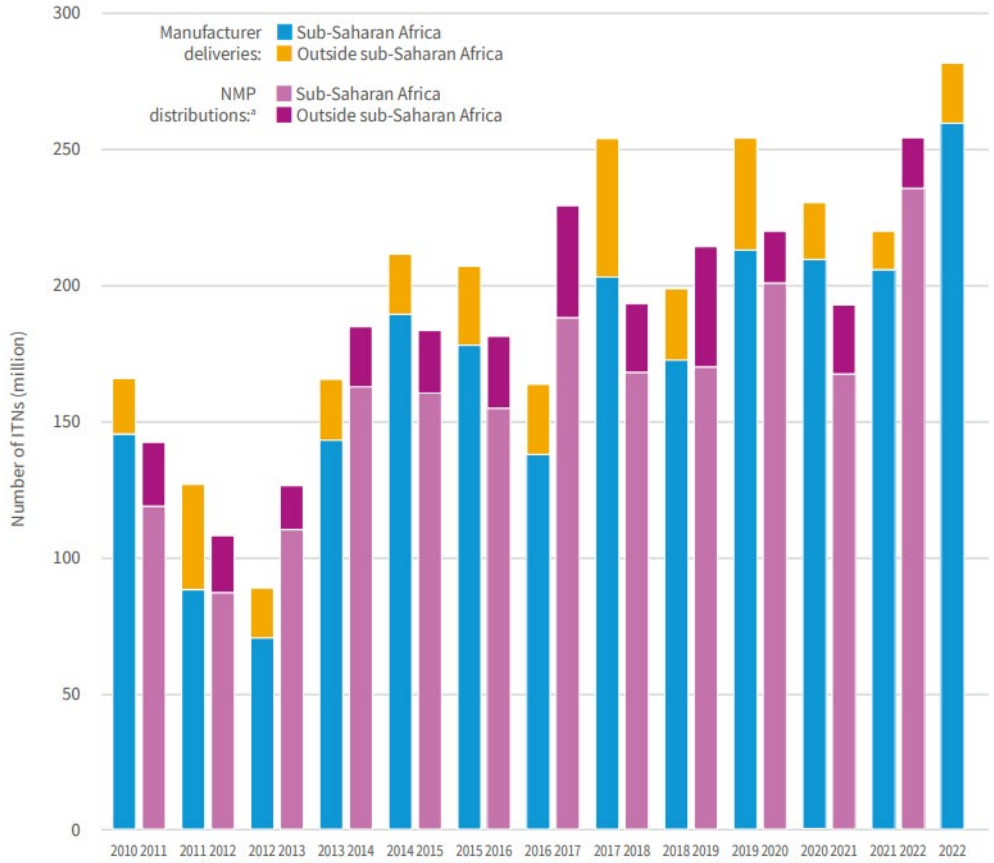
References; CDC 2020; CDC 2021; WHO 2023

Indicators of population-level coverage of ITNs were estimated for sub-Saharan African countries in which ITNs are the main vector control method.

a) Indicators of population-level access to ITNs, sub-Saharan Africa, 2000–2022 and b) indicators of population-level use of ITNs, sub-Saharan Africa, 2000–2022 *Source: ITN coverage model by the Malaria Atlas Project (47, 48).*



Number of ITNs delivered by manufacturers and distributed[a] by NMPs, 2010–2022 *Sources: Milliner Global Associates and NMP reports.*



Reference: Word malaria report 2023

Evaluation of long-lasting insecticidal nets

- The approach “innovation for development” by Rochlin & Radovich (2013) is used as an evaluation framework.
- It is designed for developing countries and can be modified to suit the specific needs of evaluating innovation.
- The innovation to be evaluated can be an idea or a device aimed at bringing about changes that benefit the poor and vulnerable.
- Evaluations need to include the voices of the most affected and take into account issues that lead to successes and durable development outcomes.

References; Donaldson, Azzam & Conner 2013

1. Relevance

LLINs act as a physical barrier and affect the reproduction of mosquitoes that encounter the insecticide on the netting material.

- **LLINs reduce the burden of malaria (incidence, morbidity, mortality).**
- **All the users and the whole community benefit from the innovation.**
- **The implementation of vector control involves different sectors.**
- **A minimal set of 14 outcome and impact indicators guide the countries to monitor the progress.**
- **Evidence gained from numerous research (RCTs, other types of studies)**
- **Household and health facility surveys, and longitudinal studies ongoing regularly.**
- **Data is continuously accumulating (malaria surveillance)**

- **Key questions/ subquestions:**
  - What is the innovation?
  - Vision and goals of innovation?
  - Who benefits from the innovation?
  - Is the need verified?
- **Indicators-Evidence**
  - Documented assessments
- **Data, sources and methods**
  - Proposal, interviews, plans, budget, maps, surveys, strategy

References; Lines, Chitnis & Paintain 2022; WHO 2015; WHO 2022; WHO 2023

2. Effectiveness and 3. impact

LLINs meet global standards of quality, safety, and efficacy. Increasing INT coverage consistently leads to a rise in community-level protection.

LLINs alleviate poverty, improve equity, and education and contribute to overall development.

The effectiveness of a specific approach is likely influenced by factors such as mosquito genetics, behavior, population dynamics, and the characteristics of insecticides used.

Technical guidance, strategy and global and national plans guide the vector control interventions.

LLINs are more cost-effective than conventional ITNs .

Standard insecticide resistance data, assessments, programme evaluations etc.

- **Key questions/ subquestions:**
  - Is the innovation achieving its objectives?
  - Is the outcome of the innovation better than the old one?
  - Clear strategy?
- **Indicators-Evidence**
  - Reporting on changes, and value over old methods
- **Data, sources and methods**
  - Progress reports, results reports, lessons learned

References; Lines, Chitnis & Paintain 2022; WHO 2015 & 2023; Pulkki-Brännström, Wolff & Brännström 2012; Walder & Fisher 2018

4. Influence, 5. sustainability and 6. risk management

Reducing the disease burden and eliminating malaria are closely linked to several of the sustainable development goals (SDGs) and universal health coverage (UHC).

Guidelines for malaria (2023) support for establishment of national policies and national malaria control programs in endemic countries adapted to local context.

Safe and ethical prioritization of resources, strong political commitment, financing and increased multisectoral collaboration is crucial.

Identify factors associated with nets use and non-use at the household, access to insecticide-treated mosquito nets, climate change, lack of sufficient diagnostic tools , and monitoring the resistance of mosquitos.

Inadequate technical and human resources hinder the sustainability and scale-up of malaria prevention efforts.

- **Key questions/ subquestions:**
  - Sustainable outcomes, policy influence and influence on other sectors?
  - Risk monitoring
  - Has the enablers and barriers to sustainability been assessed?
- **Indicators-Evidence**
  - Identification of political, environmental, cultural conditions
- **Data, sources and methods**
  - Monitoring and evaluation reports

References; WHO 2015; WHO 2023; Aweis et al. 2023

WHO guidelines for malaria (2023) present all WHO recommendations

Developing guidelines for malaria involved several steps:

- planning, and conducting a needs assessment
- establishing internal WHO Guidelines Steering Groups and external Guidelines Development Groups (GDGs)
- formulating key recommendation questions using the PICO format
- commissioning evidence reviews or independently assessing available reviews
- applying GRADE (Grading of Recommendations, Assessment, Development and Evaluation) methodology to assess the certainty of evidence
- using evidence-to-decision (EtD) frameworks to develop recommendations based on GRADE results and contextual factors.

The recommendations will be regularly updated on the online MAGICapp publication platform to incorporate new evidence

References: WHO 2023

Recommendations

Are pyrethroid-only LLINs more effective in malaria prevention than no nets with adults and children living in areas with ongoing malaria transmission?

P= the population are adults and children in malaria-endemic areas

I= intervention is pyrethroid-only LLINs

C= comparison group are adults and children in malaria-endemic areas not using nets

O= outcome is that pyrethroid-only LLINs are more effective in reducing mortality rate and incidence of severe malaria episodes than if no nets are used.

Pyrethroid-only LLINs should be deployed for the prevention and control of malaria in children and adults living in areas with ongoing malaria transmission.

References: WHO 2023

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