



**World Health
Organization**

REGIONAL OFFICE FOR **Africa**

AMP 2023 Annual Partners' Meeting

Tailoring and prioritizing ITN interventions

Malaria and vector control situation with focus on ITNs

World Malaria Report 2022

8 May 2023

Outline

Disease Burden & Vector Control

Vector Control Products

Distribution and Coverage of ITNs

Distribution, Access and Use of ITNs

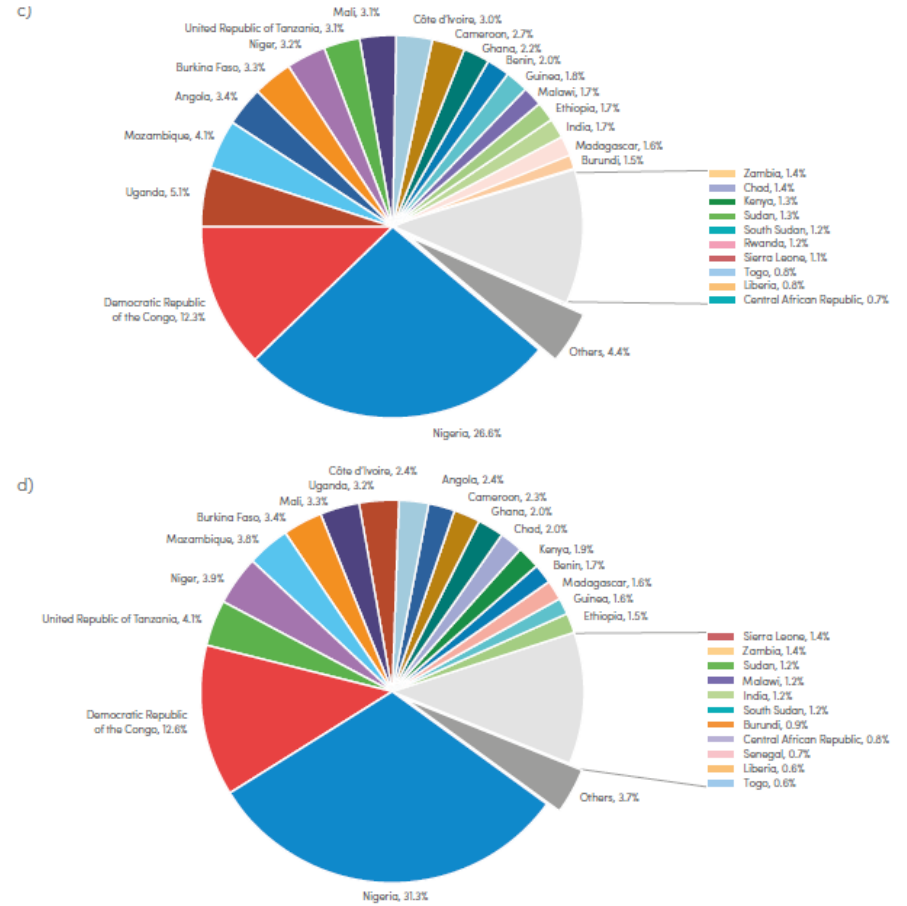
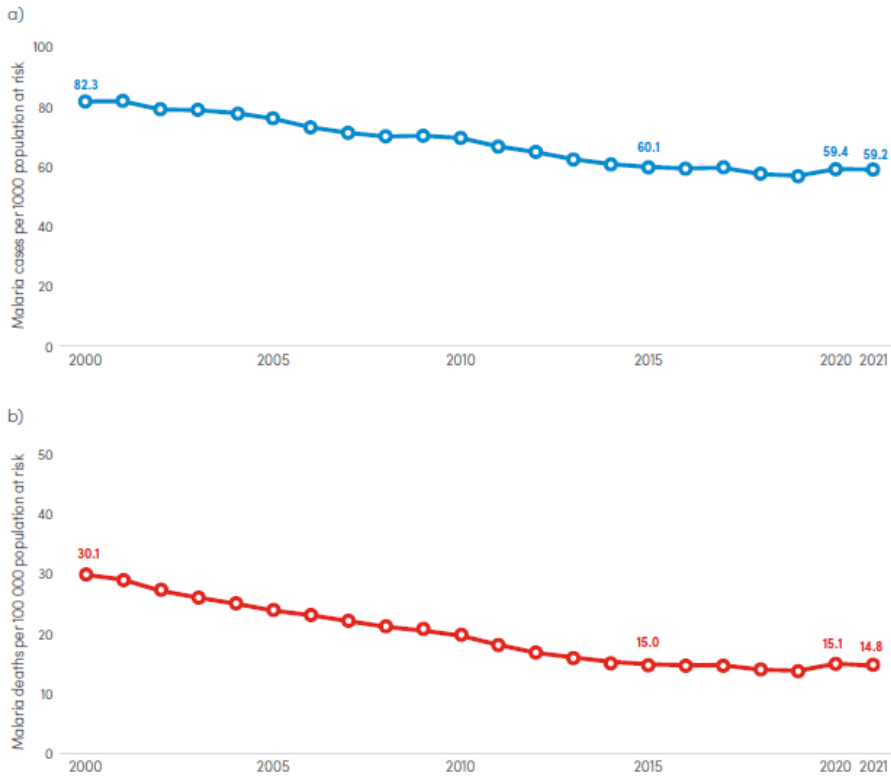
Biological & Other Threats

Disruptions during the COVID-19 pandemic

Disease Burden & Vector Control

- Vector borne diseases account for over **17%** of all infectious diseases globally, **80%** of the population at risk, and causing > **700 000 deaths** annually.
- Integrated vector management (IVM): <https://apps.who.int/iris/handle/10665/44768>
 - IVM is a rational decision-making process for optimal use of resources for efficient, cost-effective and sustainable vector control
- WHO recommended Malaria vector control interventions: <https://apps.who.int/iris/rest/bitstreams/1493946/retrieve>
 - **Core tools** for large-scale deployment:
 - ❑ Insecticide treated nets (ITNs) that are prequalified by WHO; and
 - ❑ Indoor residual spraying (IRS) with a product prequalified by WHO.
 - **Supplementary interventions** for deployment were amenable:
 - ❑ Larval source management - Larviciding & Environmental management
 - ❑ Personal protection
- Global vector control Response (GVCR) <https://apps.who.int/iris/bitstream/handle/10665/259205/9789241512978-eng.pdf>
 - GVCR strengthens vector control through increased capacity, improved surveillance, better coordination and integrated action across sectors and diseases.
- Vector control contributes to current malaria gains: <https://apps.who.int/iris/rest/bitstreams/1484818/retrieve>
 - Malaria endemic countries reduced from 108 in 2000 to 84 in 2021.
 - The number of countries with < 10 indigenous malaria cases increased from 4 in 2000 to 25 in 2021.

Global trends in a) malaria case incidence (cases per 1000 population at risk) and b) mortality rate (deaths per 100 000 population at risk), 2000–2021; and c) distribution of malaria cases and d) deaths by country, 2021 Source: WHO estimates.



WHO: World Health Organization.

<https://www.who.int/teams/global-malaria-programme/reports/world-malaria-report-2022>

Vector Control Products

■ The WHO Global Observatory on Health Research and Development (GOHRD) lists 28 vector control products in the R&D pipeline: <https://www.who.int/data/gho>

- **Eleven (39%) are ITNs** and seven (25%) are indoor residual wall treatments.
- Thirteen (46%) are in the data-generation stage to support assessment of safety, quality and entomological efficacy.
- Seven products (25%) are undergoing epidemiological trials,
- six (21%) are being assessed by WHO to inform prequalification listing or WHO policy recommendation: and
- two (7%) are at the prototype development stage.

■ IVCC vector control products pipeline lists several novel and repurposed insecticides with different modes of action, for use in **ITNs** and **IRS**.

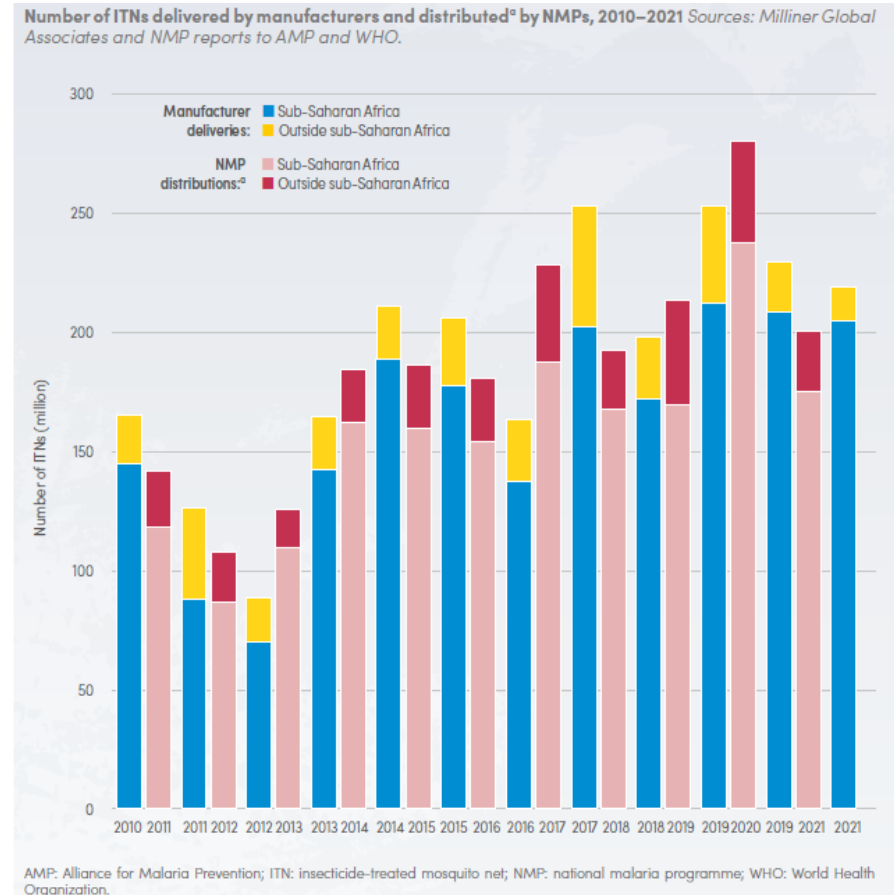
- **IRS:** pirimiphos-methyl (listed by WHOPES in January 2013), clothianidin (prequalified by WHO in 2017) and clothianidin plus deltamethrin (prequalified by WHO in 2018).
 - chlorfenapyr and broflanilide: expected to be listed for prequalification in the near future.
- **ITN: Interceptor® G2, a new ITN, combines a pyrethroid with a repurposed insecticide, chlorfenapyr, which has a different mode of action.**
 - **Three further active ingredients: expected to obtain a prequalification listing between 2026 and 2030.**

■ An expanded vector control toolbox is under development that includes larviciding, lethal house lures (eave tubes) and Attractive Targeted Sugar Bait.

- These tools are integral to managing insecticide resistance and reducing outdoor biting.

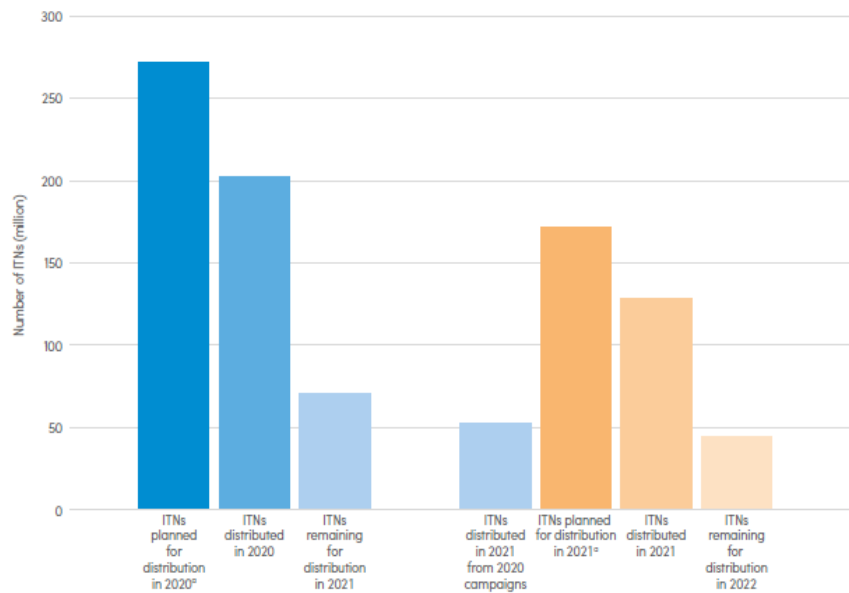
Distribution and Coverage of ITNs

- Between 2004–2021 almost 2.5 billion ITNs were supplied globally.
 - 2.2 billion (87%) to sub-Saharan Africa.
- Of the 220 million ITNs delivered to malaria endemic countries in 2021,
 - 46% were pyrethroid–PBO nets
 - 9% were dual active ingredient ITNs.
- Progress in % of households in sub-Saharan Africa between 2000 and 2021:
 - Households with at least one ITN: 5% - 68%.
 - Owning at least one ITN for every two people: 1% -38%.
 - Access to an ITN within households: 3% -54%
- The % of the population sleeping under an ITN also increased considerably between 2000 and 2021:
 - 2% - 47% for the whole population
 - 3% - 53% for children aged under 5 years
 - 3% - 53% for pregnant women
- Overall, access to and use of ITNs remains below the levels observed in 2017.



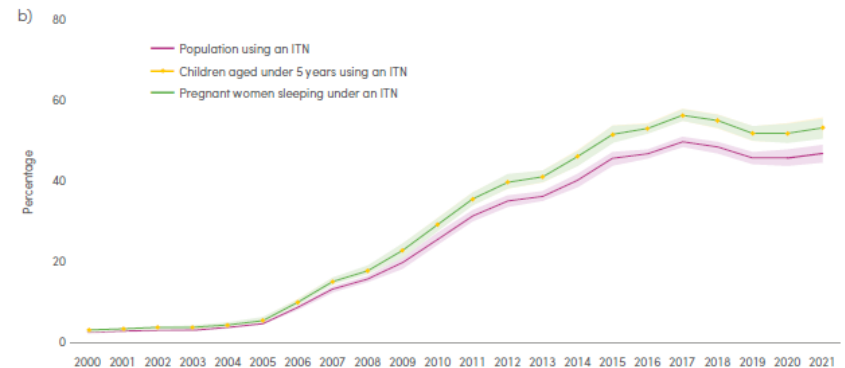
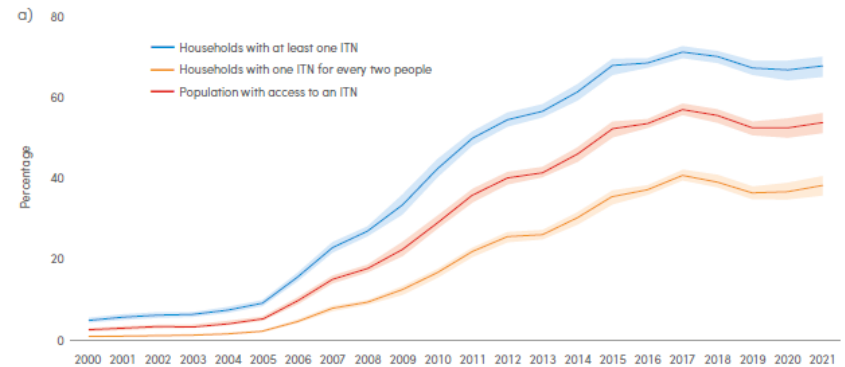
Distribution, Access and Use of ITNs

ITNs planned and distributed during mass campaigns in 52 malaria endemic countries, 2020–2022^a
 Source: AMP, RBM Partnership to End Malaria and NMP reports.



AMP: Alliance for Malaria Prevention; ITN: insecticide-treated mosquito net; NMP: national malaria programme.
^a Mass campaigns were not scheduled in 3 countries in 2020 and 1 country in 2021. Data presented here do not include ITNs distributed through continuous distribution channels.

a) Indicators of population-level access to ITNs, sub-Saharan Africa, 2000–2021 and b) indicators of population-level use of ITNs, sub-Saharan Africa, 2000–2021 Sources: ITN coverage model by Malaria Atlas Project (68, 69).



ITN: insecticide-treated mosquito net.

<https://www.who.int/teams/global-malaria-programme/reports/world-malaria-report-2022>

Biological & Other Threats to ITNs

■ Declines in malaria transmission and burden in the period 2005–2015 are ascribed to ITNs particularly in settings with moderate to high transmission:

- LLINs remain effective and WHO encourages their continued use to prevent malaria.

■ Certain factors that impair effectiveness of LLINs in malaria prevention are important in progress against malaria. These factors include:

- Physical durability of the net (i.e. fabric integrity) and its chemical durability (i.e. bioefficacy),
- Operational and behavioural constraints (i.e. delivery, access, coverage and acceptability, use, maintenance and retention), and
- Vector dynamics (species biting and resting behaviours).

■ Pyrethroid resistance is the most recognized threat to the effectiveness of pyrethroid-based LLINs:

- A WHO multicountry trial (2018): ITNs remained highly protective against malaria, despite high pyrethroid resistance.
- Several experimental hut studies suggest that, as resistance to pyrethroids increases, the repellent and mortality effects on mosquitoes are greatly reduced.
- Modelling analysis further suggests that the epidemiological impact of ITNs is reduced at high levels of pyrethroid resistance.

■ The greater efficacy seen in randomized controlled trials of some of the newer generation of ITNs (compared with pyrethroid-only ITNs):

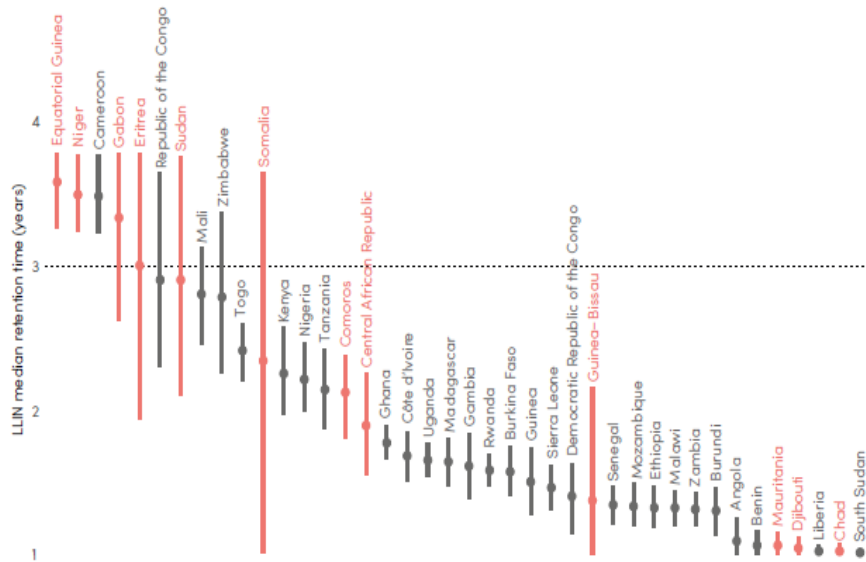
- suggests that insecticide resistance is having an effect on epidemiological outcomes.

■ Improving the effectiveness of ITNs will require:

- Improving the physical durability of LLINs
- Improving allocation efficiency of ITNs
- Improving maintenance and use of ITNs
- Mitigating the impact of widespread insecticide resistance

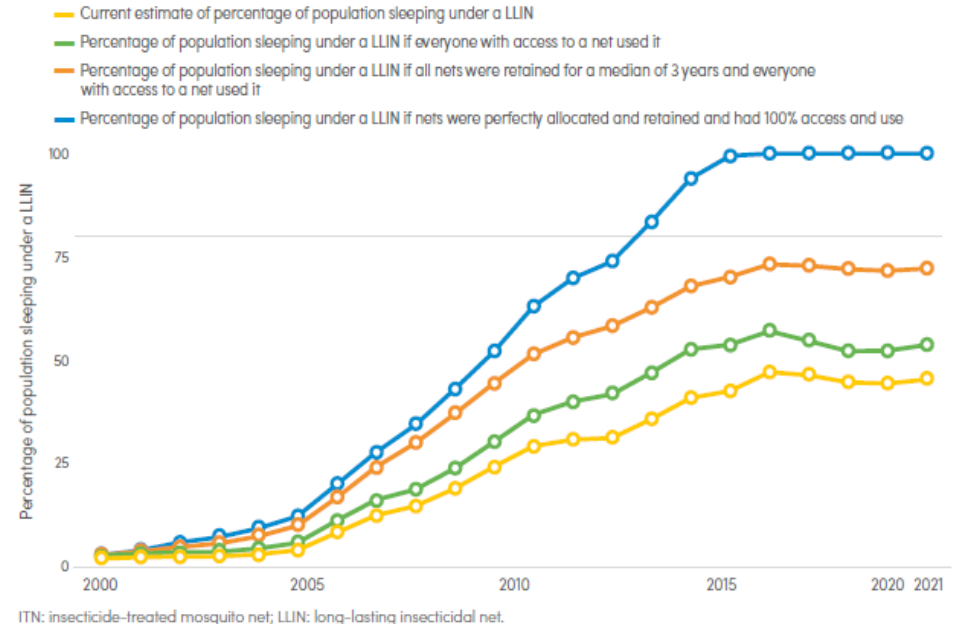
Operational and behavioural constraints

Median LLIN retention time by country, ordered from highest to lowest Dots show mean parameter values, and vertical bars indicate 95% CI width. Countries with fewer surveys have less stable model fits; those having fewer than three surveys are indicated in red. Source: Bertozzi-Villa et al. (2021) (69).



CI: confidence interval; LLIN: long-lasting insecticidal net.

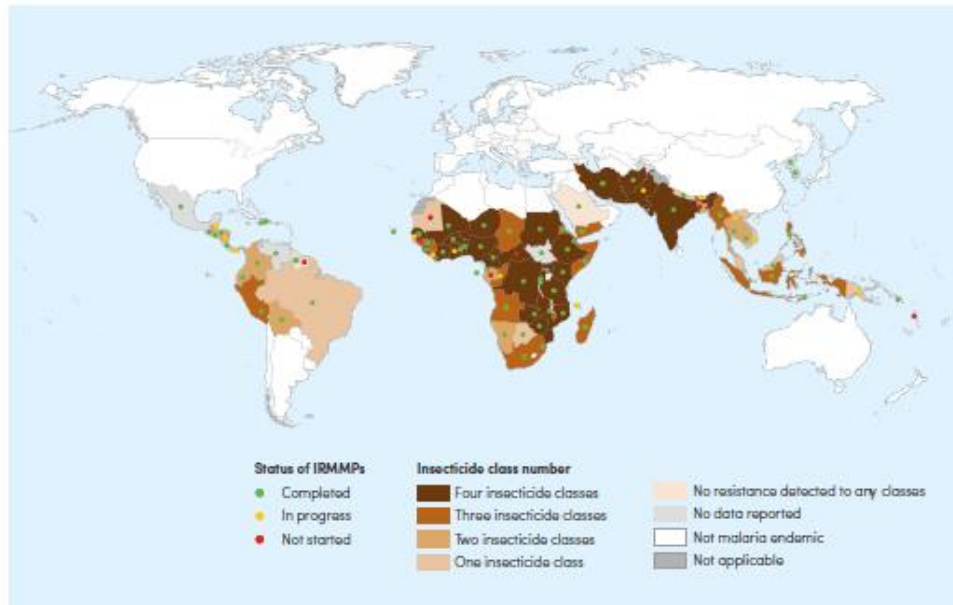
The impact on ITN use of reducing operational and behavioural constraints in sub-Saharan Africa Source: Institute for Disease Modeling and Malaria Atlas Project (68).



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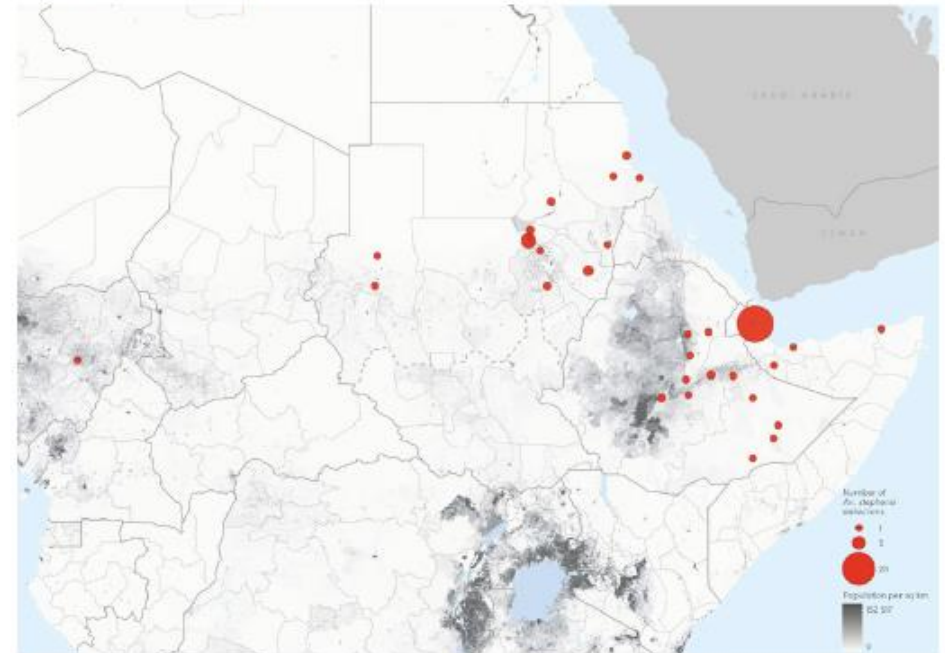
Insecticide resistance & *An. stephensi*

Number of classes to which resistance was confirmed in at least one malaria vector in at least one monitoring site, 2010–2020 Sources: Reports from NMPs and national health institutes, their implementation partners, research institutions and scientific publications.



IRMMP: insecticide resistance monitoring and management plan; NMP: national malaria programme.

Detections of *An. stephensi* in the Horn of Africa and Nigeria, reported to WHO (2012–2021) Sources: Reports from NMPs and national health institutes, their implementation partners, research institutions, scientific publications and WorldPop (73, 98).



An. stephensi: *Anopheles stephensi*; NMP: national malaria programme; WHO: World Health Organization.

<https://www.who.int/teams/global-malaria-programme/reports/world-malaria-report-2022>

Implications for overall ITN effectiveness

FIG. 9.9.

Sequential decomposition of LLIN effectiveness over 3 years (modelling pyrethroid-only ITNs; further details explaining different scenarios are provided in Table 9.1) Sources: *Institute for Disease Modeling and Malaria Atlas Project (68)*.

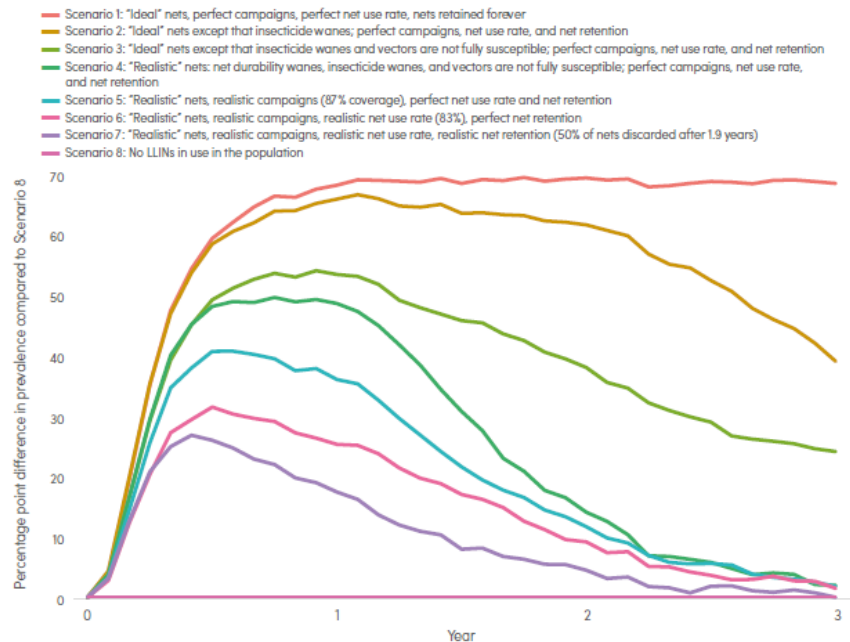


TABLE 9.1.

Descriptions of scenarios presented in Fig. 9.9^a Sources: *Institute for Disease Modeling and Malaria Atlas Project (68)*.

	Full details
Scenario 1	60% mosquito killing without waning; 90% net physical durability without waning; 100% coverage; 100% use rate; nets never discarded before 3 years
Scenario 2	60% mosquito killing with waning (3-year half-life); 90% net physical durability without waning; 100% coverage; 100% use rate; nets never discarded before 3 years
Scenario 3	42% mosquito killing with waning (3-year half-life); 90% net physical durability without waning; 100% coverage; 100% use rate; nets never discarded before 3 years
Scenario 4	42% mosquito killing with waning (3-year half-life); 90% net physical durability with waning (decline by 10% after year 1, 50% after year 2, 80% after year 3); 100% coverage; 100% use rate; nets never discarded before 3 years
Scenario 5	42% mosquito killing with waning (3-year half-life); 90% net physical durability with waning (decline by 10% after year 1, 50% after year 2, 80% after year 3); 87% coverage; 100% use rate; nets never discarded
Scenario 6	42% mosquito killing with waning (3-year half-life); 90% net physical durability with waning (decline by 10% after year 1, 50% after year 2, 80% after year 3); 87% coverage; 83% use rate; nets never discarded before 3 years
Scenario 7	42% mosquito killing with waning (3-year half-life); 90% net physical durability with waning (decline by 10% after year 1, 50% after year 2, 80% after year 3); 87% coverage; 83% use rate; nets discarded with a 1.9-year median retention time
Scenario 8	No LLINs in use in the population

LLIN: long-lasting insecticidal net.

^a The term "net physical durability" refers to the probability of a mosquito not breaching a net after landing on it. "Killing" refers to the probability of death for a mosquito that lands on a net.

<https://www.who.int/teams/global-malaria-programme/reports/world-malaria-report-2022>

Disruptions during the COVID-19 pandemic

- Between 2019 and 2021, about 13.4 million cases and 63 000 deaths attributed to disruptions to essential malaria services during the COVID-19 pandemic.

- Forty-six countries distributed 74% of 272 million ITN planned for distribution during the 2020 campaigns.

- In 2021, a total of 128 million (75%) ITNs were distributed in 43 countries that planned campaigns to distribute 171 million ITNs, with 70 million carried over from 2020 in 14 countries:
 - Eight countries – Benin, Eritrea, Indonesia, Nigeria, Solomon Islands, Thailand, Uganda and Vanuatu – had distributed less than 60% of their ITNs.
 - Seven countries – Botswana, the Central African Republic, Chad, Haiti, India, Pakistan and Sierra Leone – did not distribute any of the planned ITNs.
 - India, Nigeria and Uganda had distributed 0%, 53% and 26%, of ITNs planned for distribution in 2021.



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Thank You