Net-Target Project

Rapid Scoping to Delineate Priority Areas for ITN Distribution and Gap Analysis

Report 2: Nigeria

Malaria Consortium

18 September 2020

Background

Project context

Several Sub-Saharan African countries have faced challenges in implementing campaign distribution of insecticide-treated nets (ITNs) due to delays caused by COVID-19 and resource shortages. There is a risk of increased malaria transmission and incidence of cases as focus is shifted to deal with the COVID-19.

In this project, we propose to implement emergency actions to ensure that populations with greatest needs get ITNs while appropriate safety measures are put in place to prevent COVID-19 transmission. We also propose longer-term measures to improve evidence-based targeting of ITN distribution campaigns using customized technological solutions. The first phase of this project aims to identify areas that require a special attention for ITN distribution in the context of the COVID-19 pandemic and estimate gaps in resources.

In Report 1, we carried out prioritization mapping of districts in Uganda for ITN distribution and estimated resource gaps. The report has been shared with the National Malaria Control Department. In this report, we present findings from our analysis of information gathered from Nigeria and recommend local government areas (LGAs) and states that need to be prioritized for ITN distribution. We will also estimate ITN gaps after exploring the funding landscape.

Geography and population

Nigeria is divided into 36 states and a Federal Capital Territory (FCT), which are further sub-divided into 774 LGAs. In some contexts, these states are aggregated into six geopolitical zones: North West, North East, North Central, South East, South South, and South West. The geographic composition of the country features mangrove swamps and tropical rainforest, as well as open woodland and a variety of savannah environments.

Nigeria's estimated population projection for 2021 is 226.6 million. Forty-six percent of the population are below 15 years old. The average household size is 4.7 persons. Urban households are slightly smaller than rural households (4.3 persons versus 5.0 persons).

Malaria situation

Approximately 57 million malaria cases and nearly 100,000 malaria-related deaths occurred in Nigeria in 2018, accounting for 25% of the world's malaria burden that year [2]. The most recent Demographic and Health Survey (DHS) in 2018 reported a 23% national average malaria prevalence among children age 6-59 months [1]. This rate varied substantially among different states; for example, prevalence was 2% in Lagos and 52% in Kebbi (Figure 1). The highest prevalence occurred mostly in the North West Region. The malaria

transmission season is longer in the southern parts of the country compared with the northern parts where it lasts only for a few months.

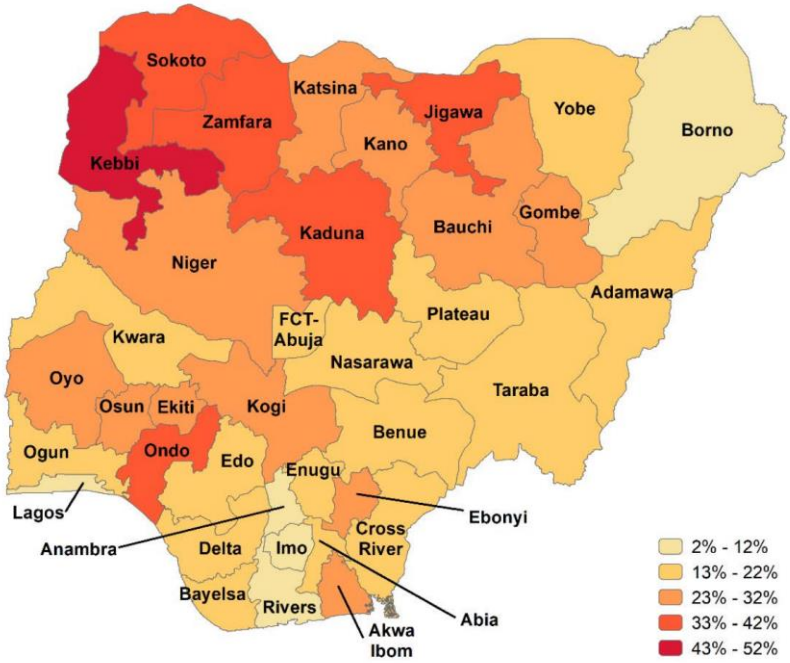


Figure 1. Percentage of children 6–59 months who tested positive for malaria by microscopy based on DHS 2018 report [1].

COVID-19 situation

According to the Nigerian Centers for Disease Control (NCDC), as of 28 August 2020, a total of 53,317 laboratory-confirmed COVID-19 cases have been reported across all states in the country, 11,580 of which were active. Lagos state experienced the highest reported proportion of cases (33.9% of all reported cases) followed by FCT (9.4% of all reported cases). Both of these areas experience high population density and movement.

Internally displaced populations

It was estimated that a total of 5,365,606 persons were internally displaced or categorized as high-risk populations (HRP) due to disruptive events, such as armed conflict in 2019. HRPs are localized to 58 LGAs in northern Nigeria (i.e. 19, 24 and 15 LGAs in Adamawa, Borno and Yobe states, respectively).

ITN distribution

The ITN strategy has been implemented in Nigeria since 2008 aiming to increase population access to and use of ITNs through mass distribution campaigns. The country's strategy is to use a mixed model approach to achieve and maintain ITN ownership and use targets. The mixed model includes a rapid large-scale distribution through state-wide mass campaigns, and continuous distribution of nets through a variety of channels to ensure coverage is maintained. Although a number of ITN distribution campaigns have been implemented over the past decade, the coverage level remains low in some areas and varies greatly between states. Resource constraint is the main challenge as large number of ITNs are required to cover the country, which is the most populous in Africa. ITN campaigns have not been implemented for nine years in five states and six years in three states.

Methods

We worked with consultants from Tulane University School of Public Health and Tropical Medicine and Malaria Consortium (MC) technical staff to develop this report. The approach we adopted here is to use a simple algorithm for characterizing and ranking LGAs and states based on drivers of malaria transmission in Nigeria's context. This section outlines the methods used to analyze the information and generate the prioritization maps, estimation of gaps, and assessment of ITN campaign funding situations in the country.

Qualitative methods

A range of government documents and data, donor operational plans, ITN campaign implementation plans and gap analysis data, information on budgets and funding gaps, epidemiological reports, and COVID-19 situations reports were assessed. In-depth interviews were also conducted with key informants, specifically the National Malaria Elimination Programme (NMEP) Coordinator, NMEP's Integrated Vector Management Branch Director, and MC Nigeria Country Director and MC Nigeria Country Technical Coordinator.

Quantitative methods

We used a mapping approach that makes use of risk factors to prioritize areas in the country, including climatic or environmental determinants of transmission (rainfall, temperature, urbanization), reported COVID-19 cases, number of years since last ITN campaign in each state, type of ITNs distributed, ITN coverage estimates, implementation of seasonal malaria chemoprevention (SMC), and presence of internally displaced populations. The basis of our methodology comes from work published by Hanafi-Bojd and colleagues in 2012 [3] where a similar approach was used for risk mapping. We adapted and refined this approach to use in Nigeria's context.

Data sources

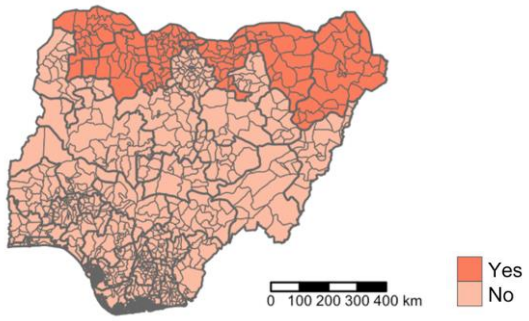
Nine input factors were used to develop prioritization maps by LGA and state: (a) implementation of SMC in 2019, (b) presence of internally displaced populations, (c) number of years since last ITN campaign, (d) ITN coverage, (e) COVID-19 case counts as of 28 August 2020, (f) built-up area presence (proxy to urbanization), (g) estimated annual rainfall during May 2019 – April 2020, (h) suitability of temperature for *Plasmodium falciparum* transmission, and (i) distribution of piperonyl butoxide (PBO) ITNs in 2019 (Figure 2).

Monthly rainfall data (for May 2019 – April 2020) was sourced from Climate Hazards Group InfraRed Precipitation with Station (CHIRPS) data. A temperature suitability index for *P. falciparum* transmission was obtained from the Malaria Atlas Project outputs for Nigeria. ITN distribution history data was provided by the NMEP. Global Human Settlement Layer (GHSL) project data which was based on satellite imagery was used to produce fine-scale maps quantifying built-up structures, which provided a proxy for classifying rural and urban regions. ITN coverage (i.e. the proportion of households with at least one ITN per two de facto household population) data from the 2018 DHS was used for spatial interpolation to calculate estimates of ITN coverage for the entire country at a 5x5km pixel level, the values of which were subsequently aggregated to LGA levels.

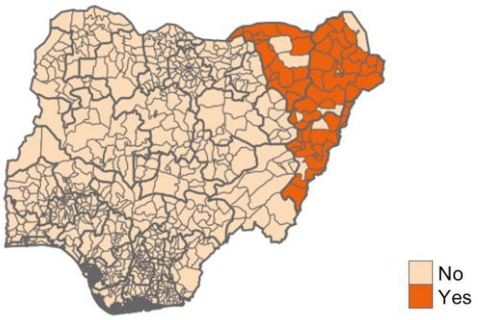
Prioritization mapping approach

A geographic information system (GIS) based weighted approach was used to categorize and rank LGAs based on malaria risk. A range of indicators, referred to here as factors, were calculated and used as primary inputs in generating malaria risk scores. Factors were used to identify LGAs that are at high risk of malaria transmission based on intervention coverage and social and biological susceptibility factors. Distribution of LGA-specific values were used to inform classification and assignment of a rank value, typically on a scale of 1 to 4.

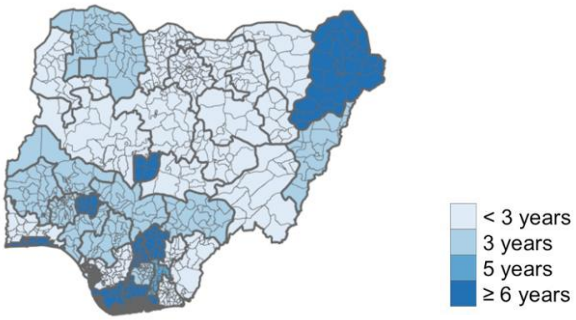
a. LGAs covered with SMC in 2019



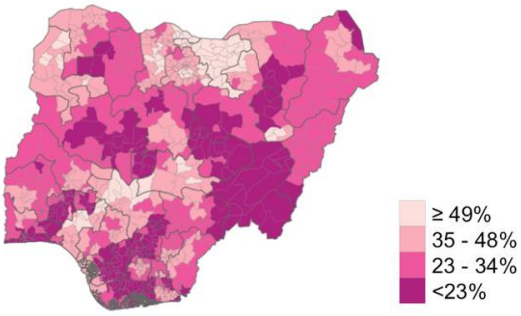
b. Internally displaced populations



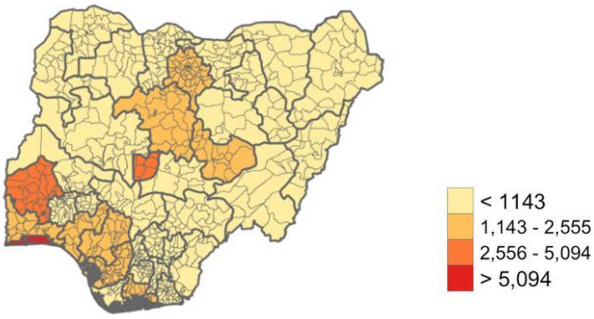
c. Years since last ITN distribution



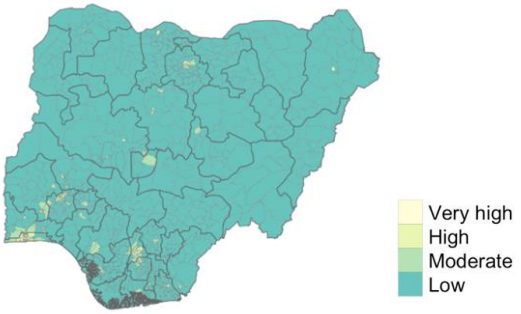
d. ITN coverage



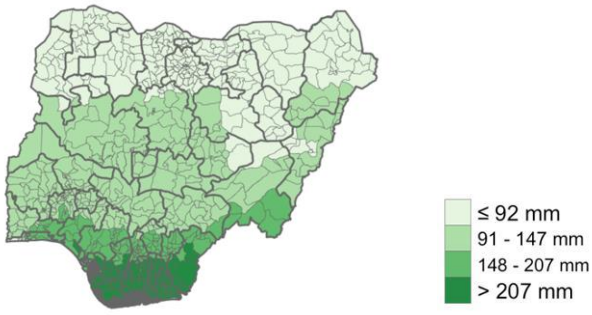
e. COVID-19 case counts as of 28 Aug 2020



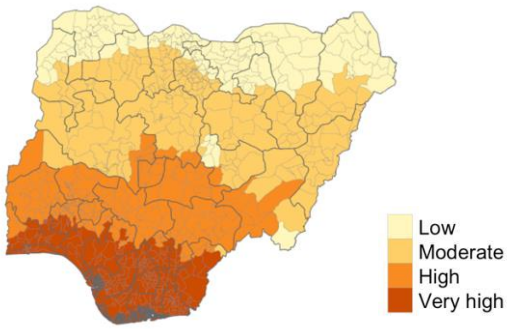
f. Built-up area presence (urbanization)



g. Mean annual rainfall (mm)



h. Temperature suitability for transmission



i. PBO ITNs distributed in 2019

Figure 2. Patterns of input factors used for prioritization mapping

Values for each LGA were then multiplied by a factor-specific weight. Factor-specific weights were assigned using responses derived from a technical input questionnaire distributed among malaria experts at Tulane University's School of Public Health and Tropical Medicine to quantify the importance of each factor in characterizing malaria risk. Respondents were asked to assign a value, on a scale of 0 to 10 (10 being extremely important) to each factor. The mean of each factor-specific value was calculated and translated into a weight (Table 1). Values for each factor were added to generate a final malaria risk score for each LGA which was then used to develop LGA and state level ITN campaign prioritization maps.

Table 1. Factors, weights, classification and ranks used to characterize malaria risk and identify priority areas

Factor	Survey rating	Standard weight	Classification	Rank value	Risk characterization
Annual rainfall during May 2019 – April 2020 (mm)	7.75	0.78	>207mm	4	Very high
			148–207mm	3	High
			92–147mm	2	Moderate
			<92mm	1	Low
Temperature suitability index for *P. falciparum* transmission	5.75	0.58	<0.453		Low
			0.453–0.570		Moderately low
			0.571–0.679		Moderately high
			>0.679		High
PBO ITNs in 2019	-	0.53	Yes	0	Low
			No	1	High
COVID-19 cases reported as of 28 August 2020	2.75	0.28	<1,143	1	Low
			1,143–2,555	2	Moderate
			2,556–5,094	3	High
			>5,094	4	Very high
Number of years since last ITN campaign distribution	7.50	0.75	≥6 years	4	Very high
			5 years	3	High
			3 years	2	Moderate
			<3 years	1	Low
ITN coverage (% households with at least 1 ITN for 2 people)	7.50	0.75	<35%	4	High
			35-49%	3	Moderately high
			50–67%	2	Moderately low
			>67%	1	Low
SMC implementation in 2019	8.20	0.82	Not implemented	1	Present
			Implemented	0	Not present
Built up area presence index (proxy for urban/rural designation)	5.40	0.54	≤ 0.0085	4	Very high
			$0.051 \geq x > 0.0085$	3	High
			$0.76 \geq x > 0.051$	2	Moderate
			> 0.76	1	Low
Internally displaced populations	4.00	0.40	1	1	Present
			0	0	Not present

Results

Prioritization map

Each LGA in the country was assigned a malaria risk category (1–6) based on the weighted scores calculated using the nine input factors to produce LGA level prioritization map (Figure 3). A state level prioritization map was also developed by taking the mean weighted malaria risk scores[1] of all LGAs per state (Figure 4). The maps indicate that southern parts of the country require higher priority for ITN distribution.

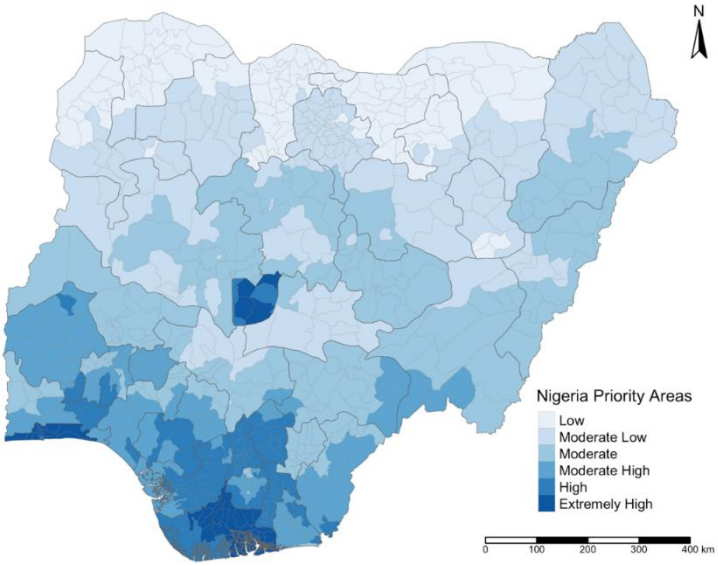


Figure 3. LGA-level ITN prioritization map.

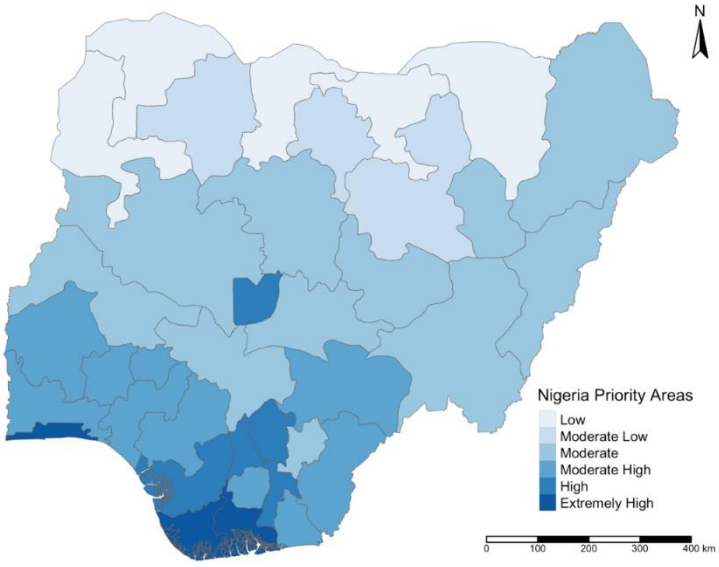


Figure 4. State-level ITN prioritization map.

[1] The mean weighted malaria risk score for each state was calculated by taking the mean prioritization score of every LGA in the state multiplied by a population weight (0.000001 multiplied by the population density of that state).

Funding landscape for ITNs

The main funders of vector control in Nigeria (which relies on ITN distribution) are Global Fund and the U.S. President's Malaria Initiative (PMI). For example, during the fiscal year 2019–2020, Global Fund and PMI allocated US$42.7m and US$9.4m for vector control, respectively [4]. Out of these, their annual budgets for the procurement and mass distribution of ITNs amounted to US$26.3m and US$8.2m, respectively. Global Fund allocated an additional US$9.0 million for procurement of ITNs for continuous distribution. These two donors support 13 and 11 states, respectively.

The remaining 13 states are supposed to be supported by the Government of Nigeria (GoN) through loans from World Bank (WB), Islamic Development Bank (IsDB) and Africa Development Bank (ADB). These loans have not been made available yet and therefore most of these states have not received ITN campaigns for several years (Figure 5).

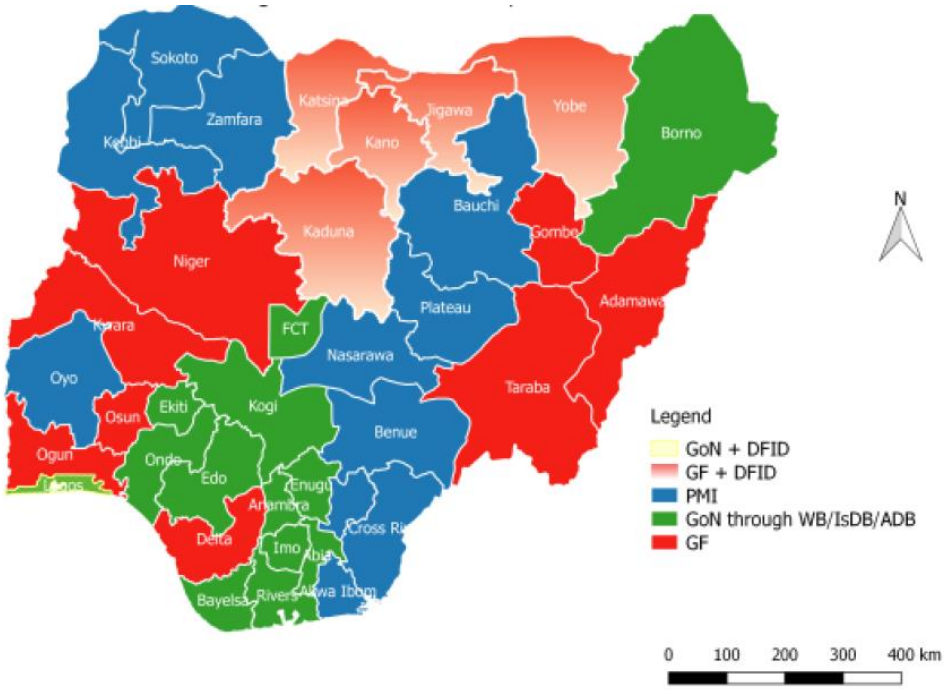


Figure 5. Malaria donor-supported states [4].

Malaria prevalence rates obtained from DHS 2018 and previous surveys have been used to prioritize the states (at least in the case of Global Fund support). In Figure 6 (a), prevalence rates for the 13 states with no donor support so far were represented by red bars. Although prevalence rates in most of these states were relatively lower than the other states supported by Global Fund and PMI, some states such as Ondo, Ekiti, Kogi and FCT still had high malaria prevalence. As shown in Figure 6 (b), ITN campaigns have not been implemented for six years and longer in nine of the 13 states, which is believed to have resulted in increased malaria prevalence in the states. The malaria risk categories for each state are superimposed as dots in Figure 6 (b), indicating that most states with high malaria risk categories are those without existing donor support. The majority of these states are located in the southern parts of the country although some are located in the northern and central parts (FCT, Kogi and Borno).

Discussions with Dr Audu Baba Mohammed, NMEP Director/National Coordinator, revealed that WB and IsDB are likely to provide support (after November 2020) to 11 of the 13 states for campaigns. The negotiations of GoN with these two banks have reached an advanced

stage as the Federal Executive Council has signed the loan agreement. The project appraisal, project implementation manual and plan and procurement plan have been all developed. The government and the two banks are in the process of finalizing the legal agreement (with Ministry of Justice taking the lead), and the financial agreement (with Ministry of Finance taking the lead), expected to be completed in the next two months.

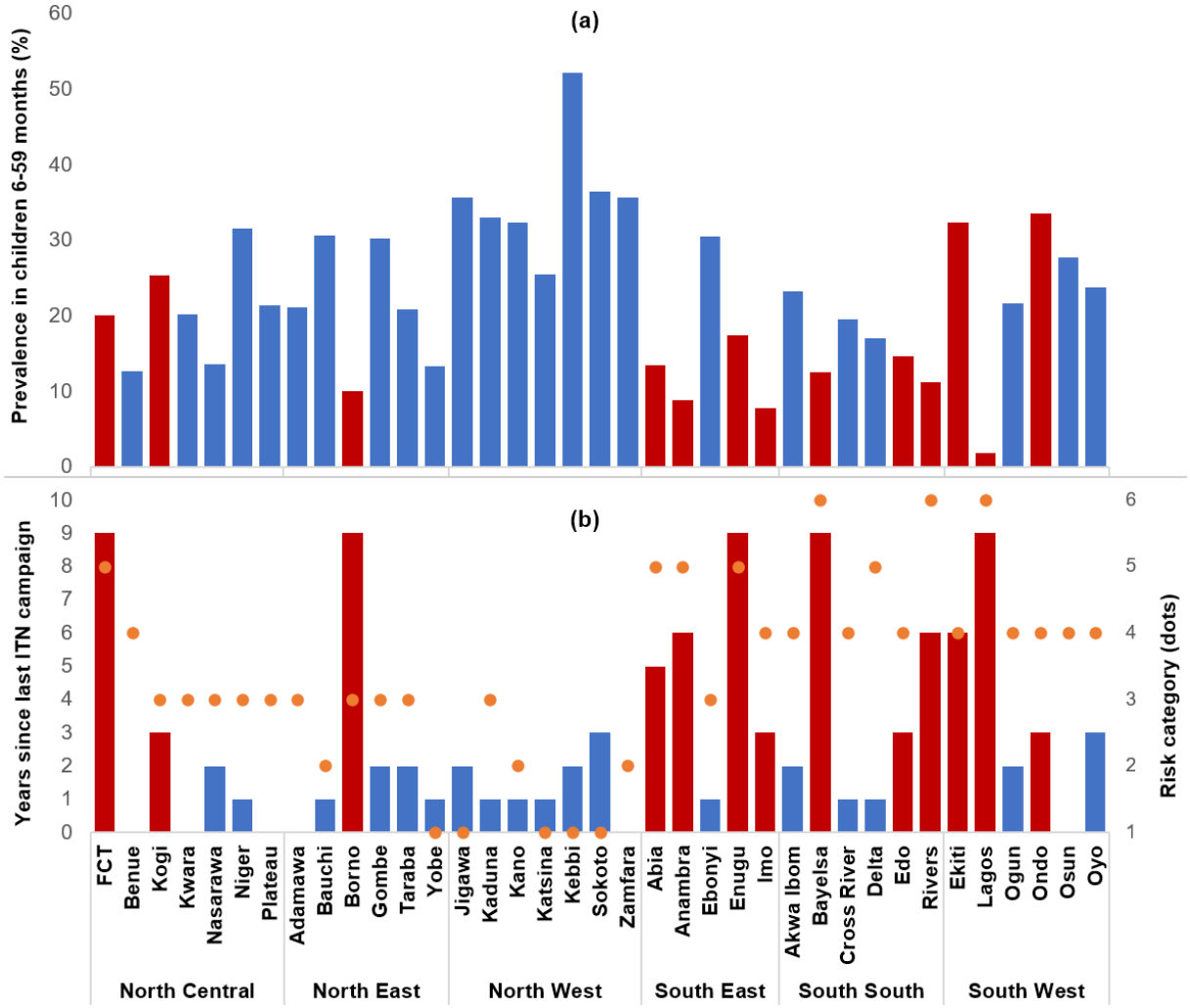


Figure 6. (a) Malaria prevalence in children 6–59 months according to microscopy as reported by DHS 2018 [1]. (b) Number of years since last ITN campaign and malaria risk categories from the prioritization mapping for each state. Red bars indicate states not supported by Global Fund or PMI.

After these agreements are finalized, the Federal Government will then sign subsidiary agreements with the participating state governments. It is estimated that all these will be concluded in November 2020 and implementation commenced in 2021. The fund agreements will be for three years with a potential for extension for additional two years.

However, NMEP is yet to hear back from ADB that is expected to provide funds for ITN campaigns in Anambra and Ondo states. After several engagements with the bank, the Board of ADB has not approved the credit to cover these two states. The only option left to the NMEP at this stage is to look for funding elsewhere for ITN intervention.

The ITN campaign in Lagos will be targeted as only specific parts of the state will be covered, while campaigns in other states will be statewide.

Table 2. ITN gaps based on campaign funding landscape analysis.

Region	State	Campaign ITNs required	Year of last campaign	Planned year of campaign	Source of fund	Donor support available for 2021 campaign	Gap (no. of ITNs)
North Central	FCT	2,706,177	2011	2021	IsDB	Yes	
	Benue	4,261,747	2020	2024	PMI	n/a	
	Kogi	2,880,986	2017	2021	IsDB	Yes	
	Kwara	2,394,974	2020	2023	GF	n/a	
	Nasarawa	1,827,228	2018	2022	PMI	n/a	
	Niger	4,121,670	2019	2022	GF	n/a	
	Plateau	3,055,406	2020	2024	PMI	n/a	
North East	Adamawa	3,147,607	2020	2023	GF	n/a	
	Bauchi	5,045,300	2019	2023	PMI	n/a	
	Borno	3,745,776	2011	2021	WB	Yes	
	Gombe	2,307,277	2018	2021	GF	Yes	
	Taraba	2,158,825	2018	2021	GF	Yes	
	Yobe	2,460,093	2019	2022	GF	n/a	
North West	Jigawa	4,080,423	2018	2021	GF	Yes	
	Kaduna	5,949,198	2019	2022	GF	n/a	
	Kano	9,640,479	2019	2022	GF	n/a	
	Katsina	5,680,514	2019	2022	GF	n/a	
	Kebbi	3,128,681	2018	2021	PMI	Yes	
	Sokoto	3,519,880	2017	2021	PMI	Yes	
	Zamfara	3,403,080	2020	2024	PMI	n/a	
South East	Abia	2,317,377	2015	2021	WB	Yes	
	Anambra	3,419,940	2014	2021	ADB	**No**	**3,419,940**
	Ebonyi	2,124,041	2019	2023	PMI	n/a	
	Enugu	2,746,054	2011	2021	IsDB	Yes	
	Imo	3,386,704	2017	2021	WB	Yes	
South South	Akwa Ibom	4,090,326	2018	2022	PMI	n/a	
	Bayelsa	1,416,854	2011	2021	IsDB	Yes	
	Cross River	2,870,278	2019	2023	PMI	n/a	
	Delta	4,145,803	2019	2022	GF	n/a	
	Edo	2,710,264	2017	2021	IsDB	Yes	
	Rivers	4,775,971	2014	2021	WB	Yes	
South West	Ekiti	2,046,261	2014	2021	WB	Yes	
	Lagos	9,409,578	2011	2021	WB	Yes*	
	Ogun	3,830,122	2018	2021	GF	Yes	
	Ondo	2,912,226	2017	2021	ADB	**No**	**2,912,226**
	Osun	3,573,962	2020	2023	GF	n/a	
	Oyo	6,032,601	2017	2021	PMI	Yes	
Total ITN gap							**6,332,166**

* Funding for Lagos is available for selected areas of the state.

Based on this funding landscape analysis, there will be a gap of **6.3 million ITNs** for Anambra and Ondo states, which will not be filled in 2021 (Table 2). Assuming a cost of US$3 per ITN; US$1 for transportation, insurance, warehousing, and quality assurance; and US$1 for distribution, we estimate that **US$31.7 million** will be required to cover the two states.

However, if funding by WB and/or IsDB will not materialize in time for the 2021 campaigns, there will be far more ITN gaps in various unsupported states. Based on the prioritization mapping, 100 LGAs with extremely high or high priorities in the other states have been identified and listed in Annex 1 in case the WB and IsDB loans will not be available and if only parts of the states with no support are to be targeted as an emergency measure. Approximately 25 million ITNs will be needed for these LGAs. The list excludes the priority states of Anambra and Ondo that will not get the expected support from ADB and therefore have been treated separately as special cases above.

Conclusion

As a result of this analysis, Malaria Consortium strongly believes that a funding gap of US$31.7 million remains for procurement and distribution of approximately 6.3 million ITNs in 2021 in Anambra and Ondo States with no expected donor support[2].

Acknowledgements

Several Malaria Consortium staff and consultants contributed to this work. The work was coordinated by Dr Tarekegn Abeku and Dr James Tibenderana. Dr Maxwell Kolawole and Dr Olusola Oresanya provided technical advice and country-specific information and data for Nigeria. Charles Nelson and Maddy Marasciulo provided management oversight and technical advice. Dr Audu Bala Mohammed and Mr Okefu Oyale Okoko provided advice and up-to-date information on the ITN campaign. Alyssa Young, Will Eaton and Honelgn Nahusenay Hiruy worked as consultants and prepared technical reports and risk maps used to develop this report. Louise Cook provided administrative support. This activity was funded by GiveWell.

References

1. National Population Commission (NPC), ICF: **Nigeria Demographic and Health Survey 2018.** Abuja, Nigeria, and Rockville, Maryland, USA: NPC and ICF; 2019.
2. WHO: **World Malaria Report 2019.** Geneva: World Health Organization; 2019.
3. Hanafi-Bojd AA, Vatandoost H, Oshaghi MA, Charrahy Z, Haghdoost AA, Zamani G, Abedi F, Sedaghat MM, Soltani M, Shahi M, Raeisi A: **Spatial analysis and mapping of malaria risk in an endemic area, south of Iran: a GIS based decision making for planning of control.** *Acta Trop* 2012, **122:**132-137.
4. PMI: **U.S. President's Malaria Initiative National Malaria Operational Plan FY 2020.** 2020.

[2] This is assuming that other 11 states with no support so far will be covered by loans from WB and IsDB. If that does not materialize, another 25 million ITNs will be required to cover prioritized LGAs within those states.

Annex 1. LGAs* to be prioritized in case of no support from WB and IsDB loans

*Note: This list does not include priority LGAs in Anambra and Ondo states for which no support is expected and therefore these two states have been separately considered to be given the highest priority for support (see Conclusion).

State	LGA	Prioritization level	Donor support expected
Bayelsa	Kolokuma/Opokuma	Extremely high	IsDB
Bayelsa	Ogbia	Extremely high	IsDB
Bayelsa	Sagbama	Extremely high	IsDB
Bayelsa	Yenegoa	Extremely high	IsDB
Federal Capital Territory	Bwari	Extremely high	IsDB
Federal Capital Territory	Gwagwala	Extremely high	IsDB
Federal Capital Territory	Kuje	Extremely high	IsDB
Federal Capital Territory	Kwali	Extremely high	IsDB
Lagos	Agege	Extremely high	WB
Lagos	Ajeromi/Ifelodun	Extremely high	WB
Lagos	Alimosho	Extremely high	WB
Lagos	Ifako/Ijaye	Extremely high	WB
Lagos	Ikeja	Extremely high	WB
Lagos	Mushin	Extremely high	WB
Lagos	Oshodi/Isolo	Extremely high	WB
Lagos	Surulere	Extremely high	WB
Lagos	Badagary	Extremely high	WB
Lagos	Amuwo Odofin	Extremely high	WB
Lagos	Eti-Osa	Extremely high	WB
Lagos	Ojo	Extremely high	WB
Lagos	Mainland	Extremely high	WB
Lagos	Shomolu	Extremely high	WB
Lagos	Ikorodu	Extremely high	WB
Lagos	Kosofe	Extremely high	WB
Lagos	Ibeju/Lekki	Extremely high	WB
Lagos	LagosIsland	Extremely high	WB
Lagos	Epe	Extremely high	WB
Rivers	Opobo/Nkoro	Extremely high	WB
Rivers	Obio/Akp	Extremely high	WB
Rivers	Port Harcourt	Extremely high	WB
Rivers	Abua/Odu	Extremely high	WB
Rivers	Ahoada East	Extremely high	WB
Rivers	Ahoada West	Extremely high	WB
Rivers	Akukutor	Extremely high	WB
Rivers	Andoni/O	Extremely high	WB
Rivers	Asari-To	Extremely high	WB
Rivers	Bonny	Extremely high	WB
Rivers	Degema	Extremely high	WB
Rivers	Eleme	Extremely high	WB
Rivers	Emuoha	Extremely high	WB
Rivers	Etche	Extremely high	WB
Rivers	Gokana	Extremely high	WB
Rivers	Ikwerre	Extremely high	WB
Rivers	Khana	Extremely high	WB
Rivers	Ogba/Egbe	Extremely high	WB
Rivers	Ogu/Bolo	Extremely high	WB

Rivers	Okrika	Extremely high	WB
Rivers	Omumma	Extremely high	WB
Rivers	Oyigbo	Extremely high	WB
Rivers	Tai	Extremely high	WB
Abia	Ikwuano	High	WB
Abia	Aba North	High	WB
Abia	Aba South	High	WB
Abia	Umu-Nneochi	High	WB
Abia	Arochukw	High	WB
Abia	Bende	High	WB
Abia	Isiala Ngwa North	High	WB
Abia	Isuikwua	High	WB
Abia	Ohafia Abia	High	WB
Abia	Umuahia North	High	WB
Abia	Umuahia South	High	WB
Abia	Isiala Ngwa South	High	WB
Abia	Oboma Ngwa	High	WB
Abia	Osisioma Ngwa	High	WB
Abia	Ugwunagbo	High	WB
Abia	Ukwa East	High	WB
Abia	Ukwa West	High	WB
Bayelsa	Ekeremor	High	IsDB
Bayelsa	Brass	High	IsDB
Bayelsa	Nembe	High	IsDB
Bayelsa	Southern Ijaw	High	IsDB
Edo	OviaNort	High	IsDB
Edo	Uhunmwonde	High	IsDB
Edo	Orhionmw	High	IsDB
Enugu	Uzo-Uwani	High	IsDB
Enugu	Igbo-Eti	High	IsDB
Enugu	Isi-Uzo	High	IsDB
Enugu	Aninri	High	IsDB
Enugu	Nkanu East	High	IsDB
Enugu	Enugu North	High	IsDB
Enugu	EnuguSou	High	IsDB
Enugu	Awgu	High	IsDB
Enugu	Enugu East	High	IsDB
Enugu	Ezeagu	High	IsDB
Enugu	Nkanu West	High	IsDB
Enugu	Oji-River	High	IsDB
Enugu	Udi	High	IsDB
Federal Capital Territory	Abaji	High	IsDB
Federal Capital Territory	AbujaMun	High	IsDB
Imo	Aboh-Mba	High	WB
Imo	Ahizu-Mb	High	WB
Imo	Ezinihit	High	WB
Imo	Ideato South	High	WB
Imo	Ihitte/U	High	WB
Imo	Ngor-Okp	High	WB
Imo	Obowo	High	WB
Imo	Ohaji/Eg	High	WB
Imo	Okigwe	High	WB
Imo	Unuimo	High	WB
Lagos	Apapa	High	WB

Annex 2. Details of NMEP officials contacted

Name	Position	Organization and address	Email
Dr Audu Bala Mohammed	Director/National Coordinator	National Malaria Elimination Programme (NMEP), Public Health Department, Federal Ministry of Health, Abuja, Nigeria	[redacted]
Mr Okefu Oyale Okoko	Assistant Director, Integrated Vector Management Branch	NMEP	[redacted]