



Long-lasting Insecticidal Nets: Supply Update

UNICEF Supply Division

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Long-lasting Insecticidal Nets - Supply Update March 2020

This update reports on UNICEF's historical and projected long-lasting insecticidal nets supply, demand, and market developments. UNICEF launched its last tender in 2018, concluding with long-term arrangements for 2019-2020 to ten suppliers with products now listed under the World Health Organization's prequalification team for vector control.

1. Summary

- Long-lasting insecticidal net (LLIN) procurement volumes can vary substantially from year-to-year in accordance with country requirements.¹ In general, countries procure new and replacement LLINs for distribution in mass campaigns on a two- to three-year cycle. In 2017 and 2018, UNICEF procured 23 and 13 million nets respectively on behalf of approximately 30 countries, compared to 41.3 million nets in 2016. UNICEF procured 47.4 million nets in 2019 and anticipates procuring an estimated 25 million nets in 2020.
- Overall aggregate supply remains stable. UNICEF estimates the total global LLIN production capacity to be 400 million nets annually, against global LLIN deliveries reaching approximately 250 million in 2019, representing over half of the reported requirements.
- The weighted average price (WAP) for LLINs secured through UNICEF continues to decline, having decreased by more than 55 per cent over the past eight years from USD 4.20 in 2011 to reach USD 1.88 in 2019, realizing further cost savings for country programmes and partners.
- UNICEF concluded its last LLIN tender towards the end of 2018 and issued ten manufacturers long-term arrangements (LTAs) to secure access to LLINs over its 2019-2020 tender period, including to new and innovative products. Through its engagement with industry, UNICEF is applying supply chain cost and sustainability considerations to its LLIN procurement strategy to address some of the programmatic and supply chain challenges undermining environmental sustainability and the risks associated with LLIN shipments and packaging.
- Currently, the World Health Organization (WHO) lists 20 different prequalified LLINs from 12 different manufacturers, including new LLIN technologies that could help stem the rise in insecticide resistance. WHO has transitioned its pesticide evaluation scheme (WHOPES), used to promote and coordinate the testing and evaluation of pesticide product safety, efficacy, and operational acceptability of public health pesticides, to a prequalification team for vector control (PQT-VC). It is now able to harmonize its evaluation processes and product assessment streams for diagnostics, medicines, vaccines, and vector control. It reflects the growing prominence and broader array of vector control interventions beyond the use of pesticides to cover a wider range of vector-borne diseases including Chagas disease, Chikungunya, dengue fever, and Zika virus disease, amongst many others.

2. Brief Background and Procurement History

Malaria is a preventable and curable life-threatening parasitic disease transmitted to people through the bites of infected female *Anopheles* mosquitoes. There are more than 400 species of *Anopheles* mosquito,² of which five are known to cause malaria in humans.³ In 2017, WHO reported that malaria parasites caused an estimated 219 million cases of the disease in 87 countries and an estimated 435,000 deaths, of which 61 per cent were children under five years of age.⁴ Africa accounts for 92 per cent of the estimated disease burden globally, and 93 per cent of malaria mortality. Five countries account globally for nearly half of all malaria cases, of which Nigeria (25 per cent), the Democratic Republic of the Congo (11 per cent),

¹ UNICEF articulates supply trends as either number of nets procured, or number of nets delivered. Substantial differences in supply data can occur between annually reported LLIN procurement and LLIN deliveries due to long-lead delivery times for shipments by sea, which can be between two to eight weeks depending on the volume, and their subsequent transit to community distribution points.

² World Health Organization, [Malaria Fact Sheet](#), WHO, Geneva, March 2019.

³ Zoonotic Plasmodium causing malaria in humans: *P. falciparum*, *P. malariae*, *P. ovale*, *P. vivax*, and *P. knowlesi*, the latter normally infecting animals. There is no known human to human transmission.

⁴ WHO, [Malaria Fact Sheet](#).

Mozambique (5 per cent), and India and Uganda (with 4 per cent respectively). As part of WHO's Global Malaria Technical Strategy 2016-2030 to reduce the burden of global malaria by 90 per cent by 2030,⁵ WHO recommends universal coverage with effective vector control including the use of indoor residual spraying (IRS) and insecticide-treated mosquito nets (ITN),⁶ particularly long-lasting insecticidal nets (LLINs), as core interventions for all populations at risk in all malaria-endemic settings. Sleeping under an LLIN is one of the most effective measures that can reduce the contact between mosquitoes and humans. It provides both a physical barrier and an insecticidal effect.

There are two categories of ITN:⁷ **Conventionally treated nets** are treated with an insecticide that repels, disables, or kills mosquitoes that encounter the netting material through dipping in a diluent containing insecticide, post-production, either at the factory or post distribution. **LLINs** are considered far more effective as they are infused with a WHO-recommended insecticide during production using netting material with insecticide bound within or around the fibres at the factory, resulting in nets that retain their efficacy for much longer than conventionally treated nets (see [5.1 Durability](#)).

Pyrethroids are one of the oldest known insecticides, initially derived from pyrethrum, which comes from the dried and crushed flower heads of a genus of perennial flowering Asteraceae. However, as deriving it was expensive and in limited natural supply, **pyrethroids** have been adapted and synthesized since 1973. Synthetic pyrethroids are more stable to light, more toxic, and last longer in the environment than natural Pyrethrum.⁸ However, from their wide-spread use in ITNs and agriculture, WHO has been reporting an increasing emergence of **insecticidal resistance** to various insecticides, including pyrethroids, among *Anopheles* mosquitoes.⁹

An evaluation by WHO in 2018 of the effects of insecticide resistance on LLINs reaffirmed that LLINs nevertheless still provide significant protection against malaria, and that universal coverage of populations at risk with LLINs should continue. Nonetheless, the expansion of the current LLIN market to include new LLINs with increased efficacy against pyrethroid-resistant mosquitoes has become a specific priority within malaria vector control. Manufacturers are developing next-generation LLINs with active ingredients other than, or in addition to, pyrethroids, and include a new class of bed net with the chemical **piperonyl butoxide (PBO)**.¹⁰ It is a chemical synergist that inhibits the enzymes in the natural defence mechanisms in insects, which prevents the detoxification of the pyrethroid. As a result, the pyrethroid in the LLIN remains potent against mosquitoes despite insecticidal resistance. Such PBO-pyrethroid-treated LLINs appear to have similar or better efficacy against resistant mosquitoes under controlled household conditions than standard LLINs that do not have PBO.¹¹

Significant progress has been achieved since 2004 in malaria control, having reduced the number of global cases by 12 per cent and deaths from malaria by 45 per cent. Among children under five years of age, LLINs provide up to 55 per cent protective efficacy in preventing mortality attributed to malaria.¹² These achievements are largely credited to the international efforts in scaling-up the core vector control interventions, particularly the use of LLINs.

In 2017, about half of all people at risk of malaria in Africa were protected by an LLIN compared to 29 per cent in 2010. However, LLIN coverage only increased marginally over the course of 2015 to 2017,¹³ reflecting a wider stagnation in progress against malaria, leaving at least half of the population at risk uncovered.

UNICEF procures LLINs on behalf of countries and partners in support of malaria control and prevention programmes, either with using programme funds or available country financing. UNICEF only procures LLINs that are prequalified by WHO. WHO currently lists 20 prequalified LLINs from 12 manufacturers (Table 1, next page). All vector control products that have been WHO prequalified, which includes IRS, insecticide treat net kits, larvicides, and space spray, can be accessed [here](#).¹⁴

⁵ World Health Organization, [Global Technical Strategy for Malaria 2016-2030](#), WHO, Geneva, May 2015, p. 3.

⁶ World Health Organization, [Guidelines for Malaria Vector Control](#), WHO, Geneva, February 2019, p. 34.

⁷ Jaramillo, Gloria I, et al., [Comparison of the Efficacy of Long-lasting Insecticidal Nets PermaNet® 2.0 and Olyset® Against Anopheles albimanus Under Laboratory Conditions](#), Scientific Electric Library Online, São Paulo, August 2011.

⁸ World Health Organization, [Safety of Pyrethroids for Public Health Use](#), WHO, Geneva, 2005, p. 5.

⁹ World Health Organization, [Insecticide Resistance](#), WHO, Geneva, 2019.

¹⁰ World Health Organization, [Conditions for Deployment of Mosquito Nets Treated with a Pyrethroid and Piperonyl Butoxide](#), WHO, Geneva, December 2017.

¹¹ Protopopoff, Natacha, et al., [Effectiveness of a Long-lasting Piperonyl Butoxide-treated Insecticidal Net and Indoor Residual Spray Interventions, Separately and Together, Against Malaria Transmitted by Pyrethroid-resistant Mosquitoes: A Cluster, Randomised Controlled, Two-by-two Factorial Design Trial](#), National Center for Biotechnology Information, U.S. National Library of Medicine, Bethesda, April 2021.

¹² Eisele TP, et al., [Protective Efficacy of Interventions for Preventing Malaria Mortality in Children in Plasmodium falciparum Endemic Areas](#), National Center for Biotechnology Information, Bethesda, 2010.

¹³ WHO, [Malaria Fact Sheet](#).

¹⁴ World Health Organization, [List of WHO Prequalified Vector Control Products](#), WHO, Geneva, April 2019.

Table 1 WHO Prequalified LLINs

Manufacturer	WHO PQ Code	WHO PQ	Product	Material	Synergist
BASF (Germany)	002-001	2017	Interceptor®	Polyester	Pyrethroid
	002-002	2018	Interceptor G2®	Polyester	Pyrethroid
Disease Control Technologies (USA)	003-001	2017	Royal Sentry®	Polyethylene	Pyrethroid
	003-002	2019	Royal Sentry®2.0	Polyethylene	Pyrethroid
	003-003	2019	Royal Guard®	Polyethylene	Pyrethroid
Fujian Yamei Industry (China)	015-001	2018	Yahe LN®	Polyester	Pyrethroid
Life Ideas Biological Technology (China)	026-001	2018	Panda Net 2.0®	Polyethylene	Pyrethroid
Mainpol (Germany)	018-001	2018	SafeNet®	Polyester	Pyrethroid
NRS Moon Netting (China)	028-001	2018	Tsara Boost®	Polyester	PBO
	028-003	2018	Tsara Soft®*	Polyester	Pyrethroid
	028-004	2018	Tsara Plus®	Polyester	PBO
Net Health (A to Z Textile Mills) (Tanzania)	009-001	2018	MiraNet®	Polyethylene	Pyrethroid
	001-004	2017	OLYSET Net®	Polyethylene	Pyrethroid
Shobikaa Impex Private (India)	006-001	2017	Duranet®	Polyethylene	Pyrethroid
Sumitomo Chemical (Japan)	001-004	2017	OLYSET Net®	Polyethylene	Pyrethroid
	001-005	2018	OLYSET PLUS®	Polyethylene	PBO
	021-001	2018	Yorkool LN®	Polyester	Pyrethroid
Tianjin Yorkool International (China)	014-001	2018	MAGNet®	Polyethylene	Pyrethroid
	014-002	2018	VEERALIN®	Polyethylene	PBO
Vestergaard (Switzerland)	005-001	2017	PermaNet 2.0®	Polyester	Pyrethroid
	005-002	2018	PermaNet 3.0®	Polyester	PBO

Source: World Health Organization

Note *: WHO suspended the prequalification of NRS Moon Netting's Tsara Soft® as of 12 December 2019 pending assessment of additional information.

Previously, WHOPES used to promote and coordinate the testing and evaluation of pesticide product safety, efficacy, and the operational acceptability of all public health pesticides. Since 2015, WHO transitioned the scheme to a prequalification team for vector control products (PQT-VC).¹⁵ This was in response to the growing prominence and broader array of vector control interventions and the need to cover a wider range of vector borne diseases including Chagas disease, Chikungunya, dengue fever, and Zika virus disease, amongst many others. It was also to harmonize the evaluation processes for all product assessment streams for diagnostics, medicines, and vaccines. The transition process took three years and was concluded in January 2017, which converted all WHOPES listed recommendations into WHO prequalified listings. WHO's PQT-VC seeks to:

- Ensure an accurate and current list of prequalified vector control products.
- Provide a baseline of information on the safety, efficacy, and quality of converted products to inform future activities to be undertaken to ensure products are supported by a modern database of evidence and a lifecycle approach.
- Link products claiming equivalence to an innovator product to an appropriate and relevant database of evidence. Products claiming equivalence will not be prequalified until the reference (generator and owner of the data) has been prequalified. Manufacturers of equivalent products will only be permitted to claim equivalence to one reference product.

3. Innovation

Currently, there are a wide range of innovative new tools, technologies, and approaches under development for vector control, overseen by WHO's newly created Vector Control Advisory Group (VCAG).¹⁶ The VCAG assists WHO to assess the public health value of new innovative interventions and provides guidance on developing the necessary evidence base to make any evaluations.

As of May 2019, the VCAG currently lists 18 different products under 11 different types of intervention. These include LLINs, spatial repellents, sugar baits, traps, but also genetic manipulation and insect sterilising techniques, amongst others. WHO regularly publishes an update providing an overview of the different intervention classes and product prototypes under review

¹⁵ World Health Organization, [Prequalification Vector Control](#), WHO, Geneva, 2019.

¹⁶ World Health Organization, [Vector Control Advisory Group](#), WHO, Geneva, 2019.

for assessment as well as their assessment stage (1: early notification, 2: initial review, and 3: assessment and review of public health value), and is accessible here:¹⁷

<https://apps.who.int/iris/bitstream/handle/10665/274451/WHO-CDS-VCAG-2018.03-eng.pdf>



With reference to ITNs specifically, VCAG is currently reviewing four innovative LLINs products:

- A **non-pyrethroid** ITN from Tijanjin Yorkool International (China) - Yorkool LN G2® (Chlorpyrifos) - A concept reviewed by VCAG in April 2017. Following a safety assessment undertaken by PQT-VC, UNICEF does not anticipate this product to be ready for WHO PQT-VC assessment before 2021-2022, subject to it obtaining VCAG's "proof of principle" approval.
- A pyrethroid plus **non-pyrethroid** ITN from BASF (Germany) under step 3 (assessment and review of public health value). WHO recently prequalified BASF's Interceptor G2®, which is now eligible to enter the market subject to the successful in-country product evaluation and pilot implementation currently in progress. The randomized control trial (RCT) protocols for two sites were reviewed by VCAG in November 2018, and the trial in Tanzania has started. The product was listed as prequalified in January 2018.
- A pyrethroid plus insect growth regulator ITN from Disease Control Technologies (DCT) (USA). Their Royal Guard® LLIN is under VCAG step 3. RCT protocols for two sites were reviewed by VCAG in November 2018, and a trial in Tanzania has started. The product was prequalified by WHO in March 2019.
- Pyrethroid plus piperonyl butoxide (PBO) net from Sumitomo Chemicals, in which further evidence on pyrethroid-PBO nets is required to support the refinement of WHO guidance regarding conditions for the deployment of products in this class. VCAG will review further epidemiological trial data as soon as they become available. Pyrethroid-PBO nets were converted to WHO prequalified listings during 2017/18.

4. Current Market Situation

Despite the progress made to date, only half of the people at risk of malaria in Africa are sleeping under an LLIN. In 2017, The Global Fund to Fight AIDS, Tuberculosis and Malaria (the Global Fund) estimated that 57 per cent of the populations were protected by a mosquito net.¹⁸ Even though this represents a significant increase from 2010 estimates of 29 per cent coverage, it still leaves half of the population at risk uncovered.¹⁹ The use of LLINs remains the most efficient approach for malaria vector control and prevention, and efforts to sustain the gains achieved to date depends on funding availability as a key driver of demand.

To achieve universal coverage with LLINs in Africa, the African Leaders Malaria Alliance (ALMA), an intergovernmental coalition of 49 African heads of state and governments established in 2009 working to eliminate malaria by 2030,²⁰ estimate gaps of over 150 million LLINs over the next three years, requiring approximately USD 750 million in additional investments, with the majority of gaps being in 2020.²¹

Total global funding allocated to malaria control programmes average approximately USD 2.8 billion a year, ranging between USD 2.5 billion and 3.1 billion,²² in support of malaria control and elimination programmes that includes malaria prevention, diagnostics, treatment, and surveillance.²³ Whilst most funding comes from the Global Fund and international donors, governments of endemic countries contribute an estimated 28 per cent of total funding (USD 900 million). Based on an average LLIN price of USD 2.00 per net, approximately USD 400-500 million is spent annually on procuring LLINs, which excludes the costs of shipping and secondary distribution. Approximately 56 per cent of this spend was channelled via the Global Fund, and 20 per cent via the United States (US) President's Malaria Initiative (PMI). The rest coming from UNICEF,

¹⁷ World Health Organization, [Overview of Intervention Classes and Prototype/Products under Vector Control Advisory Group \(VCAG\) Review for Assessment of Public Health Value](#), WHO, Geneva, May 2019.

¹⁸ The Global Fund to Fight AIDS, Tuberculosis and Malaria, [The Global Fund. Results Report 2019](#), The Global Fund, Geneva, 2019, p. 7.

¹⁹ WHO, [World Malaria Report](#), p. xviii.

²⁰ The African Leaders Malaria Alliance, [ALMA- -An Alliance Like No Other](#), ALMA, Dar es Salaam, 2019.

²¹ The African Leaders Malaria Alliance, [Gaps to Achieve and Maintain LLIN Coverage](#), UNICEF, Copenhagen, August 2018.

²² The Global Fund to Fight AIDS, Tuberculosis and Malaria, [Long-lasting Insecticidal Nets Supplier & Partner Consultative Meeting](#), PowerPoint presentation at the Global Fund LLIN Supplier and Partners Meeting, Singapore, 25-27 September 2019, p. 9.

²³ The World Health Organization, [World Malaria Report](#), WHO, Geneva, 2019, p. iii.

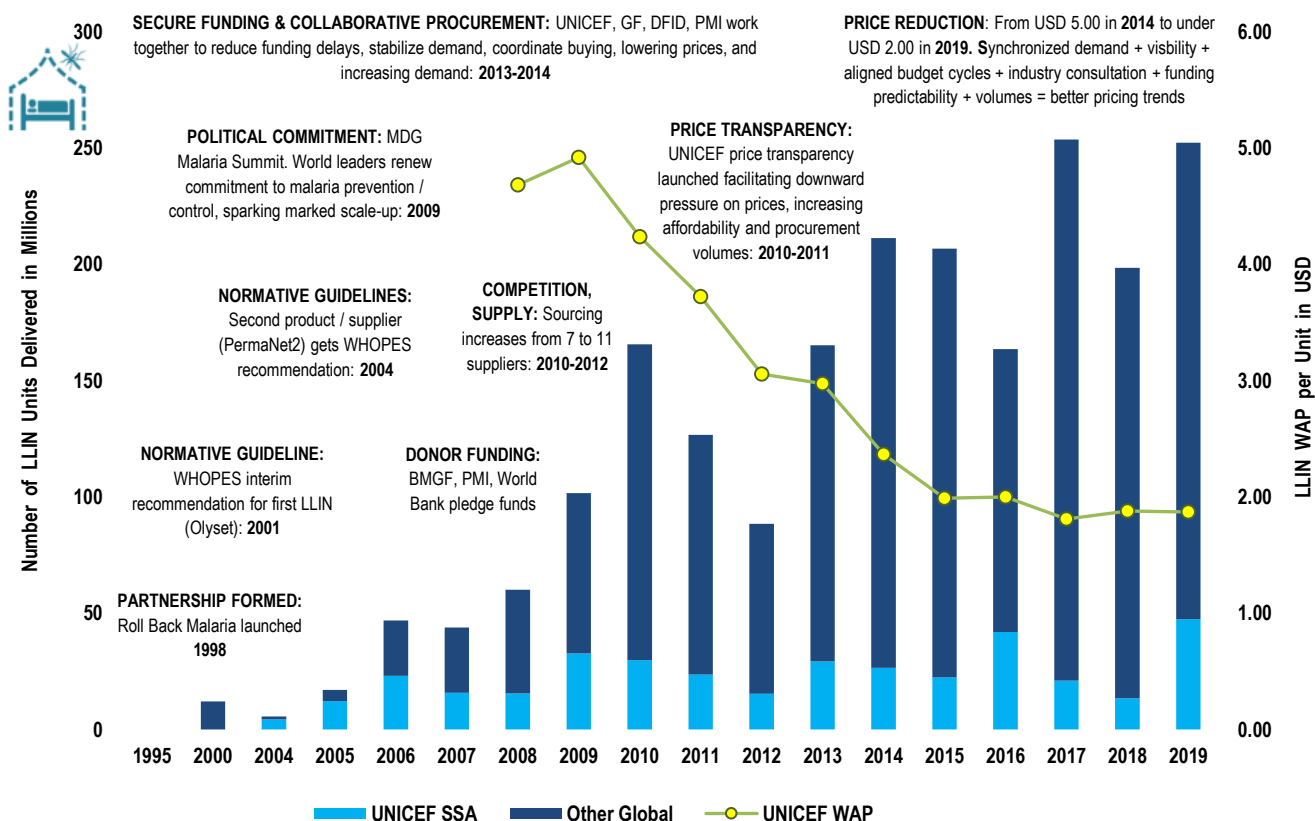
the Against Malaria Foundation (AMF),²⁴ the Canadian International Development Agency (CIDA), the United Kingdom's (UK) Department for International Development (DFID), UNITAID, as well as the World Bank, in addition to private sales.²⁵

4.1 Demand

LLIN requirements and deliveries per year are heavily influenced by country malaria programmes in large malaria endemic countries and their replenishment cycles, amongst other factors. The total global deliveries of LLIN have gradually increased over 10 years to reach over 250 million in 2017 and 2019, but which can fluctuate between 160 and 200 million nets a year over the period 2013-2018 (Figure 1). Between eighty to ninety per cent of LLINs are delivered to countries in sub-Saharan Africa (SSA), of which the Democratic Republic of the Congo, Ethiopia, Ghana, Kenya, Nigeria, Tanzania, and Uganda account for 50 per cent of volume. India represents the largest recipient country outside SSA, with six per cent of global deliveries. Ninety-nine per cent of demand comes from the public sector in endemic countries, with the private sector only accounting for one per cent of this volume.

Year-to-year demand can vary significantly for each country due to some large-scale mass distribution campaigns that require countries to renew and procure LLINs on a two- to three-year cycle. The Alliance for Malaria Prevention (AMP),²⁶ has been monitoring the delivery of WHO prequalified nets from manufacturers since 2004, detailing deliveries per quarter, per year, per country and by donor,²⁷ with the significant growth in global LLIN demand being highly dependent on the Global Fund and PMI, which accounts for over two thirds of procurement.

Figure 1 LLIN Global Deliveries 2004-2019



Source: UNICEF Supply Division

²⁴ The Against Malaria Foundation, [What We Do](#), AMF, London, 2019.

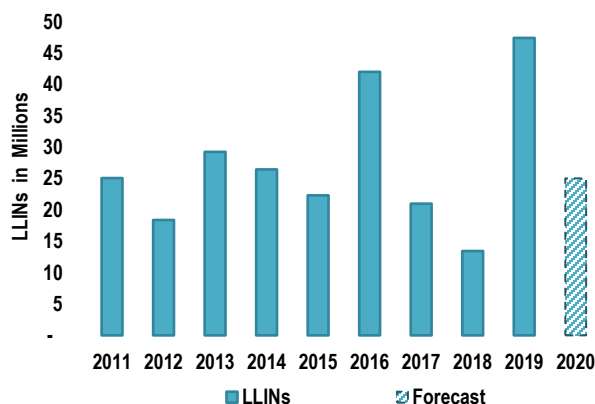
²⁵ Milliner, John, [The AMP Net Mapping Project](#), Milliner Global Associates, Idaho, October 2019.

²⁶ The Alliance for Malaria Prevention (AMP), established in 2004, is a multi-sectorial partnership within Roll Back Malaria Partnership to End Malaria, which is itself the largest global platform of 500 partners coordinating efforts to eliminate malaria.

²⁷ AMP, [Net Mapping Project](#).

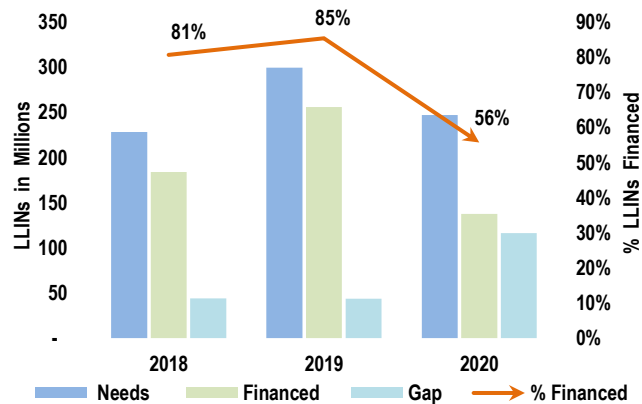
Like global demand, year to year demand through UNICEF can also vary significantly per country. In 2016, UNICEF procured approximately 43 million LLINs on behalf of 32 countries, followed by 23 million and 13 million in 2017 and 2018 respectively, and 47.4 million in 2019, of which most were for SSA (Figure 2). As UNICEF's procurement ranges on average between 20 and 40 million LLINs a year, so its share of global LLIN procurement has also fluctuated, ranging from 34 and 7 per cent over the past ten years, reflecting the increasing centralised procurement by other major partners, notably the Global Fund and PMI (Figure 1).

Figure 2 UNICEF's Global LLIN Procurement 2011-2020



Source: ALMA Net Mapping Project, UNICEF Supply Division

Figure 3 Estimated LLIN Needs in SSA during 2018-2020



Source: ALMA Net Mapping Project

Funding predictability has improved compared to 2012, and has been covering on average over 80 per cent of the needs since 2014 through to 2018, supplementing UNICEF's ability to procure additional LLINs to meet country needs. For 2019, ALMA identified a need for 299 million LLINs, of which 256 million were funded, representing 85 per cent of the needs. However, in 2020, only 56 per cent of the identified needs reaching 247 million LLINs are currently funded (Figure 3).

Country demand is also highly influenced by in-country registration requirements, which can be a barrier to access affordable LLINs. For many countries, country demand depends on their own national in-country registration requirements, and they do not automatically accept WHO prequalification or recommendations as sufficient to allow pesticide-containing products like LLINs into their programmes.

Some countries only have one LLIN product registered (i.e. in Bolivia and Sudan), which effectively renders it to a “no-choice”. From a procurement standpoint, it denies flexibility, limits availability, and heightens supply dependency and insecurity. To ensure supply security, UNICEF strongly encourages countries to register multiple products from different manufacturers.

Based on UNICEF's annual forecast exercise in 2018, UNICEF estimated the need for 70 million LLINs over 2019-2020. It included the procurement of 36.2 million LLINs for the mass campaigns in 2019 for Burundi, Chad, Côte d'Ivoire, and Sudan. UNICEF procured 47.4 million nets in 2019 and expects to procure 25 million nets in 2020.

4.2 Supply

UNICEF estimates the LLIN industry production capacity to be approximately 400 million nets, from which manufacturers globally supply approximately 200-250 million a year.

In 2018, UNICEF issued its last LLIN tender seeking offers from manufacturers with WHO prequalified products, as well as from manufacturers with products under evaluation by WHO PQT-VC. As a result of the tender, UNICEF issued ten manufacturers up to 24-month LTA supply awards for 2019-2020 (Table 2), with the possibility to extend by an additional 12 months until the end of 2021. Many of the manufacturers have long-established supply relationships with UNICEF from previous tenders.

Nets are made of polyester, cotton, cotton-synthetic blends, nylon, polyethylene or polypropylene. Multiple LLIN variations in net size, colour, mesh, shape, packaging and labelling options exist. UNICEF refers to a standard LLIN as equal to 100 denier and a dimension of (length) 190 x (width) 180 x (height) 150 cm.

Table 2 UNICEF LTAs with Manufacturers 2019-2020

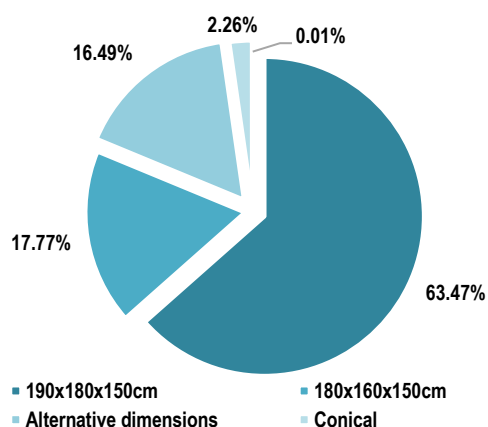
Manufacturers	Product	Material	Synergist	LTA Duration	Start Date	End Date
Disease Control Technologies (USA)	Royal Sentry®	Polyethylene	Pyrethroid	24 months	01/01/2019	31/12/2020
	Royal Sentry®2.0	Polyethylene	Pyrethroid	24 months	01/01/2019	31/12/2020
Guangdong / Life Ideas Biological Technology (China)	Panda Net 2.0®	Polyethylene	Pyrethroid	24 months	01/01/2019	31/12/2020
Mainpol (Germany)	SafeNet®	Polyester	Pyrethroid	24 months	01/01/2019	31/12/2020
NRS Moon Netting (Dubai, China)	Tsara Boost®	Polyethylene	PBO	18 months	01/07/2019	31/12/2020
	Tsara Soft®*	Polyester	Pyrethroid	18 months	01/07/2019	31/12/2020
	Tsara Plus®	Polyester + Polyethylene	PBO	18 months	01/07/2019	31/12/2020
Net Health (A to Z Textile Mills) (Tanzania)	MiraNet®	Polyethylene	Pyrethroid	24 months	01/01/2019	31/12/2020
	OLYSET Net®	Polyethylene	Pyrethroid	24 months	01/01/2019	31/12/2020
Shobikaa Impex Private (India)	Duranet®	Polyethylene	Pyrethroid	24 months	01/01/2019	31/12/2020
Sumitomo Chemical (Japan)	OLYSET Net®	Polyethylene	Pyrethroid	24 months	01/01/2019	31/12/2020
	OLYSET PLUS®	Polyethylene	PBO	24 months	01/01/2019	31/12/2020
Tianjin Yorkool International (China)	Yorkool LN®	Polyester	Pyrethroid	24 months	01/01/2019	31/12/2020
VKA Polymers (India)	MAGNet®	Polyethylene	Pyrethroid	24 months	01/01/2019	31/12/2020
	VEERALIN®	Polyethylene	PBO	24 months	01/01/2019	31/12/2020
Vestergaard (Switzerland)	PermaNet 2.0®	Polyester	Pyrethroid	24 months	01/01/2019	31/12/2020
	PermaNet 3.0®	Polyester + Polyethylene	PBO	24 months	01/01/2019	31/12/2020

Source: UNICEF Supply Division

Note *: WHO suspended the prequalification of NRS Moon Netting’s Tsara Soft® as of 12 December 2019 pending assessment of additional information.

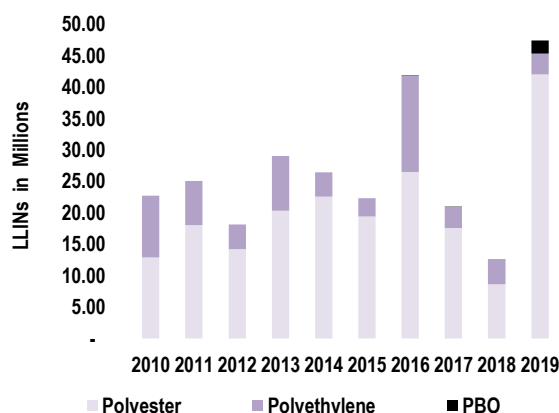
Since 2010, UNICEF used to procure three standard sizes of LLIN, two rectangular nets with sizes: (L)190 x (W)180 x (H)150 cm and (L)180 x (W)160 x (H)150 cm; and one conical net with size: (H)220 x (C)1050 cm, all in standard colours: white, blue and green, with a minimum of 100 denier.²⁸ Figure 4 shows UNICEF’s share of the different size net procurement from 2010 to 2018. The procurement of conical nets is lower due to its higher price and longer lead times for manufacturing. As such, UNICEF did not consider the conical nets as a standard size in its 2018 tender. Because of the different manufacturing processes for polyester versus polyethylene and the inherent distinctive technical specifications for each type of material, each manufacturer has an LTA for one type of material. Figure 5 shows the actual historical procurement trends for polyester versus polyethylene nets.

Figure 4 UNICEF Procurement of Different LLIN Sizes 2010-2018



Source: UNICEF Supply Division

Figure 5 UNICEF Procurement of Different LLIN Material Polyester versus Polyethylene and PBOs 2010-2019

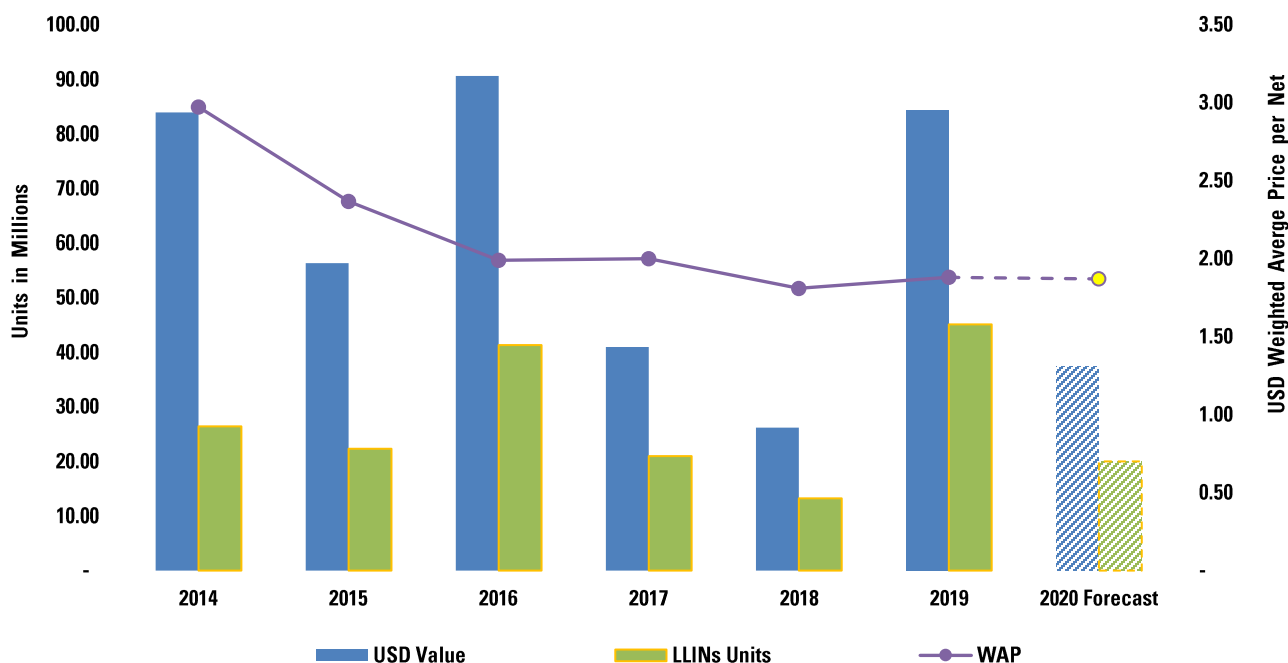


Countries overwhelmingly choose LLINs made from polyester over LLINs made from polyethylene, due to them being a softer and lighter material. This preference has resulted in LLINs made from polyester accounting for approximately 90 per cent of UNICEF’s procurement (Figure 5). However, out of the ten manufacturers awarded LTAs through UNICEF, only four produce LLINs made from polyester. This imbalance in country use of UNICEF LTA allocations undermines UNICEF’s strategy to ensure a diverse and secure supply of LLINs. UNICEF seeks to reduce the gap between polyester and polyethylene nets and to facilitate a higher adoption of polyethylene LLINs to ensure a broader balanced supply security. UNICEF’s procurement of PBO LLINs has also increased incrementally from approximately 7,000 nets in 2016 to reach 2 million in 2019.

²⁸ A denier is a unit of measurement used to determine the thickness of fibre and individual threads or filaments used in the textiles and fabric.

4.3 Pricing

Figure 6 UNICEF Procurement and WAP Data and Forecast 2014-2020²⁹



Source: UNICEF Supply Division

UNICEF publishes a [retrospective list of LLIN prices](#) for each LLIN manufacturer LTA holder.³⁰ However, published prices do not reflect volume discounts, price decreases, nor increased costs due to incurred customization during the LTA period. The WAP per LLIN secured by UNICEF has declined by 31 per cent over four years, decreasing from USD 2.90 in 2014 to reach USD 1.81 in 2018, and 1.88 in 2019 (Figure 6). The WAP UNICEF secured for PBOs also saw a reduction by 50 per cent from USD 5.00 in 2016 to USD 2.50 in 2019.

UNICEF achieved these results over recent years in collaboration with the Global Fund across a range of dimensions by reducing the range of products procured from 44 different LLIN colours, sizes and shapes to less than ten. It synchronized demand forecasts and procurement visibility over the horizon and aligned them with country budgeting cycles, as well as sending LLIN manufacturers consistent signals via co-hosting industry meetings (Copenhagen, August 2018).³¹ Together, these along with improvements in funding predictability, have helped improve the health of the market, its functioning, efficiency, and increased competition, leading to further favourable trends in pricing.

5. UNICEF LLIN procurement considerations

5.1 Durability

LLIN durability depends on its physical integrity (the number and size of holes and tears in a net while still in use), as well as encompassing net attrition (the complete loss of the net). Current WHO laboratory testing guidelines expect LLINs to retain biological activity for a minimum number of 20 standard washes under laboratory conditions, and a three-year minimum period of use under field conditions.³² An LLIN's serviceable life depends on various factors in addition to textile durability and insecticide efficacy, such as a net's attrition rate and damage depending on the way households use it.

²⁹ Data based on all LLIN products (standard and customized) and adjusted to account for rebates and other product costs.

³⁰ LLIN price based on LLINs: 190 x 180 x 150 cm; minimum 100 denier; colour white.

³¹ UNICEF, *The Global Fund and UNICEF LLINs Suppliers Meeting*, UNICEF, Copenhagen, August 2019.

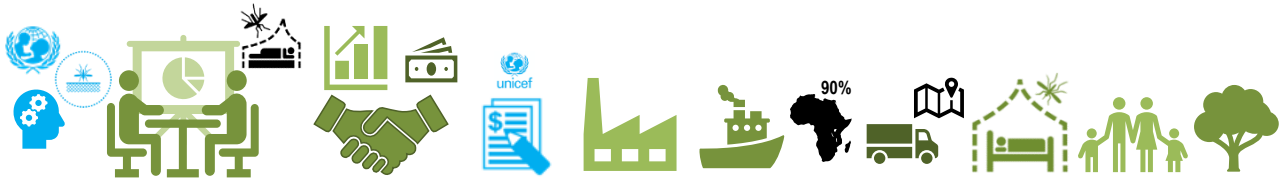
³² World Health Organization, *Guidelines for Laboratory and Field-Testing of Long-lasting Insecticidal Nets*, WHO, Geneva, 2013, p. 2.

In 2011, WHO issued “*Guidelines for Monitoring the Durability of Long-lasting Insecticidal Mosquito Nets under Operational Conditions*”.³³ These guidelines assist national vector-borne disease control programmes and partners to monitor the durability of LLINs under operational conditions to help countries to plan for the replacement of worn-out nets, and to make decisions based on understanding the factors associated with durability.

Following the publication of this guidance, numerous reports were published documenting the variations in longevity between different products and brands.³⁴ However, field durability has proved to be difficult to measure and is very country- and culture-specific.³⁵ As a result, there has to date not been enough robust evidence and durability data gathered on products to inform procurement decisions in UNICEF’s recent tenders.

At present, WHO evaluations do not differentiate between LLIN products based on their relative durability, as the assumption is that they have all undergone relevant field trials, and that they are all sufficiently and comparatively durable. Thus, despite the latest reports on WHO monitoring guidance, the results from the studies comparing findings are not yet clear. UNICEF remains willing to apply definitive and harmonised *global* durability indicators into future procurement activities once these have been developed and agreed with partners and industry. In the meantime, UNICEF will support the work of global partners to develop durability indicators and will encourage manufacturers to engage in these endeavours. In the meantime, UNICEF advocates messaging around the “appropriate use and maintenance” of nets to ensure the prolongation of their useful life, as well as access to de novo or replacement needs at critical junctures (e.g. for women during pregnancy).

5.2 Sustainable Procurement



Sustainable Procurement

Sustainable procurement is an approach to procurement that incorporates the three sustainability pillars of social, economic, and environmental impact considerations. It goes beyond the more familiar “green” public procurement, to ensure that all products and services procured support local economic and social development, with the least environmental impact, and the best value for money (VfM).

In implementing SP, UNICEF seeks to include green manufacturing quality management systems, and social and economic considerations as SP criteria in commercial tender evaluations, as well as specific supply targets to develop local industry capacity in programme countries.

In applying SP, many UNICEF procurement decisions will face trade-offs between SP’s three pillars (economic, social, and environmental), and present key operational challenges, especially between environmental and social considerations, with the latter often being more difficult to quantify. The absence of evidence to make any informed trade-off decisions will be part of the challenge. The other challenge will be the difficulty to make value judgments to prioritize one pillar over the other. However, solutions will be situation specific and priorities based on readiness, market influence, and targeted objectives.

Some SP elements, notably under the social pillar, may put some pressure on short-term costs that generate longer-term savings, such as investments in fairer employment working conditions, or health and safety, which would be offset by increased motivation, productivity, and reductions in work-related injury and absenteeism. To achieve higher tangible economic benefits and VfM, UNICEF and industry will strive to manage procurement decisions based on longer-term perspectives, considering the advantages of environmentally, socially sound products and services, and better performing staff, bring in the long-term.

Source: UNICEF Supply Division

In February 2018, UNICEF released its Procedure on SP ([SUPPLY/PROCEDURE/2018/001](#)). The procedure constitutes UNICEF’s policy on SP and is applicable across all UNICEF offices engaged in supply planning and procurement, wherever feasible and applicable, whether for goods or services, or for programmes or office assets, read more [here](#).³⁶

³³ Ibid., p. 3-4.

³⁴ World Health Organization, *WHO Guidance Note for Estimating the Longevity of Long-lasting Insecticidal Nets in Malaria Control*, WHO, Geneva, September 2013.

³⁵ A. Kilian, et al., *Field Durability of the Same Type of Long-lasting Insecticidal Net Varies Between Regions in Nigeria Due to Differences in Household Behaviour and Living Conditions*, Malaria Journal, Liverpool, 2015.

³⁶ UNICEF, *Sustainable Procurement*, UNICEF, Copenhagen, September 2018.

Through its recent 2019-2020 LLIN tender, UNICEF focused on several SP considerations and aspects:

- **Evaluation criteria:** UNICEF maintained using the expanded tender evaluation criteria to consider supply chain elements, notably on optimized container loading, which have an impact not only on freight and container costs but also on carbon footprints associated with freight (under SP's economic and environmental pillars) with reference to container loading capacity and landed cost as evaluation criteria in the tender document.
- **Eco-friendly packaging:** UNICEF standard primary packaging considers bio / oxo-biodegradable bags,³⁷ as well as an option for bulk packaging (without individual wrappings per unit) (under SP's economic and environmental pillars).
- **Local procurement:** UNICEF continues to explore opportunities for local procurement in those countries producing or finishing WHO prequalified products (under SP's economic and social pillars).
- **Sustainability:** As WHO's PQT-VC processes do not yet consider issues around sustainability and SP, UNICEF will likely still conduct onsite visit inspections to determine if manufacturers adhered to any social responsibility and environmental impact considerations.

6 Issues and Challenges

- WHO prequalified manufacturers currently estimate their total global production capacity of recommended standard sized LLINs to reach 400 million nets a year. However, global procurement still only uses fifty per cent of this production capacity, despite the needs being far higher due to lack of funded demand.
- Countries express an overwhelming preference for LLINs made from polyester, at the expense of LLINs made from polyethylene, leading to an imbalance in using UNICEF LTA allocations. UNICEF's new tender will allow access to new prices with the objective of maintaining or lowering the prices we have for exiting products and to reduce the gap between polyester and polyethylene nets to facilitate a higher adoption of polyethylene LLINs.
- A key priority for malaria-endemic countries is to have access to a range of affordable vector control tools to effectively manage insecticide resistance and a wider range of current LLIN products. It should include new LLINs that have increased efficacy against pyrethroid-resistant mosquitoes, i.e. "next generation LLINs", in particular those with active ingredients other than, or in addition to, pyrethroids.
- Product registration requirements in certain countries continue to limit product range availability, which limits flexibility and availability and heightens supply dependency and insecurity. LLIN manufacturers need to pursue product registration in countries to ensure that they increase the manufacturer-base and offer more than one WHO prequalified LLIN product.
- Inaccurate forecasts quantifying country requirements is still a challenge on account of lack of reliable and acceptable quantification methods and tools, in addition to the timeliness of funding and country planning. Rolling forecasts and the timelines for procurement have altered as the information on availability of finances changed. It is only when a requirement is financed that it is translated into a demand on the global market. The result of this can be significant and cause congestion, especially when the scale of the demand exceeds a manufacturer's production capacity and global supply. There is also a risk in possible reduction in available production capacity due to suspension of manufacturers or quality issues, and as a consequence, potential opportunistic increases in prices by manufacturers.

7 Steps Forward

- UNICEF will work with partners to ensure correct use of existing interventions and availability of new tools to maintain the effectiveness of malaria vector control.
- UNICEF will work with partners and governments to improve and diversify the number of LLIN products registered in countries, to mitigate risks to supply insecurity.
- UNICEF's will continue to foster collaboration with global partners, including the Global Fund, and PMI, to improve aggregate forecasts, monitor implementation, and ensure alignment of policy and practice to stabilize and make more certain LLINs demand, and increase market efficiency.

³⁷ Oxo-biodegradable plastics are conventional polymers that have chemicals that accelerate the oxidation and fragmentation of the material under ultraviolet light, heat, or oxygen.

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Other UNICEF information notes can be found at: http://www.unicef.org/supply/index_54214.html.