RESULTS FOR DEVELOPMENT

Expanding Access to LLINs: A Global Market Dynamics Approach

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Results for Development Institute

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Results for Development (R4D) is a nonprofit organization whose mission is to unlock solutions to tough development challenges that prevent people in low- and middle-income countries from realizing their full potential. Using multiple approaches in multiple sectors including, Global Education, Global Health, Governance and Market Dynamics, R4D supports the discovery and implementation of new ideas for reducing poverty and improving lives around the world. To learn more visit www.resultsfordevelopment.org.

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Executive Summary

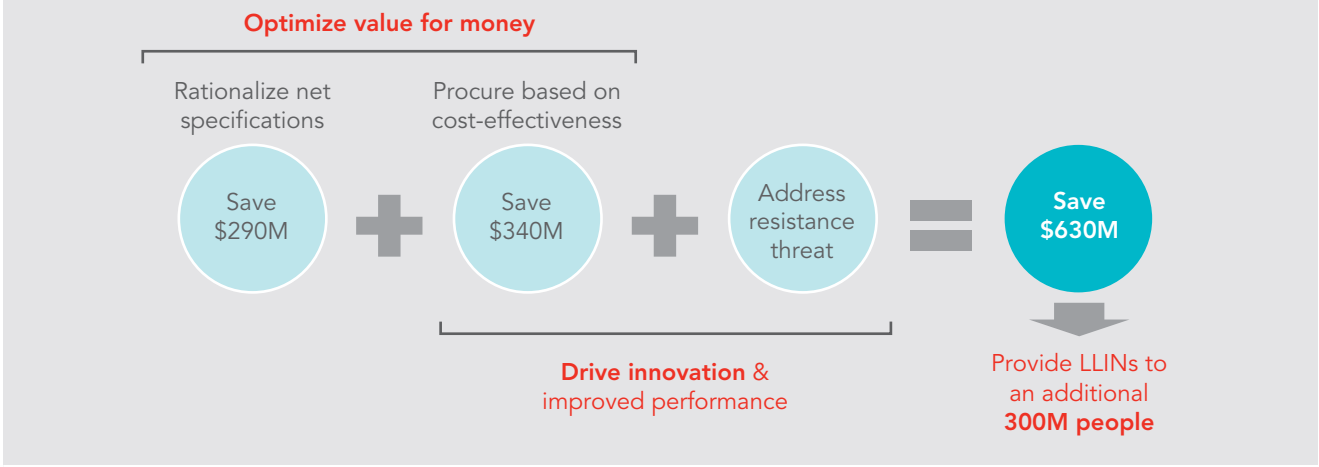
Globally, an estimated 655,000 unnecessary deaths still occur annually from malaria. Long-lasting insecticide-treated bed nets (LLINs) or "nets" have been instrumental in reversing that trend and have contributed to a 25 percent decline in malaria-related deaths over the past decade.[1] From 2004 to 2011, annual distribution grew exponentially from 5 million to 130 million nets[2] given a concerted campaign to achieve universal coverage in Africa, where over 90 percent of malaria-related deaths occur.[3]

The global LLIN field is now at a vital turning point, facing both funding shortfalls and growing resistance patterns. In order to secure ongoing access for millions, the global community and the net manufacturing industry must act in concert to address emerging threats. Based on the current net life cycle, an estimated 560 million nets[4] will be needed at a cost of $2.4 billion[5] through 2015 to maintain universal coverage. Today, over 90 percent of LLINs are donor funded, primarily by three major donors: the Global Fund to Fight Aids, Tuberculosis and Malaria, the President's Malaria Initiative (PMI), and the World Bank. Given donor constraints, there is currently an estimated 40 percent shortfall between projected funding and need through 2014. Additional expected donor commitments should reduce the magnitude of this shortfall, though a significant funding gap is still anticipated.[6] Compounding this challenge, the threat of mosquito resistance to current LLIN insecticides is growing rapidly across Africa. This necessitates urgent investments in research and development (R&D) to develop new net technologies that address resistance issues, ensuring that LLINs can remain effective tools in the global malaria fight.

Results for Development Institute (R4D) has developed a strategy that aligns the interests of both the public and private sectors to improve the global marketplace for LLINs. This strategy can save the global community up to $630 million over the next five years by driving purchasing of the most cost-effective LLINs while simultaneously generating market incentives for innovation and improved net performance. A global savings of $630 million can be used to purchase 150 million nets, which can offer an additional 300 million individuals malaria protection (see Figure 1).

This work was informed by close engagement with over 140 actors, including all 10 World Health Organization Pesticide Evaluation Scheme (WHOPES)–recommended suppliers, Ministry of Health (MoH) stakeholders in five high-malaria-burden countries, donors, regulators, and implementing partners. This engagement was coupled with rigorous analysis of global net procurement and distribution data.

Figure 1. Impact of LLIN market dynamics strategy



[1]WHO, World Malaria Report, 2011.

[2]Net Mapping Project data.

[3]WHO, World Malaria Report, 2011.

[4]John Milliner "Achieving Universal Coverage" presentation, November 2011. Forecast based on Net Mapping Project data, Roll Back Malaria (RBM) country roadmaps, and Albert Kilian net loss rate assumptions.

[5]R4D analysis. Data sources: Global Fund PQR and PMI, 2011. This assumes 2011 weighted average net price for all sizes.

[6]African Leaders Malaria Alliance (ALMA) analysis of funding gap for 2012-2014. This includes both committed funding as well as expected funding from Global Fund, PMI, DFID, World Bank, country funding, and other sources. It should be noted, however, that this excludes funding via the Global Fund Transitional Funding Mechanism (TFM) given that financing decisions had not been made at time of publication.

Primary recommendations:

I. Ensure policies and incentives to procure the most cost-effective nets

Global experts and in-country users increasingly recognize that there are differences in how long different nets last in the field (durability),[7] which is a critical component of net performance. However, currently there is no internationally reputed guidance on net performance, nor are there donor incentives in place for countries to procure the most cost-effective nets. This has led to a focus on purchasing nets on the basis of lowest price. This price-focused approach reduces overall value for money (VFM) while creating market disincentives for manufacturers to invest in improving net performance. Shifting LLIN procurement to award orders **on the basis of "cost per year of net life" could save the global community up to $340 million** over the next five years while generating financial incentives for suppliers to develop more durable nets.

Recommendations: The global community should urgently support the development of near-term Net Performance Guidance and adopt policies to purchase LLINs on the basis of lowest cost per year of net life. The World Health Organization Global Malaria Program (WHO GMP) has been engaging closely with R4D and a consortium of leading textile and field partners on an approach to develop near-term guidance. In parallel to supporting guidance development, donors and countries should adopt policies to consistently procure on the basis of cost per year of net life, rewarding both price and net performance. Donor policies should also allow countries to provide rigorous local analysis of net performance (i.e., to determine the denominator of net life) as the basis for procurement awards.

II. Rationalize fragmentation in net specifications to optimize VFM

Currently, there is a high degree of fragmentation among net specifications (200-plus listed supplier offerings across size, shape, and color, with approximately 25 commonly purchased variants). Certain product outliers, including irregularly sized nets and highly specialized packaging, generate significantly increased costs and lead times without corresponding benefits for usage. **Reducing fragmentation in these targeted specifications could save up to $290 million for the global community** over the next five years.

Recommendations: Donors and countries should adopt policies to purchase the most cost-effective net specifications while still ensuring a wide product selection for countries. NetWorks (funded by USAID and led by the Johns Hopkins Bloomberg School of Public Health) is partnering closely with R4D to develop Value for Money in LLIN Specifications Guidance that uses rigorous analysis to identify 70-plus product choices that optimally balance cost and usage benefits. Donors and countries should endorse this guidance and require procurement in accordance with it. The guidance will also include country-level guidelines for developing rigorous local evidence on usage benefits. Donor policies should allow countries to provide this evidence as justification for alternative net specification procurements.

III. Urgently develop a clear "path to market" for innovative vector control LLINs to address the resistance threat

An alarming pattern of mosquito resistance to pyrethroids (the class of insecticides used in all LLINs available today) is rapidly emerging across Africa. Novel non-pyrethroid active ingredients are required to address the threat of resistance; however, the approximately $200 million[8] R&D investment required to develop these poses a significant hurdle. It is imperative that the global community ensure access to effective insecticide resistance management (IRM) products, rather than continue to invest billions of dollars in existing nets that may prove increasingly ineffective against pyrethroid-resistant mosquito populations. Without adequate tools to protect against resistant mosquito populations, the global community risks a reversal in the malaria prevention gains made to date.

Recommendations: The global community, including WHO, countries, and donors, must urgently work to develop a clear path to market to support investment in innovative vector control LLINs, specifically through (a) rapid development of WHO regulatory accreditation systems for IRM LLINs, (b) clear guidelines and capacity investments in insecticide resistance monitoring and assessment, and (c) donor policies and programs to promote access to IRM products.

[7]Among the 12 nets recommended by WHOPES.

[8]RBM Global Malaria Action Plan (http://www.rbm.who.int/gmap/a5.html).

Secondary recommendations:

IV. Employ strategic procurement practices to maintain a competitive supply base

Many LLIN purchasers do not adequately employ strategic procurement practices such as splitting large orders among multiple suppliers, high-quality multiyear forecasts to provide demand visibility, and/or framework agreements with suppliers. This inhibits suppliers' ability to plan production capacity effectively and has historically resulted in price spikes of as much as 15 percent and increased lead times.

Recommendations: Purchasers should strengthen strategic procurement practices in order to support efficient marketplace functioning and minimize pricing and availability issues. Simultaneously, suppliers should also pursue channels to diversify their purchaser base beyond the current public-sector buyers (see V below).

V. Diversify the LLIN consumer base beyond the three major donors

As noted above, the LLIN market is over 90 percent publicly funded and relies primarily on three major donors: the Global Fund, PMI, and the World Bank. In the current environment of significant funding volatility, supplier reliance on a limited donor purchaser base exacerbates sustainability and production planning challenges. There is also an increased emphasis within the global malaria community on identifying alternate continuous replacement channels to supplement mass campaigns in order to maintain coverage gains and promote a sustainable net culture in Africa. This includes donor-funded channels as well as consumer "pull," or retail, channels.

Recommendations: Suppliers should continue to actively pursue creative channels to diversifying their purchaser base beyond the current public-sector buyers (i.e., by exploring select retail channels in both sub-Saharan Africa and Southeast Asia, partnering with multinational corporations on workplace programs, etc.). A detailed exploration of this issue is outside the scope of this report, though it merits mention given its importance to securing a diverse purchaser base as well as sustainable continuous replacement strategies to achieve malaria prevention goals.

VI. Build an in-country evidence base to evaluate the drivers of net use

Net use rates (defined as use when a net is available within a household) directly correspond to health outcomes and VFM. Though recent findings in the WHO *World Malaria Report 2011* indicate that the net use rate is approximately 96 percent, further work is required to build a robust evidence base around what specific factors (e.g., social, personal comfort, and preference) drive use versus nonuse at the country level. This analysis can ensure that program and commodity purchasing decisions optimize health outcomes and overall VFM.

Recommendations: Countries should continue to build a robust evidence base around what specific factors drive net use. This evidence should also be used to support future iterations of the VFM in LLIN Specifications Guidance to ensure that program and commodity purchasing decisions optimize health outcomes and overall VFM.

Abbreviations and Acronyms

ACT	Artemisinin-based Combination Therapy
AI	Active Ingredient
ALMA	African Leaders Malaria Alliance
AMP	Alliance for Malaria Prevention
BCC	Behavior Change and Communication
DFID	(UK) Department for International Development
DHS	Demographic and Health Surveys
GPIRM	(WHO) Global Plan for Insecticide Resistance Management
GSM	Grams per Square Meter
IRM	Insecticide Resistance Management
IRS	Indoor Residual Spraying
IVCC	The Innovative Vector Control Consortium
JSI	John Snow Inc.
kPA	Kilopascals
LLIN	Long-lasting Insecticide-treated Bed Nets
MDC	(Global Fund) Market Dynamics and Commodities Committee
MDG	Millennium Development Goals
MERG	(RBM) Monitoring and Evaluation Reference Group
MICS	Multiple Indicator Cluster Surveys
MIS	Malaria Indicator Survey
MoH	Ministry of Health
NGO	Non-governmental Organization
NMCP	National Malaria Control Program
PMI	(U.S.) President's Malaria Initiative
PQR	(Global Fund) Price and Quality Reporting Tool
R&D	Research and Development
RBM	Roll Back Malaria
R4D	Results for Development Institute
TFM	(Global Fund) Transitional Funding Mechanism
UNICEF	The United Nations Children's Fund
USAID	United States Agency for International Development
USD	U.S. Dollars
VCAG	(WHO) Vector Control Advisory Group
VCWG	(RBM) Vector Control Working Group
VFM	Value for Money
VPP	(Global Fund) Voluntary Pooled Procurement Mechanism
WHO	World Health Organization
WHO GMP	World Health Organization Global Malaria Program
WHOPES	World Health Organization Pesticide Evaluation Scheme
WWARN	Worldwide Antimalarial Resistance Network

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Expanding Access to LLINs: A Global Market Dynamics Approach

1. Project Background

In June 2011, R4D, with support from the Bill & Melinda Gates Foundation, launched a market dynamics project to analyze opportunities in and drive actions to improve the global marketplace for LLINs.

About Market Dynamics

"Market dynamics" are defined as the interrelation of market structure (actors and products), actions (financing, innovation, and transparency), and outcomes (price, supply, quality, and sustainability).[9] Suppliers, buyers, and other market players can determine outcomes within the market structure, and potentially change that structure, through their actions. Positive market dynamics outcomes, which can be achieved through deliberate strategic action, ensure that populations have timely access to affordable, high-quality, and sustainable supplies of products that meet their needs.

Project Scope

The project scope focused exclusively on market dynamics opportunities to achieve greater efficiencies in the global LLIN marketplace. Though important, other key LLIN issues, including local production, in-country distribution strategies, and financing strategies, are outside the scope and parameters of this project.

The project as it was designed and commissioned focused heavily on the role of major LLIN donors in achieving VFM objectives. Given that the market is over 90 percent donor funded, these organizations play an important role in establishing the policies and incentives that inform the overall marketplace. Therefore, the issues and recommendations in this report are oriented toward the largest LLIN donors, though other actors—including LLIN purchaser countries, manufacturers, global normative bodies such as the WHO, procurement agencies, and others—play critically important roles in securing a healthy and efficient marketplace.

Methodology and Approach

This report relies on a range of evidence from public and private sources and stakeholder interviews. The report draws conclusions based on R4D analyses of LLIN procurement data and extensive interviews with stakeholders from multiple levels of the marketplace—demand (countries), supply (manufacturers), and global intermediaries (donors, normative bodies, NGOs, etc.). In total, 144 individuals from 56 public and private organizations were consulted for this analysis.

[9]McKinsey & Company, Market Dynamics and the Global Fund: Background Research and Analysis, 2006.

2. LLIN Market Deep Dive

2.1 Market Landscape

Demand and Financing

Due in large part to the successes of recent global efforts to achieve universal coverage, the LLIN market has grown rapidly, from 5 million nets in 2004 to 130 million nets in 2011.[10] Approximately 560 million LLINs[11] will be required through 2015 alone in order to achieve and maintain universal coverage. While extremely important, the significant costs associated with scale-up and ongoing replacement needs for universal coverage present challenges in a resource-constrained environment. These constraints further emphasize the critical importance of optimizing VFM to ensure ongoing progress toward universal coverage.

According to expert estimates, over 90 percent of LLIN purchases are publicly funded. The major donors in the market are the Global Fund, PMI, and the World Bank. Based on an African Leaders Malaria Alliance (ALMA) analysis of projected global financing, there is a 40 percent financing gap[12] through 2014 of the total needed to meet and achieve universal coverage in sub-Saharan Africa.

Supplier Landscape

The number of suppliers recommended by WHOPES has increased from 3 in 2007 to 10 in 2011. There are three types of net materials on the market today: polyester, polyethylene, and polypropylene (see Table 1).

Despite the diverse supplier base, market share is highly concentrated between two suppliers—Vestergaard Frandsen and Sumitomo Chemical[14]—which account for approximately 75 percent of the Global Fund and PMI-financed market.[15]

Price Trends and Production Capacity

Historical pricing data from the Global Fund and PMI show a downward pricing trend since 2007. The average price of the "standard" 190x180x150 cm net, which accounted for approximately 45 percent of purchases in 2009/10, declined by $1.52 (29 percent) between 2007 and 2011, with $0.53 of this decline occurring between 2010 and 2011.[16,17] (See Figure 2.)

Table 1. WHOPES-recommended suppliers

Net Material	Supplier
Polyester	Yorkool International Co. Vestergaard Frandsen BASF Tana Netting Co. Ltd.
Polyethylene	Sumitomo Chemical Co. Ltd.[13] Bestnet Europe Ltd. Clarke Disease Control Technologies V.K.A. Polymers Pvt Ltd
Polypropylene	Bayer Crop Science

[10]Net Mapping Project data.

[11]John Milliner "Achieving Universal Coverage" presentation, November 2011. Forecast based on Net Mapping Project data, Roll Back Malaria (RBM) country roadmaps, and Albert Kilian net loss rate assumptions.

[12]ALMA analysis of funding gap for 2012-2014. This includes both committed funding as well as expected funding from Global Fund, PMI, DFID, World Bank, country funding, and other sources. It should be noted, however, that this excludes funding via the Global Fund Transitional Funding Mechanism (TFM) given that financing decisions had not been made at time of publication.

[13]Includes A-Z Textile Mills.

[14]Includes A-Z Textile Mills.

[15]R4D analysis. Data sources: Global Fund PQR and PMI, 2010.

[16]Additional price declines in the second half of 2011 have been reported by suppliers and purchasers, however, data for analysis is not available given lags in data reporting.

[17]Pricing analysis in the WHO World Malaria Report 2011 is consistent with this downward trend.

Figure 2. Weighted average LLIN unit price in USD (190x180x150 cm)[18]

# of WHOPES-recommended suppliers				
3	6	6	7	10

A similar price pattern holds when looking at the top five net sizes by purchasing volume, which in aggregate has seen a weighted average price decline of 24 percent in the past three to five years (see Table 2).

The steady price decline from 2007 to 2010 is generally attributed to the dramatic increase in purchased LLIN volumes combined with increased competition as more suppliers entered the market. The more significant price declines in 2011, however, were reportedly driven by excess supplier production capacity after the scale-up in 2010 to meet universal coverage targets coupled with the entrance of "equivalence" suppliers into the market.[20,21]

In 2009, following the September 2008 Millennium Development Goals (MDG) Malaria Summit, the global community embarked on a major initiative to reach universal coverage targets by 2010. The success of

Table 2. Weighted average LLIN unit price (USD) for top five net sizes by purchase volume[19]

Net Size/shape[b]	% of purchases	Weighted average LLIN prices (USD)[a]					% change in price Initial year–lasted year
		2007	2008	2009	2010	2011	
190 x 180 x 150 – R	40%	$5.25	$4.62	$4.51	$4.26	$3.73	-29%
160 x 180 x 150 – R	13%		$4.42	$4.23	$4.19	$4.56[c]	-5%
190 x 180 x 180 – R	5%		$5.66	$5.52	$4.77	$3.84	-32%
1250 x 65 x 250 – C	3%		$6.90	$7.24	$6.96	$6.18	-10%
160 x 180 x 170 – R	2%		$4.83		$3.75	$3.19	-34%
						Weighted average change in price	**-24%**

Notes: (a) Includes only data for which shipping costs are reported separately (68% of total procurements) to ensure prices reflect pure LLIN costs. Top 5 net sizes were selected from this subset of data, therefore some net sizes with greater volumes may not be represented here due to data limitations. (b) R = rectangular, C = conical. (c) Excluded from calculations: based on a single order.

[18]R4D analysis. Data sources: Aggregated Global Fund PQR and PMI data. Global Fund PQR data includes only entries with 'Shipping reported separately' and was accessed Dec 2011, though 2011 data was incomplete due to reporting lag, and PMI data is complete through Dec 2011.

[19]R4D analysis. Data sources: Global Fund PQR and PMI, 2007-2011.

20Interviews with WHOPES-recommended LLIN suppliers.

21The WHOPES equivalence process can be considered analogous to that of generic drugs (See further detail in section 2.2.2). One equivalence supplier entered in 2010 and two in 2011.

this effort led to a surge in LLIN procurement in 2009, with volumes increasing by nearly 50 percent.[22] LLIN supplier capacity was not able to keep pace with demand during this time, resulting in price spikes of as much as 15 percent[23] and increased lead times. Following the capacity crunch in 2009, suppliers scaled up production significantly at the urging of the global community.

In 2011 purchased volumes declined by approximately 20 percent from the prior year,[24] as the push for universal coverage drew to a close and countries shifted to replacement strategies, while donors faced increasing resource constraints. At 2011 capacity levels, supply far outstripped demand (see Figure 3). Excess capacity likely contributed to 2011 price wars between suppliers to win orders and keep production facilities running. The implications of excess capacity and other production planning challenges are discussed further in section 2.3.2.

2.2 Primary Issues

R4D has identified the following primary issues in the LLIN market.

2.2.1 Cost-Effectiveness

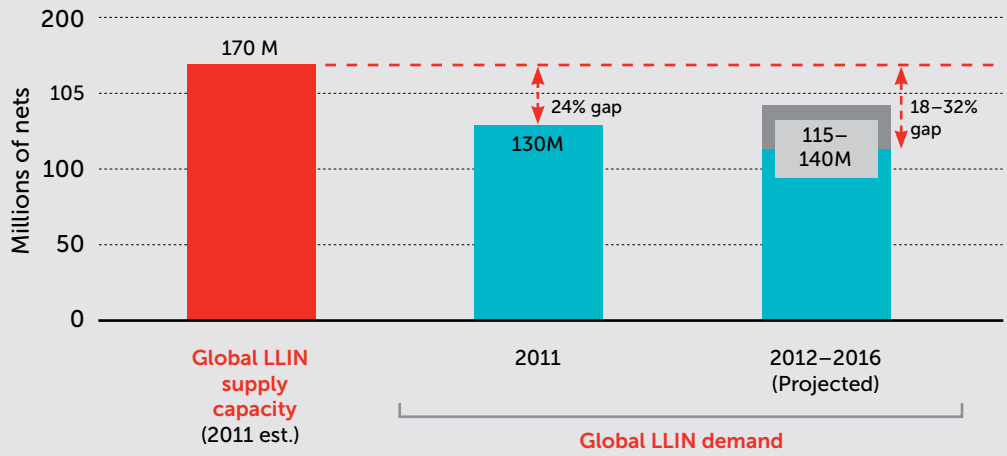
LLINs account for the largest share of most malaria program expenditures.[28] Therefore, increasing cost-effectiveness in LLIN purchases by optimizing product selection relative to price, net performance, lead time, and usage benefits presents a key lever to increase VFM. Donor policies that reward both price and net performance also align market incentives for suppliers to invest in improving performance.

The issues that hinder cost-effective LLIN procurements today are:

Price-focused procurement: Global experts agree that there are differences in how long nets last in the field (durability), which is a central element of net performance. However, currently nets are purchased on the basis of lowest price rather than an evaluation of cost-effectiveness considering both price and performance. This price-focused approach both reduces overall VFM and creates market disincentives for manufacturers to invest in net performance improvements and innovation. Current barriers to cost-effective purchasing include a lack of clear, internationally reputed guidance on net durability coupled with price-focused donor procurement policies.

Fragmented product demand: Currently, there is a high degree of fragmentation among net specifications (200-plus listed supplier offerings, with approximately 25 commonly purchased variants). Certain product outliers (i.e., irregularly sized nets, highly specialized packaging) generate significantly increased costs and lead times without corresponding benefits for usage.

Figure 3. Annual supplier capacity versus demand[25,26,27]



[22]Net Mapping Project data; Sub-Saharan Africa only.

[23]Selected orders from PQR data in late 2009; Context provided by interviews with WHOPES-recommended LLIN suppliers.

[24]Net Mapping Project data.

[25]Interviews with WHOPES-recommended LLIN suppliers.

[26]Net Mapping Project data.

[27]R4D analysis. Data sources: Global Fund PQR and PMI, Net Mapping Project, UN World Population Prospects, Albert Kilian estimates on rate of net loss.

[28]WHO, World Malaria Report, 2011.

"WHOPES provides an important quality standard, but there's no immediately available guidance on net performance. We see in the field and hear from experts that there are real differences among nets and how long they last, among other factors. We'd like to incorporate this to get highest possible value."

—HIGH-BURDEN COUNTRY MOH

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Issue 1: Price-Focused Procurement

Global experts and country users increasingly recognize that there are differences in how long different nets last in the field, which is as a core element of performance. Information on net performance, when taken in tandem with net price, should form the basis for analyzing the cost-effectiveness of a net.[29] However, currently there is no internationally reputed guidance on how long nets last, nor are there donor incentives in place for countries to procure the most cost-effective nets. This has led to a focus on purchasing nets on the basis of lowest price, significantly reducing VFM in LLIN procurements.

A first barrier to establishing cost-effective LLIN procurement is the lack of current guidance to help donors and countries determine how long LLINs last in the field. Global experts increasingly recognize that there are differences in net performance even among the 12 LLIN products recommended by WHOPES.[30] WHOPES currently sets critically important minimum standards for LLINs, but guidance beyond that minimum does not exist, especially as it pertains to the durability of nets.[31] These nets have significant variability across a number of physical characteristics[32] that textile experts have indicated can significantly affect the life of a net in the field. The WHO has recently issued *Guidelines for monitoring the durability of LLINs under operational conditions*, which will likely yield long-term durability data in three or more years but with potentially significant limitations.[33]

A host of organizations—including many major donors, countries, manufacturers, and global experts—are urgently calling for near-term guidance on net performance from an internationally credible third-party normative institution. In October 2011 the Global Fund's Market Dynamics and Commodities Committee (MDC) in its Report to the Board stated that "data [on] LLIN durability is critical and urgent," calling for the WHO to work with partners, including potentially the textiles industry, to "[rapidly] develop durability guidance…to enable comparative cost-effectiveness analysis." R4D has been engaging closely with the WHO GMP as it develops a consortium of partners, including textile and field experts, to develop near-term guidance to address this barrier.

A second key barrier is that current LLIN procurement policies focus on price[34] instead of a holistic measure of cost-effectiveness (see Box 1). This price focus implicitly suggests that all WHOPES-recommended products should be considered equal, when in fact the WHO explicitly states that that "by recommending two products, WHOPES does not imply that they are identical, it only implies that they both meet the [minimum] performance criteria."[35]

The current procurement policies also hinder supplier incentives to produce more durable nets by failing to reward investments in improved performance and quality. Suppliers acknowledge that improvements could be made to existing nets, such as reinforced borders to protect the bottom of the net. However, these improvements can directly increase raw materials costs, and hence price. Given this, the price-focused

[29]Among the 12 nets recommended by WHOPES.

[30]WHOPES, WHO recommended long-lasting insecticidal mosquito nets, updated July 2011 (http://www.who.int/whopes/Long_lasting_insecticidal_nets_Jul_2011.pdf).

[31]There is general consensus among experts that the limiting factor today in net life is the physical durability of the net, rather than the insecticide concentration.

[32]For example, polymer, denier (a measure of material density), mesh count, hole shape, weave, and other factors.

[33]While this represents an important step, experts have expressed that the limitations of this approach include the following: (1) data will be collected only in the subset of countries that elect to pursue these studies with their existing resources; (2) it will evaluate only the 3 to 4 nets that are currently widespread in the field (of the 12 WHOPES-recommended nets); and (3) it does not include a mechanism for prospectively evaluating new nets that come to market, which may discourage innovation.

[34]As well as lead time, which should continue to be included in procurement decisions.

[35]WHO, A system to improve Value for Money in LLIN procurement through market competition based on cost per year of effective coverage: Concept Note, 2011.

Box 1. Illustration of issues in price-focused procurement system

Net B is 7 percent less expensive on a price per net year basis but would be considered more expensive in the current unit price–focused tendering system.

Evaluation of net price only

WHOPES-Recommended Product	Unit Price	Average Net Life in Years	Unit Price Per Net Year
Net A	$3.50	2.8	$1.25
Net B	$3.75	3.2	$1.17

This is amplified when considering the "fully loaded" cost of a net, including shipping and distribution, which often make up approximately 40 percent[36] of the total cost to procure and deliver a net. By not incorporating these costs in evaluation processes, net decisions may undervalue products with a longer life cycle.

Evaluation of fully loaded costs

WHOPES-Recommended Product	Same unit price and average net life as above	Shipping & Distribution Cost	Fully Loaded Cost per Net	Fully Loaded Cost per Year of Net Life
Net A		$2.25	$5.75	$2.05
Net B		$2.25	$6.00	$1.88

awards can generate incentives for suppliers to focus on meeting minimum standards rather than investing in performance improvements. Relatedly, these policies can also disincentivize supplier investment in R&D for future innovation relating to improved net performance since the benefits of new net technologies are not rewarded under current policies (see section 2.2.2 for further discussion).

"As a supplier, we have no incentive to produce longer-lasting nets or invest in new technologies which extend net life. The current system doesn't reward us for doing so and in fact, punishes manufacturers that make investments or pay more in material costs to achieve this." —LLIN SUPPLIER

Creating policies that direct purchasers to evaluate the cost-effectiveness of the varied net products on the market represents an opportunity that could yield potential savings of $270 million to $340 million globally over five years,[37,38] even assuming no LLIN innovations that extend net life. Other experts have cited potential savings of up to $1 billion over five years if policies encourage LLIN innovation—for example, by spurring development of LLINs that last an average of five instead of three years.[39]

Issue 2: Fragmented Product Demand

LLIN specifications today are highly fragmented across color, shape, size, packaging, labeling, and accessories, among other factors. Maintaining a wide range of net specifications is essential to ensure net usage, which is critically important for both end-user benefits and VFM, as discussed in section 2.3.1 However, there is a limited subset of low-VFM specifications where the costs of differentiation (i.e., prices, lead time) are high, but evidence of usage benefits is low. There is currently no global guidance on the VFM of various net specifications, nor are there donor incentives in place for countries to choose more cost-effective LLIN specifications, resulting in significantly increased costs and longer lead times associated with procurement of low-VFM nets.

[36]R4D analysis. Assumes 2011 average price for standard 190x180x150 net according to Global Fund PQR data and PMI data; Average shipping and handling costs per UNICEF-UNITAID 2010 Report; Average distribution costs per RBM Harmonization Working Group "Scale up costing" file, 2010.

[37]R4D model of market impact over five years with the following inputs and data sources: (1) Volume of nets required to meet and maintain universal coverage (Net Mapping Project data, Albert Kilian estimates on rate of net loss, UN World Population Prospects data); (2) LLIN durability scenarios (interviews with suppliers and technical experts); (3) Supplier production costs (confidential interviews with suppliers); (4) LLIN prices and shipping and distribution costs (Global Fund PQR data and PMI data, UNICEF-UNITAID and RBM Harmonization working group data).

[38]Range presented assumes 80-100 percent funding availability to meet universal coverage and continuous replacement of nets.

[39]RBM VCWG Work Stream Durability of LLINs in the Field "Summary of presentations, discussion and consensus" presentation, February 2012.

"It's difficult to weigh the need for product features with the additional costs since we don't have enough information on either side. We don't always know how a specification will affect pricing and lead times, and we don't know how certain features will affect usage—and there are no global information resources on this."

—NATIONAL MALARIA CONTROL PROGRAM (NMCP) OFFICIAL

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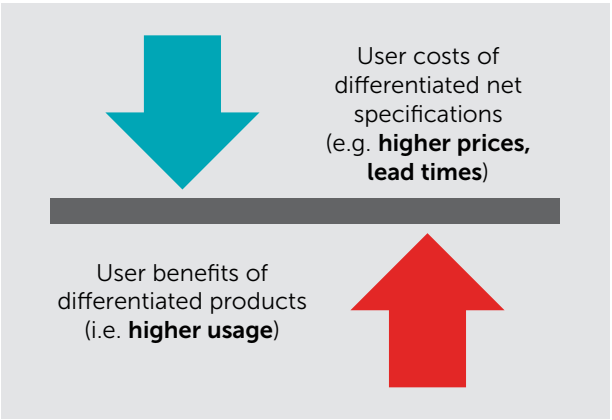
The first barrier to rationalizing net specifications is the lack of clear guidance on what constitutes preferred VFM specifications when weighing both costs and end-user benefits. There are currently over 200 variations in LLIN specifications available on the market, including over 10 colors and 20 sizes and shapes, with a wide variety of packaging and labeling options. Among these, approximately 25 specifications represent the most commonly purchased products globally.[40] Given the wide variety of options, in the absence of global guidance it is difficult for countries to evaluate the costs against usage benefits for each specification.



A second major barrier is that current donor policies and incentives are not well aligned to encourage optimal product selection at the country level. Currently, countries receive full funding for any of the 200-plus LLIN specifications. Review of LLIN product selection—beyond ensuring WHO-recommended products—is not typically included in donor funding review and approval processes.

A select set of exceptional specifications seem to be leading to significantly higher costs and longer lead times with limited documented evidence of increased user benefit. These targeted specifications include the following[41]:

Nonstandard sizes: Nonstandard net sizes, specifically those over 170 cm in height, add a $0.79 price premium per net.[42]

Individual packaging in mass distribution campaigns: Individual packaging adds an $0.11 price premium per net[43] and is typically discarded prior to distribution in mass distribution campaigns—also creating significant waste management issues.

Customized labeling/artwork: Highly customized artwork on net packaging[44] (e.g., the president's portrait) can increase lead times by four to six weeks while adding a small price premium per net.[45]

Moving away from these specifications would still allow end users wide choice to select LLINs that work optimally in their settings, including up to 70-plus listed offerings. Reducing fragmentation in these targeted specifications represents an opportunity that could save up to $290 million for the global community over the next five years while decreasing lead times by up to four to six weeks (see Figure 4).

Nonstandard Sizes

Size is currently one of the greatest sources of product fragmentation in the net market, with over 20 different

[40]R4D analysis. Data source: Global Fund PQR and PMI data, 2010; Includes 8 sizes and 3 colors.

[41]Net accessories such as hooks and strings can also add significant cost; however, further investigation is required to determine whether end-user benefit balances the cost.

[42]R4D analysis. Data source: Global Fund PQR and PMI data, 2010.

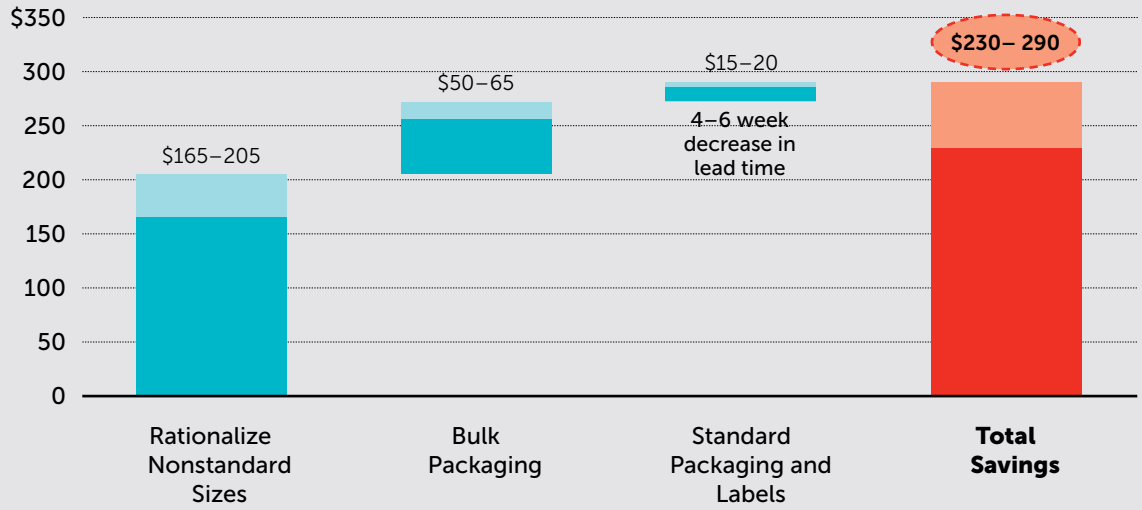
[43]Interviews with WHOPES-recommended LLIN suppliers; Suppliers cite an $.11 cost premium which is passed on directly as price.

[44]Beyond a standard country flag or logo for tracking purposes, which should be specified in the tender.

[45]Price premium of ~$.03 according to supplier discussions.

[46]Range presented assumes 80-100% funding availability to meet Universal Coverage and continuous replacement of nets.

Figure 4. Rationalizing net specifications: five-year global savings (millions USD)[46]



net shapes and sizes procured in 2010 alone.[47] A subset of these net sizes are driving increased costs—specifically nets taller than 170 cm in height, which command an average price premium of $0.79. This represents a 20 percent price premium above a standard-sized net. The higher price of these nets is driven by two factors: (a) the cost of the additional raw material required to produce larger nets and (b) decreases in factory efficiency, since increasing the height of a net beyond 170 cm[48] requires production line changes, given standard knitting machine settings and widths. There is very limited research and data-driven evidence that oversized nets increase adoption and usage among the population.[49,50,51,52,53,54]

Individual Packaging in Mass Distribution Campaigns

During mass campaigns, the individual net packaging is often removed prior to distribution. As noted in a number of country interviews, this practice is undertaken to prevent leakage; however, it creates significant waste disposal issues and environmental concerns. Furthermore, it adds an $0.11 cost for a package that is discarded. Discussions with suppliers have indicated that it would be feasible to move to bulk packaging for mass campaigns, i.e., packing 40 nets to a bale.[55] Uganda—one of the largest-volume country purchasers of LLINs—undertook this approach in 2011 for a recent campaign (see Box 2). It is important to note that while bulk packaging is optimal for mass distribution campaigns where individual packaging is typically discarded, individual packaging should be maintained for other routine distribution channels.

Additionally, when pursuing bulk packaging, it is important that countries ensure appropriate distribution of safety and usage information to the end user[56] as well as appropriate worker safety practices for individuals who distribute nets.

[47]Global Fund PQR data and PMI data.

[48]Though knitting equipment varies, newer knitting machines can often produce four rolls at a time up to 170cm (the net height); taller nets reduce the machine's capacity from four rolls to three rolls, reducing production efficiency. In some cases, this cut-off can be 150 cm. However given that the pricing data available does not reflect a price premium between 150 to 170cm tall nets, a 170cm threshold is presented here.

[49]Pulford et al, Reported reasons for not using a mosquito net when one is available: a review of the published literature, Malaria Journal, April 2011.

[50]Baume and Franca-Koh, Predictors of mosquito net use in Ghana, Malaria Journal, Sept 2011.

[51]Banek et al, Evaluation of Interceptor LLINs in eight communities in Liberia, Malaria Journal, March 2010.

[52]NetMark Research (www.netmarkafrica.org/Research/).

[53]Discussions with field experts and behavior change and communication (BCC) experts.

[54]It is important to note that while users may have preferred specifications if given a choice, these preferences do not necessarily indicate that a user will not use a free net that falls outside of these preferences. End-user preferences around net specifications may become more important in the future however if a consumer retail market becomes a channel in continuous net distribution strategies.

[55]The number of packed nets per bale may vary by product and supplier.

[56]These channels could include a leaflet that is distributed with the net and/or social marketing posters in public community locations; suppliers have indicated strong support for these alternate approaches.

Box 2. Uganda case study: Benefits of bulk packaging

In 2009, Uganda's NMCP was in the process of planning for its largest universal coverage campaign, which would aim to distribute over 17 million nets to the country's population. The campaign would be split into two phases—initially targeting pregnant women and children under the age of five and then the rest of the populace to reach the desired universal coverage outcome. To achieve this massive undertaking and make most efficient use of the resources allotted, the NMCP decided to bulk package the nets instead of ordering individual net packaging.

"Given the large scope of our campaign, we had to be resourceful in how we spent our money. One strategy was to bulk package the nets. By doing so, we saved approximately $700,000 in just our first phase, which allowed us to purchase additional nets. We didn't feel the individual packaging was worth the additional cost." —NMCP OFFICER

In addition to saving money, the bulk packaging created a more efficient process at distribution points. "It's our policy to tear off the packages to deter recipients from reselling the nets. Having the nets bulk packaged sped up our process and made the distribution more efficient," stated a field-implementing partner.

Uganda's NMCP also noted that the production and disposal of the individual plastic bags were key considerations in its decision: "We didn't want 17 million plastic bags floating around out there. The individual packages seemed unnecessary in our process, and our staff was concerned by the disposal and impact on the environment."

Customized Packaging and Labeling

Donors and countries often request highly customized artwork (e.g., a picture of the head of state) on the packaging and/or net label. Although this results in a limited increase in unit costs (approximately $0.03), these customized requirements create significant delays in delivery, often increasing lead times by up to four to six weeks.[57] This additional lead time can be a determinant of whether LLINs are delivered in time for the rainy season or not. Suppliers cite that these delays occur because countries typically do not provide the artwork specifications in the tender document, and highly customized specifications can require numerous back-and-forth communications. Customized labeling can also lead to significant inventory management challenges for suppliers by reducing the fungibility of stocks.[58]

Experts indicate that including a country flag or standard MoH or donor logo on the package is often used to reduce cross-country leakage and is therefore important to maintain; though critically these requests should be provided at tender issue to avert delays. However, additional artwork or specialized customization on the package or the net label beyond the exceptions noted above[59] do not confer similar benefits and can increase lead times significantly.

2.2.2 Vector Control Innovation

As discussed in section 2.2.1, the current price-focused purchasing system can reduce incentives for innovation. While LLIN innovation is needed in several areas, it is most urgent to incentivize development of and enable access to effective tools to address the pyrethroid-resistance patterns rapidly emerging across Africa.

The issue that hinders vector control innovation is:

Inadequate market incentives for vector control innovation: It is imperative that the global community ensure access to effective products, rather than continue to invest billions of dollars in existing products once these become ineffective against pyrethroid-resistant mosquito populations. Lack of regulatory and policy guidelines for IRM LLINs combined with donor procurement policies may reduce current incentives for supplier investments in R&D, potentially limiting future access to efficacious products to address the threat of resistance.

Potential opportunity areas for LLIN innovation include (a) increased physical net durability to allow for longer net life in the field and reduce frequency of distribution; (b) improvements in net design, such as increased breathability or aesthetic improvements to increase usability; and (c) incorporation of new active ingredients (AIs)[60] or reformulations to address increasing pyrethroid resistance. Challenges to driving innovation in net durability are primarily linked to market disincentives, as discussed in section 2.2.1. This section focuses on insecticidal R&D given the urgent need to ensure that countries have access to the necessary tools to address the growing threat of pyrethroid resistance.

Pyrethroid-based LLINs and indoor residual spraying (IRS) have been the basis for malaria control programs to date. These interventions have enabled remarkable progress toward reduction in malaria-related morbidity and mortality;

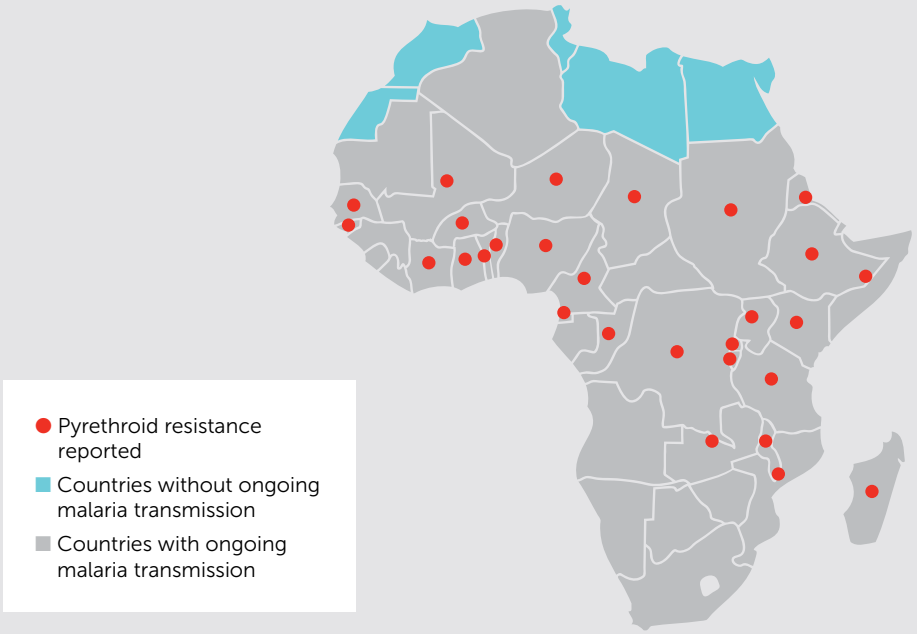
[57]Interviews with WHOPES-recommended LLIN suppliers.

[58]Suppliers face difficulties in maintaining nets in inventory if they have to retroactively sew in a new label and/or repackage based on customized specifications.

[59]And local language requirements as needed.

[60]A new insecticide with a novel mode of action that is effective against pyrethroid-resistant mosquitos.

Figure 5. African countries reporting pyrethroid-resistance in at least one malaria vector in at least one monitoring site (WHO 2011)[61]



however, widespread use of a single insecticide class has resulted in a natural cycle of resistance. The WHO *World Malaria Report 2011* states that pyrethroid resistance has been reported in 27 countries across the African continent and 41 countries worldwide (see Figure 5).

Ultimately, novel AIs with different modes of action are required to address the threat of resistance but are not projected to become available until 2020.[62] However, reformulations of existing AIs[63] may serve as an important "stop gap" in the coming years to delay the spread of resistance and preserve susceptibility to insecticides until novel AIs become available.[64] The R&D investment required to develop novel AIs, estimated to be approximately $200 million,[65] poses a significant market hurdle. The Innovative Vector Control Consortium (IVCC), a product-development partnership, has been established to catalyze the development of new vector control tools in conjunction with industry partners. IVCC's current pipeline includes several reformulations that are in late stages of development as well as LLINs with novel AIs that are completely unaffected by current resistance mechanisms.[66]

Given emerging resistance issues, significant and ongoing investment in these new technologies is critical to equip countries with LLINs that are effective in their settings. However, the absence of a clear "path to market", specifically the lack of established regulatory requirements and clear procurement systems and policies, can result in underinvestment in vitally important R&D. Three primary steps are required to develop a clear path to market for LLINs with reformulations or novel AIs:

A. **Regulatory accreditation systems for IRM products:** Currently, there are no regulatory systems or guidelines in place to define what constitutes an IRM net. Similar to the WHOPES system of providing a minimum quality standard for current nets, standards are necessary to accredit LLINs with reformulations or novel AIs. Among vector control technologies, this is especially critical for LLINs, where currently pyrethroids are the only approved class of insecticide. Manufacturers repeatedly cited the urgent importance of understanding the expected WHO standards for both reformulations and

[61]WHO, World Malaria Report, 2011; References reports from WHO regional entomologists in AFRO and EMRO; A dot indicates that resistance to pyrethroids has been reported in at least one malaria vector in at least one monitoring site. Note that map provides no indication of how widespread resistance is within a country. Countries with no insecticide resistance reported may either have no resistance, no susceptibility testing may be performed, or results of susceptibility test may be unavailable.

[62]IVCC Annual Report, 2010.

[63]Reformulations include non-pyrethroid LLINs, which use existing AIs that have been repurposed for public health use from other areas (typically agriculture) and LLINs treated with two insecticides.

[64]WHO GPIRM, 2012.

[65]RBM Global Malaria Action Plan (http://www.rbm.who.int/gmap/a5.html).

[66]IVCC Website.

"Though we are encouraged by the support of IVCC and the WHO's call to action, we have serious concerns that our investments in resistance management products today will not be rewarded in the market. We only have today's tendering system to go by; there has been no signal by donors that they will finance resistance-management LLINs, which are likely to be more expensive than existing nets."

—LLIN SUPPLIER

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novel AIs to inform the R&D process, especially as several reformulations are in late stages of development.[67] Recognizing this, the WHO has proposed the Vector Control Advisory Group (VCAG) work with WHOPES to establish criteria for evaluation for new vector control tools.

"We are investing significant resources to develop new resistance tools; however, without knowing the expected standards we are shooting in the dark. Once published, if the WHO standards set different parameters than our internal expectations this would be a real blow to our progress and investments to date." —LLIN SUPPLIER

B. **Guidelines and country capacity to determine** when a region requires IRM interventions: Though resistance is widely recognized as a concern, there is currently a lack of guidance to define at what threshold a country or region requires IRM tools. This is in part driven by the complexity of the resistance picture, including evolving and multiple forms of resistance. However, in the absence of this guidance, it is unclear in what cases donors and countries should finance procurement of these new technologies. The WHO has issued a call to action via the forthcoming Global Plan for Insecticide Resistance Management in malaria vectors (GPIRM)[68] to address this issue, among others.

C. **Donor policies to improve access to IRM technologies:** Given the significant financial investment required to develop reformulations and novel AIs, and the relatively small markets for public health insecticides, it is anticipated that LLINs using these new insecticides will also be more expensive. Some donors do not currently have clear policies in place to allow for procurement of more expensive IRM products should countries provide data demonstrating that these interventions are required (see Step B above). Though these technologies are not immediately available, it is critical that the policies of major donors signal that successful supplier investments in innovation today can be recognized in the future.

It should be noted that the WHO does not currently provide data protection for LLIN supplier information submitted via the WHOPES process. Discussions are currently under way between CropLife[69] and the WHO regarding this issue. A central topic under discussion is the WHOPES "equivalence" approval process, through which products that prove equivalence to an existing "originator" product are submitted under an expedited and lower-cost review process.[70] Originator suppliers believe that the equivalence process significantly decreases their incentives for innovation, while other experts in the community argue that these policies ensure country access to the most cost-effective products. Furthermore, some suppliers note that without data protection, competitors have access to proprietary data, which may increase the ease and speed with which equivalence products come to market.[71] These suppliers expressed particularly acute concerns on the equivalence process as it relates to IRM technologies, where inadequate data protection could be an important disincentive given the significant R&D investments required to develop reformulations and novel AIs.

[67]WHO GPIRM, 2012.

[68]Final publication expected in May 2012.

[69]Croplife is an industry association that represents manufacturers of pest control products.

[70]Interviews with supplier regulatory experts; The full WHOPES review process has three phases and costs approximately $500,000, while the equivalence review process includes only phase I of the review process, which costs approximately $50,000.

[71]In ongoing discussions, Croplife is requesting intellectual property protection for all data submitted to WHOPES for a designated number of years as well as a review of the equivalence process.

2.3 Secondary Issues

R4D has identified the following secondary issues in the LLIN market.

2.3.1 Drivers of Net Use

Higher net use rates (defined as use when a net is available within a household) translate to improved health outcomes and significantly increased VFM. As such, it is important to understand and incorporate drivers of net use in program design and purchasing decisions to maximize usage rates.

The issue that hinders incorporation of net use data in program design and purchasing decisions is:

- **Lack of robust country-level data and analysis:** Though recent findings in the *World Malaria Report 2011* indicate that the net use rate is approximately 96 percent, further efforts are required to build a robust evidence base around what specific factors (e.g., educational, social, personal comfort, structural, and preference) drive use versus nonuse at the country level. This analysis should drive improved program design and commodity purchasing decisions to optimize health outcomes and overall VFM.

Net use rates have direct implications on program successes and efficiencies. These rates are a key indicator of whether resources that are being used to procure and distribute nets are effectively driving improved health outcomes. As a simple illustrative example, if five nets are purchased and distributed to households but only four are used, this effectively represents 20 percent "wasted" resources that are not being used toward driving malaria prevention.

Use of available nets has not been historically tracked as a core indicator for evaluation. However, by using a composite analysis of country household survey data in a subset of countries, the WHO *World Malaria Report 2011* concludes that net use rates is approximately 96 percent. While this information is promising, it is important to note that the existing evidence base around reasons for nonuse (defined as lack of use when a net is available within the household) is limited. This prevents countries from identifying and undertaking activities that improve usage.

Historically, countries have relied on the following indicators recommended by the Roll Back Malaria (RBM) Monitoring & Evaluation Reference Group (MERG) and collected in the MIS, DHS, and MICS household surveys[72] as proxies for usage rates: percentage of pregnant women who slept under an insecticide-treated net (ITN)[73] the previous night and percentage of children under five who slept under an ITN the previous night. While these indicators provide a picture of how many vulnerable individuals slept under nets, the denominator in these statistics does not account for who has nets (e.g., percentage of pregnant women who slept under an LLIN the previous night in net-owning households). Therefore, it is challenging to present a clear picture of in-country net use.

Though the currently recommended core population indicators do not directly address available net use, it is possible to calculate this figure using a composite analysis of standard questions included in household surveys. Such an analysis was included in the recent *World Malaria Report 2011*, which encouragingly found that "approximately 96% of persons with access to a net within the household actually use it."[74] These findings indicate that when a person has access to a net, usage is very high, and the limiting factor is availability of nets. However, it is important to note that this reflects findings only in a subset of 15 countries studied in this report, and further efforts to both replicate these findings and undertake this analysis in a wider set of countries are required.

Though limited literature is available, usage behavior patterns seem to be driven by a number of factors, including program-related efforts targeted at increasing usage (e.g., behavior change communication activities, hang-up campaigns), social practices, the perceived threat of malaria, and personal comfort and preferences. Reported reasons for nonuse include discomfort due to perceived heat,[75] perceived low mosquito density, and to a lesser extent technical factors (e.g., difficulties in hanging the net) or social factors (e.g., the individual slept elsewhere).[76] Net specifications have not been cited as primary drivers of net nonuse,[77] with the potential exception of color in limited studies.[78]

[72]Malaria Indicator Survey (MIS), Demographic and Health Surveys (DHS), Multiple Indicator Cluster Surveys (MICS).

[73]The MERG Guidelines use the terminology ITN as inclusive of both LLINs and conventionally treated nets. Since 2007, WHO has recommended that malaria control programs and their partners procure only LLINs, and as noted in the WHO World Malaria Report 2011, the vast majority of nets being procured and distributed today are LLINs.

[74]This analysis used a composite of two statistics collected in the DHS and MIS surveys (# of nets per household and # of persons sleeping under a net the previous night) at a household level across 15 countries to determine usage rates amongst persons with access to a net.

[75]Though limited literature is available, a review indicates that the most commonly reported reason for nonuse is discomfort primarily due to heat.

[76]Pulford et al, Reported reasons for not using a mosquito net when one is available: a review of the published literature, Malaria Journal, April 2011.

[77]Especially in the environment of free net distribution where the options are to use the net provided or not use one at all, this has not historically been a driving factor.

[78]In a literature review of 15 studies, only 1 identified colors as a driver of use (Baume and Franca-Koh, Predictors of mosquito net use in Ghana, Malaria Journal, Sept 2011).

More can and should be done to consistently measure nonuse in communities, understand drivers of this, and actively incorporate this information into program and procurement decisions. Additionally, this information can be used to inform future iterations of the VFM in LLIN Specifications Guidance as discussed in section 2.2.1 to optimize health outcomes and overall VFM in procurement decisions.

2.3.2 Sustainability

As discussed in section 2.1, though there are 10 WHOPES-recommended suppliers, two suppliers[79] maintain approximately 75 percent market share.[80] Reversion to an overly concentrated supplier market with a limited number of suppliers may lead to increased prices and availability issues. Therefore, it is important to take measures to maintain a diverse, sustainable, and competitive supplier base with efficient production to secure affordable and reliable availability of LLINs.

The issues that hinder supply base sustainability are:

- **Production planning challenges:** Many LLIN purchasers do not adequately employ strategic procurement practices such as splitting tenders, high-quality multiyear forecasts, and/or framework agreements. This inhibits suppliers' ability to plan production capacity effectively, which can ultimately lead to increased prices and longer lead times. These challenges are exacerbated by reliance on three major donors—the Global Fund, PMI, and the World Bank—in an environment with significant funding volatility.
- **Downward pricing pressure:** Prices have declined steadily since 2007, in part due to the natural effects of increased competition. However, with the increased downward pricing pressure in 2011, prices may be reaching unsustainable levels for some suppliers if the trend continues.

Issue 1: Production planning challenges

Suppliers have universally cited production planning challenges given current donor procurement practices coupled with global LLIN funding volatility. Manufacturers are almost exclusively reliant on three public-sector purchasers but face limited demand visibility given donor shifts in overall funding availability and prioritization of LLIN funding relative to other health interventions. Furthermore, with the exception of UNICEF, few major purchasers and countries regularly undertake strategic procurement practices such as advanced volume indications or framework agreements to improve demand visibility.

These challenges have historically led to demand being significantly over or under supplier capacity, resulting in price spikes of as much as 15 percent[81] and longer lead times. The capacity crunch of 2009 versus the excess capacity situation of 2011 (see section 2.1) underscores the supply challenges posed by significant funding volatility. In 2009 there was a global push to reach universal coverage targets by 2010, with volumes increasing by nearly 50 percent.[82] Suppliers were unable to scale up in time, resulting in insufficient supply to meet demand. Purchasers were either faced with increased lead times or had to pay a price premium to acquire nets on an expedited timeline.

Following the capacity crunch, suppliers scaled up at the request of the global community to meet universal coverage targets; however, this resulted in an excess of capacity in 2011, given declining demand. This excess capacity can have negative consequences for both suppliers and the market overall, since it leads to higher per net production costs. Some suppliers are now seeking to reduce 2012 capacity through the closing of production facilities.

> *"We increased our production capacity by 50% at the end of 2009 at the strong request of the global community. However, today in 2011 order volumes have decreased dramatically. We are currently selling our nets for a loss to stay competitive, but this is still better for us than halting production, which incurs significant costs. We can scale down if needed; however, frequently adjusting our production capacity is also an expensive exercise. We'll absorb this loss in the short term given our strong commitment to vector control but this is not a sustainable business model for us."* —LLIN SUPPLIER

Production planning challenges are exacerbated by the fragmentation in net specifications discussed in section 2.2.1, since it limits suppliers' ability to produce and hold standard stock, which can be deployed in various

[79]Vestergaard Frandsen and Sumitomo, which includes A-Z Textile Mills.

[80]R4D analysis. Data sources: Global Fund PQR and PMI, 2010.

[81]Selected orders from PQR data in late 2009; Context provided by interviews with WHOPES-recommended LLIN suppliers.

[82]Net Mapping Project data; Sub-Saharan Africa only.

"While our senior management supports our commitment to address the global public health need, we simply cannot stay in this business if we are losing money. We're seeing tenders that are won for below $3.00 per net today. If this trend continues we will have to exit the market." —LLIN SUPPLIER

settings. Faced with uncertain future orders, suppliers are either forced to stop production lines between orders or produce standard stock, which they may or may not be able to sell depending upon future tender specification requests. Both of these practices result in additional costs for suppliers, which are ultimately passed on in the final LLIN selling price and can create an unsustainable market for suppliers.

"We have three million nets we produced during downtime sitting in a warehouse; we have to hope that orders will be placed for nets with these specifications. Moreover, if there are specialized labeling requirements it means we'll have to re-sew labels on each of these nets. These practices are unsustainable and will ultimately drive us out the LLIN business." —LLIN SUPPLIER

Lack of demand visibility generates a 'negative cycle' preventing smaller suppliers from gaining share

Smaller suppliers don't scale up capacity due to unknown ability to achieve return on investment...

...and are unable to bid on large tenders, remaining relatively small players

These production planning challenges are particularly acute for smaller suppliers, given their limited capacity. Several small suppliers indicated that they can only bid on orders up to approximately 500,000 nets, given the standard lead time, yet 70 percent of Global Fund– and PMI-funded LLIN purchases by volume in 2009/2010 were orders for more than 500,000 nets.[83] In the absence of splitting tenders or other mechanisms such as dividing large orders into smaller "lots,"[84] small suppliers are frequently excluded from bidding on higher-volume tenders. Furthermore, without guaranteed orders (e.g., via volume guarantees or framework agreements), small suppliers are hesitant to make substantial investments in scale-up. This leads to a negative cycle in which small suppliers cannot scale up capacity without firm orders, yet cannot be awarded these orders unless they scale up capacity. This negative dynamic is a key reason that the supply base has remained so highly concentrated.

Some suppliers are increasingly recognizing the need for a diversified consumer base beyond the current public-sector buyers. For example, in October 2011 Sumitomo Chemical launched Olyset Classic into the retail market in Kenya, where it is now available in supermarkets and other shopping channels nationwide.[85] In 2011 Bestnet introduced Logo Nets, through which both public sector and major private-sector organizations (e.g., mining, oil, and soft drink companies) can donate nets with their printed logos on them. Additionally, in 2012 Bestnet plans to introduce "Football" nets, with national team colors and an image of a football, into retail channels across Sub-Saharan Africa.[86] However, suppliers face significant challenges selling retail public-health products to the target consumer market. As documented for both LLINs and preventive public healthcare products such as deworming treatments and disinfectants, charging even

[83]R4D analysis. Data sources: Global Fund PQR and PMI, 2009 and 2010.

[84]Though VPP (via PSI) permits suppliers to bid on lots within a large order (i.e. a 2 Million net order will have four lots of 500,000), anecdotal evidence indicates that typically one of the two large suppliers will win all lots in an order.

[85]Sumitomo Chemical website.

[86]Bestnet website.

Box 3. Variation in physical properties among WHOPES-recommended nets[87]

As noted in section 2.2.1, the WHO has stated that "by recommending two products, WHOPES does not imply that they are identical, it only implies that they both meet the [minimum] performance criteria."[88] As presented below, there is wide variation in required physical properties (or specifications) among WHOPES-recommended nets.

There are currently eight specifications among WHOPES-recommended nets, which are determined based on unique combinations of fiber type and AI. The table presents the key physical properties of WHOPES-recommended nets, and a brief explanation of each term is provided below.

- **Bursting strength:** Bursting strength is a metric WHOPES uses to evaluate net strength as determined by a lab test. WHO guidelines state that the minimum bursting strength for any acceptable net must be no less than 250 kPa.[89]

Denier: Denier is a unit of fiber linear mass density defined as the weight in grams per 9,000 meters of material, which is reflected in the yarn thickness. Higher denier is reflective of thicker yarn.

Mesh size: Mesh size is the number of holes per square centimeter (or per inch) of netting material. Higher mesh count (i.e., more holes per square centimeter) means more netting material is required.

Fabric weight: Fabric weight in grams per square meter (GSM) is a function of denier, mesh count and knitted structure (or "pattern") and determines the amount of netting material required to produce a net. By definition, a product with higher GSM requires more raw netting material.

Physical properties of current WHOPES-recommended nets[90]

WHOPES description	WHOPES specifications			
Fiber (specification number)	**Denier**	**Minimum bursting strength[91] (kPa)**	**Mesh size (average number of holes/cm²)**	**Fabric weight[92] (GSM)**
Polyethylene 454/LN/2	150	500	20	45
Polyethylene 331/LN	150	350	528 holes per 100 cm²	43
Polypropylene 333/LN/4	100	450	21-29	40
Polyester 454/LN/1 (1 of 2)*	100	405	24	40
Polyester 333/LN/1 (1 of 2)*	100	Body: 350 Border (if present): 420	24	40
Polyester 333/LN/2 (1 of 2)*	100	350	24-26	40
Polyethylene 333+33/LN**	100	400	21	40
Polyethylene 333/LN/3	118	400	20	38
Polyester 454/LN/1 (2 of 2)*	75	250	24	30
Polyester 333/LN/1 (2 of 2)*	75	Body: 250 Border (if present): 320	24	Body: 30 Border (if present): 40
Polyester 333/LN/2 (2 of 2)*	75	250	24-26	30

*Polyester specifications have both 75 and 100 denier options- each option is listed separately here
**Specification 333+3/LN is combined with specification 333/LN/1

[87]Chemical properties are not addressed here, though similar variation exists across AI specifications.

[88]WHO, A system to improve Value for Money in LLIN procurement through market competition based on cost per year of effective coverage: Concept Note, 2011.

[89]WHO, Technical consultation on specifications and quality control of netting materials and mosquito nets: Updated WHO specifications for netting materials and mosquito nets, December 2005.

[90]WHOPES specifications (http://www.who.int/whopes/quality/newspecif/en/).

[91]These represent minimum requirements by specification. It should be noted that some suppliers claim to routinely exceed the minimum bursting strength and denier requirements of their specifications. This assertion has been supported by independent third-party reviews in published literature. Source: Skovmand and Bosselmann, Strength of bed nets as a function of denier, knitting pattern, texturizing and polymer, Malaria Journal, April 2011.

[92]The GSM for each net specification was collected directly from supplier websites, brochures and packaging, with the following exceptions: (a) 333+33/LN source: Malaria Journal 2010, 9:113; (b) 333/LN/1 border source: Malaria Journal 2010, 9:113; (c) 454/LN/1 (2 of 2) source: Personal communication with Albert Kilian.

a small user fee can sharply limit demand and uptake.[93] For example, a field study in Kenya found that LLIN uptake among pregnant women dropped by 75 percent when the price increased from zero to $0.60.[94] Vestergaard Frandsen also cited this challenge as the reason for closing its African retail channels.

Issue 2: Downward Pricing Pressure

As discussed in Section 2.1, LLIN prices have steadily declined since 2007. Though these price decreases were driven in part by the natural effects of increased competition, which can encourage suppliers to lower costs and/or margins, the market may soon become unsustainable if prices continue decreasing in line with recent trends. This issue is particularly critical for products with higher fabric weight requirements (see Box 3), since raw netting fabric is a key driver of LLIN production costs.

Raw materials are the primary driver of production costs, and as such higher GSM requirements generate increased costs of production. R4D developed a production cost model triangulating information from confidential manufacturer data, publicly available raw materials pricing data and estimates of labor and manufacturing costs, and information from textile experts. This analysis indicated that if prices continue to decline consistent with recent annual trends, products at the higher end of the GSM spectrum may become unable to compete given the increased raw materials requirements.[95]

In order to maintain a sufficiently healthy and attractive marketplace, it will be essential to ensure that appropriate incentives are in place to reward product performance as informed by the critical near-term Net Performance Guidance (see section 2.2.1) and vector control innovations (see section 2.2.2) to allow manufacturers to realize investments in higher-performance products and in R&D.

[93]Poverty Action Lab, Policy Lessons: Pricing Health Products (http://www.povertyactionlab.org/policy-lessons/health/pricing-health-products).

[94]Cohen and Dupas, Free distribution or cost sharing? Evidence from a randomized malaria prevention experiment, The Quarterly Journal of Economics, February 2010.

[95]It should be noted that myriad factors, including variability in raw materials (both fiber and insecticide), pricing arrangements for raw materials, supplier manufacturing processes, production location, and/or contract arrangements can influence production costs. However, as raw materials are the primary determinant of net production cost, nets with significantly higher amounts of raw materials required are a key driver of increased production costs.

3. Recommendations for the Global Community

3.1 Primary Recommendations

Presented below is a targeted strategy to address the primary LLIN market issues identified in section 2.2. These recommendations are aimed at driving donor-funded procurement of the most cost-effective LLINs while ensuring development and uptake of innovative new vector control technologies, specifically to address the threat of resistance. Taken together they can save the global community up to $630 million over the next five years while generating manufacturer incentives to develop and produce higher-quality nets.

3.1.1 Optimize Cost-Effective Procurements

Procuring LLINs on the basis of cost-effectiveness (e.g., "cost per year of net life") as opposed to price alone can save the global community up to $340 million over the next five years and create market incentives for suppliers to invest in both innovations and production of higher-performance nets. Current barriers to this are the lack of internationally reputed guidance on net performance coupled with donor policies that focus on net price as opposed to a composite measure of price and performance.

Optimizing cost-effective procurements should be a two-step process:

1. **Rapid development of normative Net Performance Guidance**

   A host of organizations—including many major donors, countries, manufacturers, and global experts—are urgently calling for near-term guidance on net performance from an internationally credible third-party normative institution. This guidance is necessary to inform procurement on the basis of cost per year of net life.

   The global community should provide urgent support to obtain this guidance. R4D has been working closely with the WHO GMP as it develops a consortium of key textile and field experts to develop near-term guidance within an 18- to 21-month period from project launch. Given the potential for hundreds of millions in savings—which can translate into significantly increased net access—and improved net performance, donors and partners should engage actively with the WHO GMP and other relevant actors to ensure the necessary financial and technical contributions to secure rapid development and dissemination of this guidance by the end of 2013.

   The expected outcome of Net Performance Guidance is to classify each net into several broad "performance bands" (e.g., Band 1 lasts 3–3.5 years) and/or indicate specific net life-years in order to inform procurement decisions. The Guidance is also expected to evaluate whether country or regional variability exists in net performance and tailor guidance accordingly.[96] It is important to note that only WHOPES-recommended nets would be evaluated, ensuring that the guidance was fundamentally underpinned by the critically important standards set by WHOPES.

2. **Undertake procurement on the basis of cost per year of net life**

   Current donor policies typically state that purchasing decisions should be made on the basis of lowest price,[97] without consideration of key parameters of net performance such as durability. Donors should revise their policies for LLINs to require that countries procure on the basis of lowest cost per year of net life to provide a composite measure of price and performance. Furthermore, countries themselves should seek to make all donor-funded net purchases on this basis in order to maximize net coverage and VFM.

   In order to fully capture savings, purchasers should use the most inclusive definition of LLIN cost possible, including the price of the net as well as shipping and distribution. As discussed in section 2.2.1, considering the fully loaded cost of a net is critical to robustly evaluate cost-effectiveness; failing to incorporate this cost in net procurement decisions will undervalue products with a longer life cycle. Experts note that given the wide variation in regions and distribution channels even within a single order, it may be challenging to prospectively estimate a single distribution cost for an entire order. Major donors should therefore, in

[96] If so, guidance could then be developed for multiple environmental 'scenarios' accordingly and countries/regions would procure based on which environment most closely matches their own.

[97] And lead time, which should continue to be evaluated.

conjunction with the relevant partners, evaluate and determine whether historical distribution rates from previous campaigns in a given country or alternative metric(s) can be used as an average proxy for distribution costs in procurement calculations. In the event that an appropriate distribution cost proxy is not identified, the LLIN price plus the cost of shipping to port can be used to calculate the cost in the equation of cost per year of net life. However, this approach has significant limitations and will undervalue products with a longer life cycle.

Though the Net Performance Guidance is expected to evaluate whether country or regional variability exists and provide guidance accordingly, countries should continue to collect local evidence per the WHO Guidelines for Monitoring the Durability of LLINs. Countries should consistently procure on the basis of price per year of net life. Importantly, donor policies should allow for countries to provide rigorous local evidence of net performance (i.e., to determine the denominator of net life-years) as the basis for this calculation.

3.1.2 Rationalize Net Specifications

Rationalizing net specifications in areas where they incur significant financial or program costs with little evidence of commensurate user benefit can save the global community up to $290 million over the next five years (see section 2.2.1). This rationalization is currently prevented by two major barriers: a lack of internationally reputed guidance on what constitutes preferred VFM specifications and the absence of donor incentives for countries to procure the most cost-effective net specifications. Rationalizing fragmentation in net specifications to optimize VFM should be a two-step process:

3. **Develop rigorous guidance on VFM in net specifications**

   Countries and donors are currently lacking highly credible and independent guidance on the costs and benefits of various LLIN specifications. NetWorks (funded by USAID and led by the Johns Hopkins Bloomberg School of Public Health) is partnering closely with R4D to address this through development of VFM in LLIN Specifications Guidance. NetWorks brings deep expertise and experience in evaluating key drivers of LLIN usage, relying on primary data from field sites as well as secondary literature. R4D has contributed market dynamics expertise to conduct in-depth analysis of cost and price drivers drawn from Global Fund and PMI procurement data and extensive interviews with both country purchasers and WHOPES-recommended suppliers.

   Together NetWorks and R4D are developing guidance based on a comprehensive review of the impact of net specifications on usage, price, and lead times. This guidance will still allow end users wide choice to select LLINs that work optimally in their settings, including 70-plus supplier offerings, and would only recommend moving away from a targeted set of specifications where there are significantly increased costs (either price and/or lead times) and limited evidence of programmatic or end-user benefits. The guidance will also include country-level methods for developing rigorous local evidence on usage benefits to inform procurement decisions (see 2 below). The first version of the VFM in LLIN Specifications Guidance will be produced in May 2012 and will be updated regularly to ensure that emerging data on both usage and costs are dynamically incorporated.

4. **Purchasers endorse and undertake procurement based on global VFM guidance**

   Under current donor policies, countries are able to procure LLINs with any of the 200-plus specifications offered by suppliers. Countries should seek to procure nets listed in the VFM in LLIN Specifications Guidance in order to maximize value and coverage in the current resource-constrained environment. Furthermore, donors should implement a policy requiring countries to procure LLIN specifications in accordance with the VFM guidance. Donor policies should, however, allow countries to procure alternative specifications on the basis of rigorous local evidence on usage benefits.

   In tandem, countries should also continue to build a robust evidence base around what factors—including those related to net specifications—drive net use. This evidence should be used to support future iterations of the VFM in LLIN Specifications Guidance to ensure that program and commodity purchasing decisions optimize health outcomes and overall value.

3.1.3 Develop a Clear Path to Market for IRM LLINs

The global community must prioritize strategies to develop and enable access to nets that address resistance issues. Otherwise it will risk investing billions of dollars in existing nets with insecticides that may prove ineffective against pyrethroid-resistant mosquito populations, thereby endangering recent malaria control gains. The WHO, countries, and donors must rapidly work to develop a clear path to market to support the ongoing investments by suppliers[98] in developing innovative vector control LLINs that will address the emerging resistance threat. This should include the following:

[98]Ongoing investments by both suppliers and the Gates Foundation-funded product development partnership IVCC.

1. **Rapid development of WHO regulatory accreditation systems for IRM products**

   The global community should encourage the proposed WHO VCAG and WHOPES to rapidly establish regulatory systems and guidelines to accredit IRM products. This is particularly urgent for reformulations, as several products are already in late stages of development, though also important for novel AIs to inform R&D. Transparently available regulatory requirements are critical to ensuring that suppliers invest in developing technologies that meet countries' needs.

2. **Clear guidelines and capacity investments in insecticide resistance monitoring and assessment**

   The global community, including donors and technical partners, should urgently seek to build the necessary capacities to identify which regions and countries require access to IRM products. Donors should seek to support such efforts under way at the global and country levels. The WHO should continue to rapidly move forward in developing guidelines to support countries in interpreting thresholds at which a region has insecticide-resistant mosquito populations that require investments in IRM tools. Technical partners with entomological and insecticide resistance expertise should also provide support to collect and interpret data on insecticide resistance as appropriate.

   The structure and process for collecting and managing in-country data on insecticide resistance is still under development. The WHO GPIRM (expected May 2012) recommends that all countries build capacity to collect resistance data per WHO guidelines and have a decision-making body for IRM, with access to the WHO and partners with relevant technical expertise to support them on data interpretation and decision making.

   As countries are still in the early stages of building capacity and expertise to monitor resistance, technical validation will be important in order to justify the procurement of more expensive IRM LLINs. Therefore, major donors may need to work with a technical partner to validate resistance data. Donors should also directly support in-country capacity and infrastructure to monitor insecticide resistance.

   The GPIRM also recommends the development of an aggregated global database of resistance data from all malaria-endemic countries to provide global direction. The WHO would consult with countries and partners to identify a reputable institution to host the database. Donors and countries should support efforts to develop a global database, which will be instrumental in informing the global IRM strategy. An example of such a database is the WorldWide Antimalarial Resistance Network (WWARN), which provides a comprehensive global surveillance system that aggregates quality-assured data to track the emergence of resistance to artemisinin-based combination therapies (ACTs).[99]

3. **Donor policies and programs to promote access to IRM products**

   a. **Implement clear procurement policies:** Donors should implement clear policies to ensure that when a region meets the identified insecticide resistance criteria (see Step 2 above) the relevant country can procure IRM products as appropriate. LLINs with reformulations and novel AIs will be in a different category than existing LLINs, and the tender should not allow inclusion of nets that are deemed ineffective for a given region. The tender should be issued on the basis of cost per year of net life (see section 2.2.1).

      There will likely be a single supplier that is first to develop and market an IRM LLIN. Donors should ensure that clear policies are in place to allow countries to procure from a sole source on the basis of a strong health outcomes justification.[100]

   b. **Drive access and uptake:** As noted in section 2.2.2, R&D investments of approximately $200 million[101] are required to develop novel AIs. These investments are critical today to ensure that the community is able to address the threat of resistance in the long term and prevent a reverse in the malaria prevention gains made to date. Major donors should continue to evaluate opportunities to develop incentives to drive rapid access and uptake when these new products enter the market.

      Such opportunities may include product introduction programs through donors such as UNITAID or programs via the Global Fund that allow for expedited repurposing of grant funding to superior new products, among other opportunities. Such efforts can help ensure rapid access to IRM products as they become available, and also help overcome barriers commonly faced by new public-health products (i.e., suboptimal volumes, which can in turn lead to higher prices and low availability). Planning for these incentives today can also provide a market signal to suppliers that investment in R&D is merited.

[99] WWARN website.

[100] The Global Fund is an example of a major donor that already has an existing policy in place to accommodate sole sourcing on the basis of a justified technical explanation from WHO.

[101] RBM Global Malaria Action Plan (http://www.rbm.who.int/gmap/a5.html).

3.2 Secondary Recommendations

Recommendations are presented below to address the two secondary market issues identified in section 2.3 above.

3.2.1 Employ Strategic Procurement Practices

Many LLIN purchasers do not adequately employ strategic procurement practices, which has historically led to pricing and availability issues. Purchasers should strengthen their procurement practices in the following areas in order to support efficient marketplace functioning[102]:

- **Splitting tenders (high-volume purchasers):** Splitting tenders generates a diverse supplier base by ensuring that multiple suppliers receive volumes.[103] This practice is particularly important for high-volume purchasers (including high-volume countries) where a single order can often represent millions of LLINs.[104] In the absence of splitting tenders a very limited number of suppliers may receive the majority of purchasing volumes, ultimately driving other suppliers out of the market.
- **Framework agreements (high-volume purchasers):** Given the inherent nature of a tender-based system, coupled with high fragmentation in net specifications, suppliers can face difficulties in planning production over the course of a year. Framework agreements or other advanced volume commitments based on robust forecasting allow suppliers to improve production planning, which can lower costs and hence prices, and also ensure that the market remains sustainable for a diverse supplier base. This strategic procurement practice is likely to be most feasible for global and large-volume procurers, such as John Snow Inc. (JSI) for PMI or the Global Fund Voluntary Pooled Procurement Mechanism (VPP). UNICEF already engages in annual framework agreements.
- **High-quality forecasting (all purchasers):** Limited visibility into procurement timing and volumes poses significant challenges to supplier production planning and may result in increased prices and availability issues (see section 2.3.2). Though procurement volumes are fundamentally linked to global funding availability, high-quality annual and/or multiyear forecasts at the country level represent a critical first step to transparently sharing required volumes, both to assess funding requirements and to improve supplier production planning.
- **Focus on quality and price in tenders (all purchasers):** Considering factors other than price (e.g., net performance/quality, past supplier performance in on–time delivery, etc.) in awarding tenders is critical to create appropriate supplier incentives for overall performance and optimize VFM. The importance of procuring LLINs on the basis of cost per year of net life as opposed to price only is discussed further in section 2.2.1.
- **Expedited registration (countries):** Streamlining and expediting product registration is essential to ensure that countries achieve access to new products (e.g., IRM LLINs) in a timely manner and promote competitive tendering practices.

Simultaneously, suppliers should also pursue channels to diversify their purchaser base beyond the current public-sector donors (see section 3.2.2 below.)

3.2.2 Diversify the LLIN Consumer Base

As discussed previously, suppliers currently rely primarily on three major donors for over 90 percent of purchases. There has been an increased emphasis within the global malaria community on identifying alternate continuous replacement channels to supplement mass campaigns in order to maintain coverage gains and promote a sustainable net culture in Africa.[105] This includes donor-funded channels as well as the possibility of consumer "pull," or retail, channels.

Suppliers should continue to support these efforts by actively pursuing creative channels to diversify their purchaser base beyond the current public-sector buyers (e.g., by exploring select retail channels in both sub-Saharan Africa and Southeast Asia, partnering with major private-sector multinational corporations, etc.). A detailed exploration of this issue is outside the scope of this report. However, it merits mention given its critical importance to ensuring the sustainability of a diverse purchaser base as well as a sustainable continuous replacement strategy to achieve malaria prevention goals.

[102]UNICEF- a primary purchaser of LLINs already follows many of these best practices including splitting tenders, framework agreements and high-quality forecasting.

[103]This can also be achieved by splitting large orders into multiple lots and allowing suppliers to bid on individual lots (e.g. an order of 2 million nets can be split into 4 lots of 500,000 nets).

[104]For smaller countries this procurement practice is less relevant, both because of the additional administrative requirements and because small orders may be less appealing for suppliers.

[105]As noted in 2011 WHO World Malaria Report; Has also been a key agenda item in recent meetings of the Alliance for Malaria Prevention (AMP) and multiple Roll Back Malaria (RBM) workstream meetings.

3.2.3 Build an In-country Evidence Base

Though recent findings in the *World Malaria Report 2011* indicate that the net use rate is approximately 96 percent, further work is required to build a robust evidence base around what specific factors (e.g., social, personal comfort, and preference) drive use versus nonuse at the country level. Countries and the global community can then use this data to better inform program design and procurement decisions.

Countries should continue to build a robust evidence base around what specific factors drive net use. Given the significant impact of net usage on VFM, it is important to systematically validate this evidence, including across a broader range of countries, and carefully identify reasons for nonuse via the following channels:

- **Net use indicators:** As noted above, current MERG guidance does not include an indicator to directly evaluate net use. However, it has been a topic of discussion at recent meetings, and MERG is currently revising its recommended indicators, with new guidance expected in the coming months.[106,107] A standard indicator of net use would allow countries to routinely monitor this critically important information via annual MIS and DHS results. In the interim, countries can conduct analysis based on existing indicators, similar to that presented in the *World Malaria Report 2011*, to monitor local net use rates.
- **Further studies to evaluate and incorporate drivers of net use:** In order to maintain high use rates, it is important to fully understand what drives net use and nonuse. Combined with local net use data, this information is critical to both program services and commodity purchasing decisions in order to optimize VFM. A review of the current evidence demonstrates a strong linkage between net use and behavior change or program design elements. Although these elements fall outside the scope of this report, the correlation bears mention given the health impact and effects on VFM of purchased nets. This evidence can and should also support future iterations of the VFM in LLIN Specifications Guidance, as discussed in section 2.3.1.

[106]Report from the Seventeenth Meeting of the RBM MERG, June 2011.

[107]Report from the Eighteenth Meeting of the RBM MERG, January 2012.

RESULTS FOR DEVELOPMENT

Appendices

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Appendix B: Interview list

In-country Stakeholders

Name	Organization
Sussann Nasr	CDC, Ethiopia
Lillian Kidane	CHAI, Nigeria
Megumi Gordon	CHAI, Tanzania
Lydia Babinga	Crown Agents, Ethiopia
Issa Baba	DFID, Nigeria
Liz Tayler	DFID, Tanzania
Charles Mburu	GF PSCMC, Kenya
George Oduor	GF PSCMC, Kenya
Ernest Nwokolo	Society for Family Health
Asefaw Getachew	mACEPA, Ethiopia
Godfrey Magumba	Malaria Consortium, Ethiopia
Ricki Bezeidenhout	MEDA, Tanzania
Faith Patrick	MEDA, Tanzania
Meseret Aseffa	Ministry of Health, Ethiopia
Elizabeth Juma	Ministry of Health, Kenya
Rebecca Kiptui	Ministry of Health, Kenya
Chioma Amajoh	Ministry of Health, Nigeria
Jide Coker	Ministry of Health, Nigeria
Tunde Ipaye	Ministry of Health, Nigeria
Dorothy Onyango	Ministry of Health, Nigeria
Ope Abegunde	Ministry of Health, Nigeria
Mohamed Jiddawi	Ministry of Health, Tanzania
Renata Mandike	Ministry of Health, Tanzania
Seraphine Adibaku	Ministry of Health, Uganda
Connie Balayo	Ministry of Health, Uganda
Nelson Musoba	Ministry of Health, Uganda
Okui Peter	Ministry of Health Uganda
Richard Reithinger	PMI, Ethiopia
Joseph Malone	PMI, Ethiopia
Gladys Teteh	PMI, Kenya
Kassahun Belay	PMI, Nigeria
Folake Olayinka	PMI, Nigeria

Name	Organization
John Quinley	PMI, Nigeria
Peter McElroy	PMI, Tanzania
Henry Semwanga	PSI, Ethiopia
Angus Spiers	PSI, Kenya
Anne Musuva	PSI, Kenya
David Dadi	PSI, Tanzania
Romanus Mtunge	PSI, Tanzania
Susan Mukasa	PSI, Uganda
Marcy Erskine	Red Cross, Kenya
Nick Brown	Swiss Tropical Health Institute, Tanzania
Claudia Hudspeth	UNICEF, Ethiopia
James Mcquen Patterson	UNICEF, Ethiopia
Dereje Muluneh	UNICEF, Ethiopia
Ketema Bizuneh	UNICEF, Kenya
Naawa Sipilanyambe	UNICEF, Nigeria
Worku Bekele	WHO, Ethiopia
Apkapa Kalu	WHO, Kenya
Ritha Njau	WHO, Tanzania
Katie Bigmore	World Bank, Kenya
Oluwole Odutol	World Bank, Nigeria

LLIN Suppliers

Name	Organization
Pierre Guillet	A-Z Textiles Mills
Kalpesh Shah	A-Z Textiles Mills
Egon Weinmueller	BASF
Gerhard Hesse	Bayer Crop Science
Justin Mcbeath	Bayer Crop Science
Torben Holm Larsen	Bestnet Europe Ltd.
Doreen Weatherby	Bestnet Europe Ltd.
Rod Flinn	Clarke
Bill Jany	Clarke
Kevin Magro	Clarke
Andy Butenhoff	Disease Control Technologies
Adam Flynn	Sumitomo Chemical Co. Ltd.
Ishige Fumiharu	Sumitomo Chemical Co. Ltd.
Lisa Goldman	Sumitomo Chemical Co. Ltd.
John Lucas	Sumitomo Chemical Co. Ltd.
Scott Mitchell	Sumitomo Chemical Co. Ltd.
Tatsuo Mizuno	Sumitomo Chemical Co. Ltd.
Maxime Besnier	Tana Netting Co. Ltd.
Chris Messer	Tana Netting Co. Ltd, former employee
Sanne Fournier-Wendes	Vestergaard Frandsen
Klaus Ostergaard	Vestergaard Frandsen
Helen Pates Jamet	Vestergaard Frandsen
Anand Samiappan	VKA Polymers Pvt Ltd.
Bill Li	Yorkool International Co.
Yangjia	Yorkool International Co.

Other Global Health Stakeholders and Experts

Name	Organization
Omer Imtiazuddin	Acumen, former employee
Kwame Agyarko	ALMA
Joy Phumaphi	ALMA
Melanie Renshaw	ALMA
John Gimnig	CDC
Stephen Smith	CDC
Dave Ripin	CHAI
Oliver Sabot	CHAI
Ellen Chang	CHAI, former employee
Justin Cohen	CHAI, former employee
Jessica Rockwood	Development Finance International, Inc.
Nichola Cadge	DFID
James Droop	DFID
Saul Walker	DFID
Kate Aultman	Gates Foundation
David Brandling-Bennett	Gates Foundation
Alexandra Farnum	Gates Foundation
Carol Medlin	Gates Foundation
Susan Nazzaro	Gates Foundation
Patrick Alyward	Global Fund
Martin Auton	Global Fund
Scott Filler	Global Fund
Eline Korenromp	Global Fund
Mariatou Tala Jallow	Global Fund
Rifat Atun	Global Fund, former employee
Ole Skovmand	Intelligent Insect Control
Tom Mclean	IVCC
Nicholas Berndt	JSI
Lisa Hare	JSI
Miguel Jaureguizar	JSI
Jo Lines	LSTMH

Other Global Health Stakeholders and Experts (CONT.)

Name	Organization
Leah Pedersen Thomas	Malaria No More
Srishti Gupta	McKinsey
Nine Steensman	McKinsey
Sarah Hoibak	MENTOR
Rima Shretta	MSH
Hannah Koenker	NetWorks
Matt Lynch	NetWorks
Laura Andes	PMI
Megan Fotheringham	PMI
George Greer	PMI
Sonali Korde	PMI
Michael Macdonald	PMI
John Milliner	PMI, former employee
Charity Ngaruro	PSI
Christian Lengeler	Swiss Tropical Health Institute
Albert Kilian	Tropical Health LLP
Ian Boulton	TropMed Pharma

Name	Organization
Suprotik Basu	UN Special Envoy
Alan Court	UN Special Envoy
Valentina Buj	UNICEF
Shanelle Hall	UNICEF
Helene Moller	UNICEF
Elena Trajkovska	UNICEF
Stephen Russell	University of Leeds
Prashant Yadav	University of Michigan
Shaffiq Essajee	WHO
Abraham Mnzava	WHO GMP
Rob Newman	WHO GMP
Jan Van Erps	WHO RBM
Thomas Teuscher	WHO RBM
Awa Coll-Seck	WHO RBM
Morteza Zaim	WHOPES
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