Manufacturing mosquito nets in Africa: can we do more?

Prof William Brieger looks at local production of bed nets against malaria. Tanzania has dominated. Rwanda is starting. Nigeria has been thinking

The technology of insecticide-treated nets (ITNs) to prevent malaria has been around for nearly three decades.[1] ITNs have evolved from a process of semi-annual soaking and impregnating nets with a safe insecticide at the household or community level to long-lasting insecticide-treated nets (LLINs), where the insecticide is integrated into the nets during the manufacturing process. The challenge has always been guaranteeing enough currently treated nets to cover the population and impede malaria transmission.

Net plans in Rwanda

Recently, Rwanda announced its intentions to establish LLIN manufacturing in-country. The Ministry of Trade and Industry has begun screening of bidders.[2] The government's main rationale for this move is projecting the need for a large and continuous supply of LLINs in the country through 2020, 'making it a prudent to set-up a production plant in the country.'[3] In particular, Rwanda estimated a need of 7 412 937 nets for 2015–16, with at least a million more for replacement and provision to pregnant women in 2017.

Rwanda was also moved by the challenge of procuring quality nets. With high demand from few global LLIN producers, Rwanda had purchased nets that were later considered to be of very low quality, hence the desire to have control of production of nets at home.[2] Considering the estimated current need, plus replacements every two years,[4] there would appear to be strong net demand in the country.

Interestingly, Rwanda does have two textile industries, one existing since 1984. These produce clothing, and there is demand to scale that up for the local market.[5] In addition to net manufacturing investors, Rwanda is also looking for investors to strengthen and expand capacity for textiles generally. Hopefully there may be a synergistic connection between general textiles and LLIN production as seen elsewhere.

When this information from Rwanda was shared with our malaria/tropical health update mailing list, a number of readers expressed interest and hope that their own governments would follow suit.[6] This article provides some background for readers to consider.

Local nets, not a new idea

The idea of locally made mosquito nets is not new. MacCormack and Snow documented that, '95% of people were already sleeping under locally-made nets,' in The Gambia in the 1980s.[7] Likewise in Burkina Faso it was common to find nets made from imported materials or local cotton that were sewn by local tailors.[8] People in Burkina Faso were 'willing to treat existing nets and to buy ITNs, but only if such services would be offered at reduced prices and in closer proximity to the households.'

The concept of creating and meeting demand for ITNs was tested in several countries by the USAID sponsored NetMark project between 1999 and 2009.[9] NetMark started with linking textile companies and insecticide producers. 'Its partners included over 40 national and international insecticide and net manufacturers, product distributors, and advertising companies.'[10] Advertisers were involved as part of marketing efforts since NetMark was focused initially on private sector strengthening. The result in Nigeria was a bundled

Rwandan locals collecting their insecticide-treated nets as part of the Net Distribution campaign

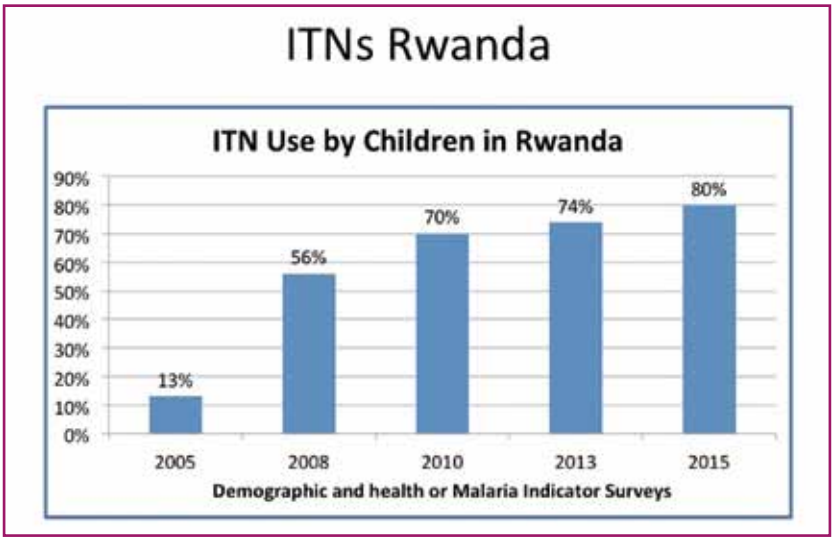
William R Brieger is a Professor for the Department of International Health, the Johns Hopkins Bloomberg School of Public Health, and Senior Malaria Specialist, Jhpiego, an affiliate of Johns Hopkins University.

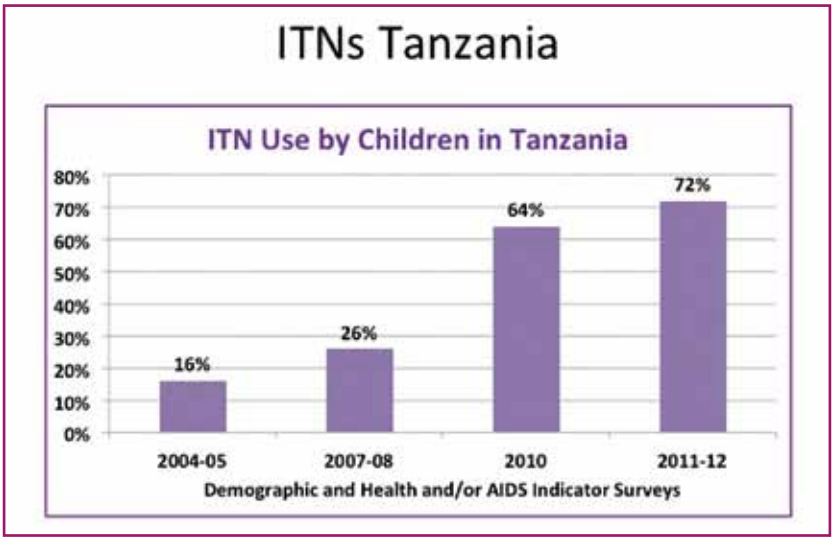
product of a locally woven bednet and a locally produced insecticide treatment kit.

At a point ExxonMobil contributed US$120 000 to a pilot programme with NetMark Nigeria that enabled pregnant women attending antenatal clinics in Primary Health Care facilities in six local Government area clusters in Lagos State to receive a discount voucher of US$2 on the purchase of an ITN. In this pilot effort over 74 000 vouchers were issued and 50 000 redeemed.[11]

Expanded net ownership between 2000 and 2004 was seen in four NetMark countries with increases between 50–100%. Over the six-month period from October 2007 to March 2008, NetMark Nigeria recorded sales of over 855 000 ITNs from its retail partners and over 1710 000 from its institutional partners.[12] Although the project made ITNs available at reduced prices and resulted in gains in awareness, ownership, and use of nets, 'none of the countries reached the ambitious Abuja targets'.[10]

Even at reduced or subsidised prices the ITNs made available through this commercial sector approach were still more expensive than most families could afford. Unfortunately, partway through the project the emphasis shifted from local products to imported LLINs leaving a very bitter taste, particularly in Nigeria with its large industrial sector, in mouths of the textile and chemical partners who, during malaria partners meetings at the time, expressed a sense of betrayal.





Tanzania has only Africa-based net production facility

Talk arose in Nigeria about the potential for starting LLIN production in the country, but no one stepped forward with funding or technical assistance. In the meantime, on the other side of the continent, A to Z Textiles of Tanzania entered into a partnership,[13] and by 2003 LLINs were being produced in Arusha.[14]

The public-private partnership with A to Z included Sumitomo Chemical, ExxonMobil, the World Health Organization (WHO), and the United Nations Children's Fund (UNICEF).[15]

Sumitomo Chemical provided a royalty-free technology license to the company for its Olyset LLINs. 'By 2010, Olyset Net production capacity (at A to Z) reached 30 million LLINs per year, creating 8000 jobs; more than half of the global Olyset Net output and an outstanding contribution to the local economy.'

A to Z Textile Mills produces 30 million LLINs per year and the Global Fund supports the purchase of these nets through programmes in Tanzania and other countries in East Africa.[16] Even at this level of production, A to Z Textiles are hard pressed, just like the few other global LLIN manufacturers, to meet demand. Over the period, the focus changed from protecting young children and pregnant women to universal coverage of the population. Also, research and actual use found that the lifespan of an LLIN was not the five years as initially projected, but more like two.[17] These factors meant that supply could rarely meet demand for regular replacement nets.

Supply and demand issues

Malaria control efforts in neighbouring Kenya show the same challenge of meeting demand. 'Current methods of delivering ITNs, i.e., one mass campaign every five years and regular distribution of ITNs from health centre can barely maintain the current effective coverage.'[18]

In 2013 there were 11 LLIN suppliers approved by the WHO Pesticide Evaluation Scheme (WHOPES), and five more products currently going through the approval process. As supplies have increased, costs have reduced. Even so there is a gap between the number required to maintain coverage and the planned volumes of production.[19] The 16 LLIN manufacturers are listed at the WHOPES website.[20]

In addition to supply issues, does local availability of LLINs make a difference in fighting malaria? Regular studies by the Demographic and Health Survey group of USAID in Tanzania found that ITN use increased over time by children below five years of age.[21] The most recent survey still shows that the 2010 Abuja target of 80% was not met (let alone a target of universal coverage), but the findings hint at the importance of having locally available LLINs. Neighbouring Rwanda, which is hoping to develop its own net production capacity, actually performed slightly better rising from only 13% of young children sleeping under LLINs in 2005 to 80% in 2015.[22]

Let's wish Rwanda success in establishing its LLIN manufacturing capacity. For colleagues in Nigeria and elsewhere who have expressed interest in this issue, your advocacy work is just beginning.

References

1. Lindsay SW, Snow RW, Broomfield GL, et al. Impact of permethrin-treated bednets on malaria transmission by the Anopheles gambiae complex in The Gambia. *Med Vet Entomol* 1989; 3 (3): 263–71.
2. Nkurunziza M. Minicom to screen bidders for mosquito net plant establishment. The Rwanda Focus. 4 May 2016. http://www.focus.rw/wp/2016/05/04/minicom-to-screen-bidders-for-mosquito-net-plant-establishment/
3. Gahigi MK. Rwanda seeks investors for mosquito net factory. The East African. 19 March 2016. http://www.theeastafrican.co.ke/Rwanda/News/Rwanda-seeks-investors-for-mosquito-net-factory-/-/1433218/3123816/-/90domq/-/index.html
4. Hakizimana E, Cyubahiro B, Rukundo A, et al. Monitoring long-lasting insecticidal net (LLIN) durability to validate net serviceable life assumptions, in Rwanda. *Malar J* 2014; 13: 344. DOI: 10.1186/1475-2875-13-344.
5. Fibre2Fashion News Desk Rwandan textile industry looks for investors. Fibre2Fashion.com (World of Garment). http://www.fibre2fashion.com/news/textile-news/rwandan-textile-industry-looks-for-investors-176616-newsdetails.htm.
6. Tropical Health Update. Producing bednets where they are needed. 24 May 2016. https://knowledge-gateway.org/tropicalhealth/discussions/hw4k5bsg
7. MacCormack CP, Snow RW. Gambian cultural preferences in the use of insecticide-impregnated bed nets. *J Trop Med Hyg* 1986; 89 (6): 295–302.
8. Okrah J, Traoré C, Palé A, et al. Community factors associated with malaria prevention by mosquito nets: an exploratory study in rural Burkina Faso. *Trop Med Int Health* 2002; 7 (3): 240–248. http://onlinelibrary.wiley.com/doi/10.1046/j.1365-3156.2002.00856.x/abstract
9. fhi360. NetMark. http://pshi.fhi360.org/whatwedo/projects/netmark.html.
10. Baume CA, Marin MC. Gains in awareness, ownership and use of insecticide-treated nets in Nigeria, Senegal, Uganda and Zambia. *Malar J* 2008; 7: 153. http://malariajournal.biomedcentral.com/articles/10.1186/1475-2875-7-153
11. NetMark Nigeria. EXXONMOBIL's USAID-NetMark pilot targeted subsidy voucher scheme in Lagos State. Unpublished project report, January 2006.
12. NetMark Nigeria. NetMark partner monthly ITN sales performance at a glance. NetMark Flash, April-June 2008. Unpublished project newsletter.
13. Sumitomo Chemical. Manufacturing in Africa: 'Made in Africa, by Africans, for Africans' - Olyset Net is a vital tool in the fight against malaria. http://sumivector.com/about-us/olyset-manufacturing-in-africa.
14. A to Z Textile Mills. Bed nets. http://www.azpfl.com/index.php/en/products/bednet.
15. Acumen. A to Z Textile Mills: locally produced long-lasting antimalaria bednets. http://acumen.org/investment/a-to-z-textile-mills/. Accessed 1 June 2016
16. The Global Fund to Fight AIDS, TB and Malaria. Japan and the Global Fund (Donor Support Fact Sheet) *The Global Fund*, December 2015. http://www.theglobalfund.org/documents/replenishment/2015/Replenishment_2015JapanDonorSheet_Report_en/
17. Morgan J, Abílio AP, do Rosario Pondja M, et al. Physical durability of two types of long-lasting insecticidal nets (LLINs) three years after a mass LLIN distribution campaign in Mozambique, 2008-2011. *Am J Trop Med Hyg* 2015; 92 (2): 286–93. DOI: 10.4269/ajtmh.14-0023. Epub 2014 Nov 17.
18. Zhou G, Li JS, Ototo EN, et al. Evaluation of universal coverage of insecticide-treated nets in western Kenya: field surveys. *Malar J* 2014; 13: 351. DOI: 10.1186/1475-2875-13-351. http://malariajournal.biomedcentral.com/articles/10.1186/1475-2875-13-351
19. Game C, Jallow MT. The Global Fund: Where we are today and our new approach to supplier management. presented at The Global Fund. LLIN Supplier Conference Geneva. Monday 13th May 2013. www.theglobalfund.org/.../P4I_2013-05-09- 1bGlobalFundLLINSupplierConference_Presentations_en/
20. World Health Organization/WHOPES Working Group. Updated 1 April 2016 WHO recommended long-lasting insecticidal nets. http://www.who.int/whopes/Long-lasting_insecticidal_nets_April_2016.pdf?ua=1
21. DHS Programme: Demographic and Health Surveys. Tanzania Surveys. http://dhsprogram.com/Where-We-Work/Country-Main.cfm?ctry_id=39&c=Tanzania&Country=Tanzania&cn=&r=1.
22. DHS Programme: Demographic and Health Surveys. Rwanda Surveys. http://dhsprogram.com/Where-We-Work/Country-Main.cfm?ctry_id=35&c=Rwanda&r=1.