Almost Caught:
The Missteps in Mosquito Net Deployment

By Daniel Peck

Mosquito Nets

Topic: Mosquito Nets and Deployment
Medium: Implementation Design
Designer: ??
Scale: Mostly the Developing World in Africa and parts of Asia
Era: 18th Century – Modern Times

The mosquito net has origins that date back to even Egyptian times, but the modern use of the net occurred after the discovery of mosquitos as vectors of transmission by Ronald Ross in 1897 (History of Malaria Control). Currently, the mosquito net's primary purpose is to impede the spread of malaria, *Plasmodium falciparum*, and other forms of vector transmitted diseases, and in particular to impede the *Anopheles Gambie* genus of mosquitos (Tsuang). But are these nets working?

The design of the mosquito net has traditionally been exclusively to prevent the spread of Malaria, but in some cases it has not proven to be an effective means for change, exclusively. Some studies have shown that the greater the ration in the household to net, the higher the usage rate (Tsuang). According to a study in Papua New Guinea, the average ownership of a net of any form is over 80%, however, usage hovers around 44% (Hertzal). The distribution was able to reach a great deal and increase ownership to over 80% but why the low use? Another study attempts to answer this question with a meta research analysis. This found, based on 22 other academic studies, that the main reasons for the lack of use of mosquito nets was due to discomfort from heat, and a lack of the perceived mosquito density (Pulford).

Though this sounds like a reasonable answer if we look to a very humanistic report by the New York Times, we see a different reason. An article reported that a primary reason for the lack of use for mosquito nets in Zambia was that they were being used as fishing nets (Gettleman). We can see a clear disconnect between the intended use of the nets, and the value of which the people see their own needs and resources. Sonia Shah says in a L.A. Times article,

> "Perhaps what we need is a whole new approach. Instead of masterminding solutions for distant problems and then handing them down from on high — as we do not just in our anti-malaria efforts but in a variety of aid programs aimed at extreme poverty — we should empower the poor to come up with their own solutions, and then help figure out how to implement them." (Shah)

This is demonstrative of the way a distant idea to solve a health based problem can be disconnected with the actual people and their needs. The people of Zambian coast clearly see the need for fresh food to be of greater priority than the mosquito threat, valid or not. This disconnect is also demonstrative of how quantitative data is insufficient to be used to validate the effectiveness of products and deployments, as an in person evaluation needs to be done.

Bibliography

Gettleman, Jeffrey. "Meant to Keep Malaria Out, Mosquito Nets Are Used to Haul Fish In." *The New York Times*. The New York Times, 2015. Web. 12 Apr. 2016.

Hetzel, Manuel W et al. "Ownership and Usage of Mosquito Nets after Four Years of Large-Scale Free Distribution in Papua New Guinea." *Malaria Journal*11 (2012): 192. *PMC*. Web. 13 Apr. 2016.

Njau, Ritha JA et al. "Implementation of an Insecticide-Treated Net Subsidy Scheme under a Public-Private Partnership for Malaria Control in Tanzania – Challenges in Implementation." *Malaria Journal* 8 (2009): 201. *PMC*. Web. 13 Apr. 2016.

Pulford, Justin et al. "Reported Reasons for Not Using a Mosquito Net When One Is Available: A Review of the Published Literature." *Malaria Journal* 10 (2011): 83. *PMC*. Web. 13 Apr. 2016.

Shah, Sonia. "In Africa, Anti-malaria Mosquito Nets Go Unused by Recipients."*Los Angeles Times*. Los Angeles Times, 2010. Web. 13 Apr. 2016.

Tsuang, Angela, Jo Lines, and Kara Hanson. "Which Family Members Use the Best Nets? An Analysis of the Condition of Mosquito Nets and Their Distribution within Households in Tanzania." *Malaria Journal* 9 (2010): 211.*PMC*. Web. 13 Apr. 2016.

"History of Malaria Control". Archived from the original on November 11, 2009. Retrieved 2016-04-12.

Further Reading

http://www.nytimes.com/2015/01/25/world/africa/mosquito-nets-for-malaria-spawn-new-epidemic-overfishing.html?_r=0

The New York Times | http://nyti.ms/1BW0goy

AFRICA

Meant to Keep Malaria Out, Mosquito Nets Are Used to Haul Fish In

By JEFFREY GETTLEMAN JAN. 24, 2015

BANGWEULU WETLANDS, Zambia — Out here on the endless swamps, a harsh truth has been passed down from generation to generation: There is no fear but the fear of hunger.

With that always weighing on his mind, Mwewa Ndefi gets up at dawn, just as the first orange rays of sun are beginning to spear through the papyrus reeds, and starts to unclump a mosquito net.

Nets like his are widely considered a magic bullet against malaria — one of the cheapest and most effective ways to stop a disease that kills at least half a million Africans each year. But Mr. Ndefi and countless others are not using their mosquito nets as global health experts have intended.

Nobody in his hut, including his seven children, sleeps under a net at night. Instead, Mr. Ndefi has taken his family's supply of anti-malaria nets and sewn them together into a gigantic sieve that he uses to drag the bottom of the swamp ponds, sweeping up all sorts of life: baby catfish, banded tilapia, tiny mouthbrooders, orange fish eggs, water bugs and the occasional green frog.

"I know it's not right," Mr. Ndefi said, "but without these nets, we wouldn't eat."

Across Africa, from the mud flats of Nigeria to the coral reefs off Mozambique, mosquito-net fishing is a growing problem, an unintended consequence of one of the biggest and most celebrated public health campaigns in recent years.

The nets have helped save millions of lives, but scientists worry about the collateral damage: Africa's fish.

Part of the concern is the scale. Mosquito nets are now a billion-dollar industry, with hundreds of millions of insecticide-treated nets passed out in recent years, and many more on their way.

They arrive by the truckload in poor, waterside communities where people have been trying to scrape by with substandard fishing gear for as long as anyone can remember. All of a sudden, there are light, soft, surprisingly strong nets — for free. Many people said it would be foolish not to use them for fishing.

"The nets go straight out of the bag into the sea," said Isabel Marques da Silva, a marine biologist at Universidade Lúrio in Mozambique. "That's why the incidence for malaria here is so high. The people don't use the mosquito nets for mosquitoes. They use them to fish."

But the unsparing mesh, with holes smaller than mosquitoes, traps much more life than traditional fishing nets do. Scientists say that could imperil already stressed fish populations, a critical food source for millions of the world's poorest people.

Scientists are hardly the only ones alarmed. Fistfights are breaking out on the beaches of Madagascar between fishermen who fear that the nets will ruin their livelihoods, and those who say they will starve without them. Congolese officials have snatched and burned the nets, and in August, Uganda's president, Yoweri Museveni, threatened to jail anyone fishing with a mosquito net.

"We need a regulation to deal with these people," Mr. Museveni said.

Many of these insecticide-treated nets are dragged through the same lakes and rivers people drink from, raising concerns about toxins. One of the most common insecticides used by the mosquito net industry is permethrin, which the United States Environmental Protection Agency says is "likely to be carcinogenic to humans" when consumed orally. The E.P.A. also says permethrin is "highly toxic" to fish.

Most scientists say the risks to people are minimal, because the dosages are relatively low and humans metabolize permethrin quickly. But with coldblooded animals, it's a different story.

"If you're using freshly treated nets in a smallish stream or a bay in the lake, it's quite likely you're going to kill fish you don't intend to kill," said Dan Strickman, a senior program officer for the Bill and Melinda Gates Foundation, which has invested heavily in malaria research and development. "That's definitely an environmental hazard."

The leading mosquito net manufacturers insist that their products are not dangerous. Still, many nets are labeled: "Do not wash in a lake or a river."

Some labels go even further, warning people to pour any water used in washing a net into a hole in the ground, "away from home, animals and wells."

When asked about this, Egon Weinmueller, a public health executive for BASF, a major netmaker, said, "We want to avoid any form of contamination." He acknowledged that "if it's a small pond, say maybe 10 meters, it could be a problem."

Though experts say that the vast majority of mosquito nets are used exactly the way they were intended — hung over beds — the full extent of mosquito-net fishing is unknown.

"No one is going to come forward in a survey and say, 'That thing you're

giving me, we're not using it properly,' " said Seth Faison, a spokesman for the Global Fund to Fight AIDS, Tuberculosis and Malaria, which has financed the purchase of 450 million nets.

Yet Mr. Faison and several other public health officials maintained that mosquito-net fishing was "anecdotal."

"In regards to what we face," Mr. Faison said, "it's an infinitesimal problem, maybe 1 percent."

But that would still amount to millions of nets.

One of the few detailed studies on the issue showed that in several villages along Lake Tanganyika, an essential body of water shared by four East African nations, 87.2 percent of households used mosquito nets to fish. When that study was presented at a malaria conference last year, the reception, according to some of those in attendance, was decidedly cool.

"People are very defensive about this topic," said Amy Lehman, an American physician and the founder of the Lake Tanganyika Floating Health Clinic, which conducted the study. "The narrative has always been, 'Spend $10 on a net and save a life,' and that's a very compelling narrative.

"But what if that net is distributed in a waterside, food-insecure area where maybe you won't be affecting the malaria rate at all and you might actually be hurting the environment?" she said. "It's a lose-lose. And that's not a very neat story to tell."

Fabric of a Community

An insecticide-treated mosquito net, hung over a bed, is the front line in the battle against malaria. It's also the perfect mosquito-killing machine. The gauzy mesh allows the carbon dioxide that people exhale to flow out, which attracts mosquitoes. But as they swarm in, their cuticles touch the insecticide on the net's surface, poisoning their nervous systems and shutting down their

microscopic hearts.

Western governments and foundations donate the money. Big companies like BASF, Bayer and Sumitomo Chemical design the nets. They are manufactured at about $3 apiece, many in China and Vietnam, shipped in steel containers to Africa, trucked to villages by aid agencies, and handed out by local ministries of health, usually gratis. The World Health Organization says the nets are a primary reason malaria death rates in Africa have been cut in half since 2000.

But at the end of the line, in poor areas where little goes to waste, mosquito nets become many other things: soccer balls and chicken coops, bridal veils and funeral shrouds. Mosquito nets are literally part of the fabric of a community.

For many uses, a secondhand net, which has less insecticide on it, will do. But for fishing, it's different.

"New mosquito nets are the best," said David Owich, who fishes on Lake Victoria. "No holes."

When asked where he had gotten his, he smiled.

"At the hospital," he said. "Much cheaper than a real net."

(A "real" net costs about $50, an enormous expense in a place where many people survive on a few dollars a day.)

In Mr. Owich's world, there is no overstating the centrality of fish. His daily catch pays for school supplies and keeps the kerosene lamp lit in his mud hut. All around Lake Victoria, Lake Tanganyika, Lake Malawi and so many others, fish are the engine block of the economy and a de facto social security system for landless people.

"You can see it in people's moods," said Said Katensi, a Tanzanian

conservationist on Lake Tanganyika. “Whenever there’s fish, everyone is happy. When there isn’t any fish, like now, everyone is sad.”

Dwindling Fish Populations

Out on the Bangweulu flood plains of Zambia, where the swamps stretch all the way to the horizon in every direction, a reed basket used to be the primary fishing technology.

But the other day, when one of Mr. Ndefi’s neighbors went to check some fish traps in a few feet of dank swamp water, it was obvious why mosquito mesh had replaced it. A trap made from traditional reeds was empty. The trap next to it, made from a mosquito net, was jumping with tiny silvery fish.

“It’s simple economics,” said Carl Huchzermeyer, a fisheries manager for African Parks, a conservation organization in Bangweulu. “You could spend two days making a basket out of reeds, or just use a mosquito net.”

Recent hydroacoustic surveys show that Zambia’s fish populations are dwindling. Harris Phiri, a Zambian fisheries official, blamed deforestation, rapid population growth and the widespread use of mosquito nets.

“They are catching very small fish that haven’t matured,” Mr. Phiri said. “The stocks won’t be able to grow.”

Jeppe Kolding, a Danish fisheries ecologist, has challenged the conventional wisdom. He advocates a “balanced harvest” approach that calls for catching more juvenile fish and sparing some of the adults, arguing that mosquito-net fishing may not harm fish stocks as much as widely believed.

“Fish are more like plants than other animals,” he said, “in that they disperse millions of seeds.”

But even he acknowledges that, for fishing purposes, it would be much better if the nets used were not treated with toxic chemicals.

In many places, fish are dried for hours in direct sunlight on treated mosquito nets. Direct sunlight can break down the insecticide coating. Anthony Hay, an associate professor of environmental toxicology at Cornell University, said fish could absorb some of the toxins, leaving people to ingest them when they eat the fish.

"It's just another one of these 'white man's burdens,' " Mr. Hay said, referring to William Easterly's well-known book critical of foreign aid by the West. "We think we have a solution to everybody's problems, and here's an example of where we're creating a new problem."

Fishermen's Feud

Every morning at sunrise in Antongil Bay, along Madagascar's ruggedly beautiful northern coast, fishing crews drag seines made from mosquito nets through the putty-colored sea. It's a family affair, with spindly grandmothers and 8-year-old boys wrapping their hands around the wet ropes and pulling as hard as they can.

When the nets land on the beach, it's like peering into the stomach of the sea: a squishy mass of sand, seaweed, dead blowfish, dead baby eels and thousands of baby shrimp, their bodies translucent, their tiny eyes black dots no larger than specks of sand.

The Malagasy word for these nets is "ramikaoko," or the thing that takes all things together. The extent of the damage is unclear, but recent surveys show that Madagascar's industrial shrimp catch plummeted to 3,143 tons in 2010 from 8,652 tons in 2002.

Because Antongil Bay is considered a crucial shrimping area, Madagascar recently banned the use of ramikaoko nets there. But the government has been in such disarray since a military coup a few years ago that enforcement of the decree is now up to a group of threadbare vigilante fishermen.

The group calls itself Fearless, and it prowls the pebbly, windswept beaches, looking for mosquito nets to seize.

Be Zocilin, a stocky member with a thick neck and browning teeth, sheepishly held up his left arm to show a half-moon scar — a bite mark.

“We didn’t expect war,” he said, “but the other side brought war.”

Mr. Zocilin explained, and several witnesses confirmed, that he had been attacked and nearly killed by mosquito-net fishermen.

In another village, mosquito-net users crept up to the boats of professional fishermen late one night and cut them loose into the sea. The net users were so furious about anyone trying to take away their nets that they started a boycott of the professional fishermen.

“Even my own sisters didn’t sell me rice,” said Adrien Labiza, a professional fisherman who has tried, with little success, to persuade friends and family not to fish with mosquito nets.

Clearly, there are no easy answers. In all these places, the people fishing with mosquito nets tend to be those without boats or even tackle, often women and children, the most dispossessed. They work from shore, tugging the nets through shallow waters, precisely where many species spawn, creating another potential problem: the slow, steady destruction of sensitive aquatic breeding grounds.

Dr. Lehman, the American physician on Lake Tanganyika, wonders if there might be better malaria solutions for waterside communities. Specially treated wall coverings? Custom-fit window screens? “Why is this question not being asked?” she said, a bit exasperated. “Is it that we don’t really want to know the answer?”

For Mr. Ndefi, it is a simple, if painful, matter of choice. He knows all too well the dangers of malaria. His own toddler son, Junior, died of the disease

four years ago. Junior used to always be there, standing outside his hut, when Mr. Ndefi came home from fishing.

Mr. Ndefi hopes his family can survive future bouts of the disease. But he knows his loved ones will not last long without food.

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