



Commentary

More is More: Are We Delivering Enough LLINs?

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Mass campaigns of long lasting insecticidal nets (LLINs) have been the primary vector control tactic for malaria-endemic countries for the last 20 years, with universal campaigns every three the norm since 2009. These campaigns are cost-effective, equitable, and generally succeed at reaching high proportions of targeted households. The triennial intervals of the campaigns were founded on assumptions that LLINs should last three years, that is, that they are capable of retaining both their insecticidal capabilities and their physical integrity, and likewise are being retained and used by the household for the same period. It is well documented that in contrast to these lofty assumptions, LLIN coverage declines between campaigns, due to wear and tear, net loss, etc., such that median LLIN lifespans are generally three years – that is, 50% or more of LLINs distributed in a mass campaign will have worn out by the time the next campaign rolls around [1–3]. Despite these limitations, these campaigns are the cornerstone of malaria control, with LLINs estimated to be responsible for the lion's share of the reductions in malaria burden since 2000 [4].

While we've known for some time that LLIN coverage declines post-campaign, few studies demonstrate the temporal link between net availability and malaria morbidity in the context of additional distribution channels. Girond and colleagues [5] present an innovative longitudinal analysis based on 18 sentinel health center registries in highly endemic districts of Madagascar, translating counts of weekly confirmed malaria cases into percentile ranks and identifying alert thresholds when the percentile exceeded 90% for three consecutive weeks. They found that for the first year after a mass campaign, almost no sites reached an alert threshold; in the second year, 44.3% of sites had

alerts, while in the third year, 68.5% of the sites had alerts. One site proved to be an exception – Toamasina district on the East Coast, where a community-based continuous distribution was implemented from September 2013 to June 2014, providing additional LLINs. In this district, no alerts were reached during the community distribution period, and malaria cases declined by 14% compared to similar districts on the East Coast. Of note, by June 2014, eighteen months after the mass campaign, population access to an LLIN in Toamasina was still high at 81.5% [6]. The pilot continued into 2015, expanding to two additional districts, then to a total of 10 in 2016–17, and in 2018, 20 districts on the East Coast [7].

The findings raise several important considerations for policymakers and donors. First, the study clearly demonstrates the link between declining LLIN access and increases in morbidity. If the goal is to remain alert-free, mass campaigns clearly fail to meet this goal in their second and third years. If mass campaigns are only strongly effective for the first 12 months, it stands to reason that country programs need to temper their expectations about malaria control gains if they continue to rely primarily on this channel. Policymakers should take note that status quo approaches of triennial mass campaigns combined with distribution to pregnant women and children are unlikely to succeed at reaching the targets laid out in the WHO Global Technical Strategy [8].

Second, a promising solution to the first problem is found in the case of Toamasina, where the community-based continuous distribution filled gaps in LLIN access as mass campaign LLINs wore out. While the observational study design cannot eliminate alternative explanations, it seems abundantly likely that the continued protection observed in the Toamasina sentinel site was due to continued high LLIN access, as there were no other reported changes in malaria interventions. This is the first instance reported of a continuous distribution channel's impact on malaria morbidity.

Third, we must ask why can we not get LLINs to remain effective for the full three years? While malaria control is always top of mind for malaria policymakers and researchers, households have their own priorities. Indeed, “Tazomoka is not a problem” [9] illustrates this aptly. Even in Madagascar, where LLIN use among those who have access to one is the highest of any malaria-endemic country [10], nets will still wear out, still be washed, possibly too many times, and are unlikely to be repaired, particularly if there are opportunities to obtain a new LLIN. Research from other countries indicates that it is much less the inherent construction of the LLIN, but rather, a complex set of human perceptions and behaviors – a desire to have it last longer, belief that this is possible, tying it up to prevent damage, protecting it from children, animals, and sharp/rough objects – that determine its field longevity [1].

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LLINs have never been a perfect tool, but they have worked remarkably well despite their imperfections. Nonetheless, if we are serious about malaria control, it is abundantly clear that more LLINs need to be delivered than we are currently providing. Further research is needed as the community channel is scaled up in Madagascar to additional districts, and this should provide greater clarity on the benefits. Likewise, cost-effectiveness analysis on the best combinations of LLIN distribution channels to maintain high population access without unnecessarily oversupplying communities is needed to inform policy decisions.

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