On the cost-effectiveness of insecticide-treated wall liner and indoor residual spraying as additions to insecticide treated bed nets to prevent malaria: findings from cluster randomized trials in Tanzania

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Abstract

Background: Despite widespread use of long-lasting insecticidal nets (LLINs) and other tools, malaria caused 409,000 deaths worldwide in 2019. While indoor residual spraying (IRS) is an effective supplement, IRS is moderately expensive and logistically challenging. In endemic areas, IRS requires yearly application just before the main rainy season and potential interim reapplications. A new technology, insecticide-treated wall liner (ITWL), might overcome these challenges.

Methods: We conducted a 44-cluster two-arm randomized controlled trial in Muheza, Tanzania from 2015-2016 to evaluate the cost and efficacy of a non-pyrethroid ITWL to supplement LLINs, analyzing operational changes over three installation phases. The estimated efficacy (with 95% confidence intervals) of IRS as a supplement to LLINs came mainly from a published randomized trial in Muleba, Tanzania. We obtained financial costs of IRS from published reports and conducted a household survey of a similar IRS program near Muleba to determine household costs. The costs of ITWL were amortized over its 4-year expected lifetime and converted to 2019 US dollars using Tanzania's GDP deflator and market exchange rates.

Results: Operational improvements from phases 1 to 3 raised ITWL coverage from 35.1% to 67.1% of initially targeted households while reducing economic cost from $34.18 to $30.56 per person covered. However, 90 days after installing ITWL in 5,666 households, the randomized trial was terminated prematurely because cone bioassay tests showed that ITWL no longer killed mosquitoes and therefore could not prevent malaria. The ITWL cost $10.11 per person per year compared to $5.69 for IRS. With an efficacy of 57% (3%-81%), IRS averted 1,162 (61-1,651) disability-adjusted life years (DALYs) per 100,000 population yearly. Its incremental cost effectiveness ratio (ICER) per DALY averted was $490 (45% of Tanzania's per capita gross national income).

Conclusions. These findings provide design specifications for future ITWL development and implementation. It would need to be efficacious and more effective and/or less costly than IRS, so more persons could be protected with a given budget. The durability of a previous ITWL, progress in non-pyrethroid tools, economies of scale and competition (as occurred with LLINs), strengthened community engagement, and more efficient installation and management 48 procedures all offer promise of achieving these goals. Therefore, ITWLs merit ongoing study.