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The durability of long-lasting insecticidal nets distributed to the households between 2009 and 2013 in Nepal

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Abstract

Background: Understanding and improving the durability of long-lasting insecticidal nets (LLINs) in the field are critical for planning future implementation strategies including behavioral change for care and maintenance. LLIN distribution at high coverage is considered to be one of the adjunctive transmission reduction strategies in Nepal's Malaria Strategic Plan 2014–2025. The main objective of this study was to assess the durability through assessment of community usage, physical integrity, residual bio-efficacy, and chemical retention in LLINs: Interceptor[®], Yorkool[®], and PermaNet[®] 2.0 which were used in Nepal during 2009 through 2013.

Methods: Assessments were conducted on random samples ($n = 440$) of LLINs from the eleven districts representing four ecological zones: Terai plain region (Kailali and Kanchanpur districts), outer Terai fluvial ecosystem (Surkhet, Dang, and Rupandhei districts), inner Terai forest ecosystem (Mahhothari, Dhanusa, and Illam districts), and Hills and river valley (Kavrepalanchok and Sindhupalchok districts). For each LLIN, fabric integrity in terms of proportionate hole index (pHI) and residual bio-efficacy were assessed. However, for chemical retention, a representative sample of 44 nets (15 Yorkool[®], 10 PermaNet[®] 2.0, and 19 Interceptor[®]) was evaluated. Data were analyzed using descriptive statistics stratified by LLINs brand, districts, and duration of exposure.

Results: On average, duration of use of LLINs was shortest for the Yorkool[®] samples, followed by PermaNet[®] 2.0 and Interceptor[®] with median ages of 8.9 (IQR = 0.4), 23.8 (IQR = 3.2), and 50.1 (IQR = 3.2) months, respectively. Over 80% of field distributed Yorkool[®] and PermaNet[®] 2.0 nets were in good condition (pHI < 25) compared to Interceptor[®] (66%). Bio-efficacy analysis showed that average mortality rates of Interceptor and Yorkool were below World Health Organization (WHO) optimal effectiveness of $\geq 80\%$ compared to 2-year-old PermaNet 2.0 which attained 80%. Chemical retention analysis was consistent with bio-efficacy results.

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