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Abstract

Background: Nigeria suffers the world's largest malaria burden, with approximately 51 million cases and 207,000 deaths annually. As part of the country's aim to reduce by 50% malaria-related morbidity and mortality by 2013, it embarked on mass distribution of free long-lasting insecticidal nets (LLINs).

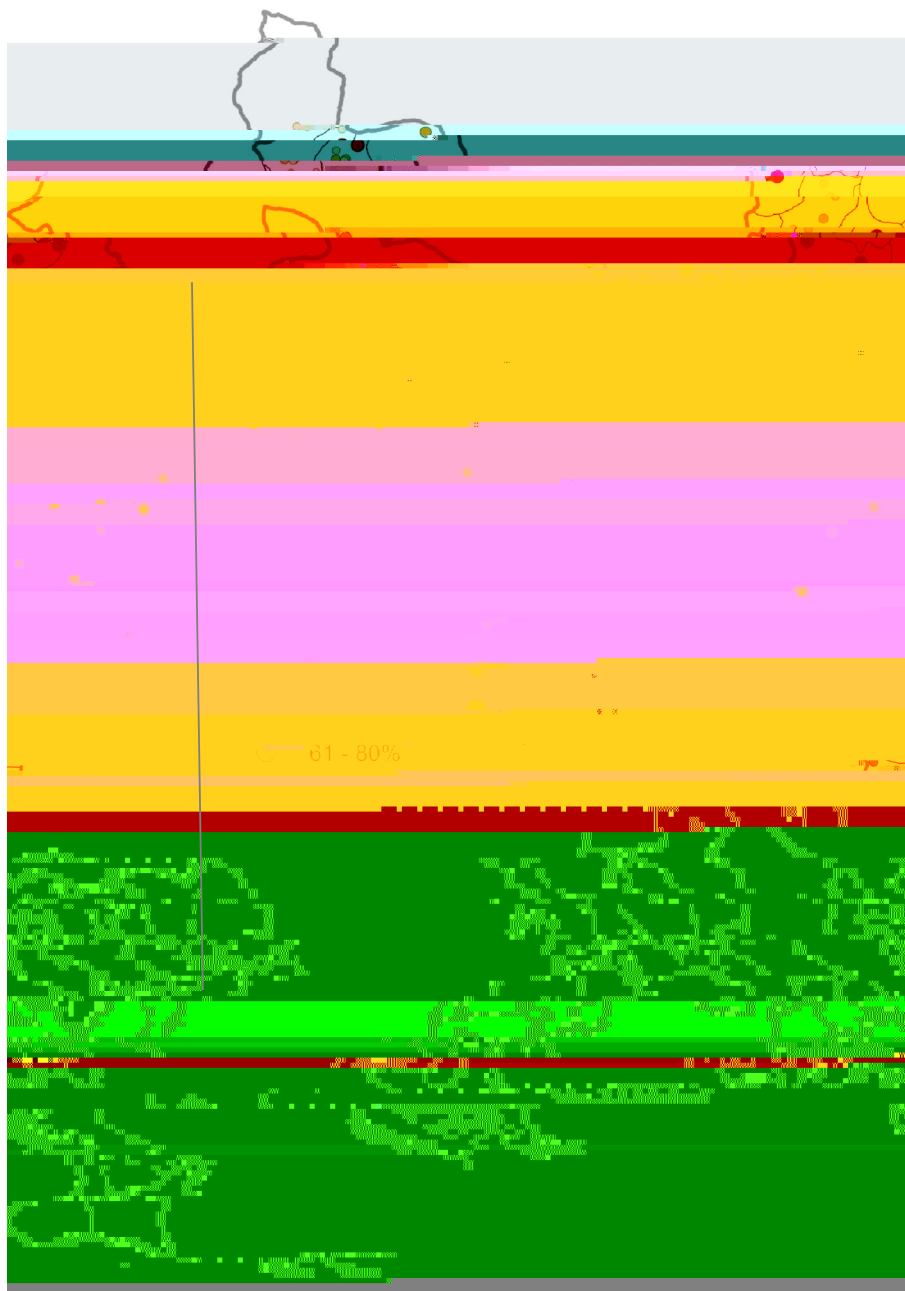
Methods: Prior to net distribution campaigns in Abia and Plateau States, Nigeria, a modified malaria indicator survey was conducted in September 2010 to determine baseline state-level estimates of Plasmodium prevalence, childhood anemia, indoor residual spraying (IRS) coverage and bednet ownership and utilization.

Results: Overall age-adjusted prevalence of Plasmodium infection by microscopy was similar between Abia (36.1%, 95% CI: 32.3%–40.1%; n = 2,936) and Plateau (36.6%, 95% CI: 31.3%–42.3%; n = 4,209), with prevalence highest among children 5-9 years. *P. malariae* accounted for 32.0% of infections in Abia, but only 1.4% of infections in Plateau. More than half of children ≤ 10 years were anemic, with anemia significantly higher in Abia (76.9%, 95% CI: 72.1%–81.0%) versus Plateau (57.1%, 95% CI: 50.6%–63.4%). Less than 1% of households in Abia (n = 1,305) or Plateau (n = 1,335) received IRS in the 12 months prior to survey. Household ownership of at least one bednet of any type was 10.1% (95% CI: 7.5%–13.4%) in Abia and 35.1% (95% CI: 29.2%–41.5%) in Plateau. Ownership of two or more bednets was 2.1% (95% CI: 1.2%–3.7%) in Abia and 14.5% (95% CI: 10.2%–20.3%) in Plateau. Overall reported net use the night before the survey among all individuals, children <5 years, and pregnant women was 3.4%, 6.0% and 5.7%, respectively in Abia and 14.7%, 19.1% and 21.0%, respectively in Plateau. Among households owning nets, 34.4% of children <5 years and 31.6% of pregnant women in Abia used a net, compared to 52.6% of children and 62.7% of pregnant women in Plateau.

Conclusions: These results reveal high Plasmodium prevalence and childhood anemia in both states, low baseline coverage of IRS and LLINs, and sub-optimal net use—especially among age groups with highest observed malaria burden.

Keywords: Malaria, Plasmodium, Falciparum, Malariae, Anemia, Net use, Net ownership, Nigeria, LLIN, Bed net

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Commission, 60 clusters per state were selected in systematic (equal interval) fashion with a random start. Survey teams made a rough listing and sketch map of household locations within each cluster, and if the number of households exceeded pre-defined thresholds, the cluster was randomly divided into segments and one segment randomly selected according to the Multiple Indicator Cluster Survey (MICS) methods [14]. All households within selected clusters were eligible for inclusion in the study. If

no one was home at the time of first visit, interviewers returned later in the day in an attempt to include all eligible households.

A household was defined as: a married man, his wives and all of his dependents who currently live with him (including biological children, adoptive children, domestic workers, other family members for whom he is responsible); an unmarried (widowed, divorced, never married) woman who is recognized as the head of household and

Ethics considerations

This protocol received ethical clearance from the Emory

In Abia, 68.1% of infections were identified as *Pa* -
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(95.2%; 97.7%, respectively) were hung at an appropriate height—i.e. able to be tucked in under sleeping mat on floor or mattress on bed. The most commonly reported reasons for not hanging nets in each state included: respondent did not want to use net (40.0% in Abia, 28.4% in Plateau), have not yet hung it (14.6%; 12.9%), were too tired to hang it last night (9.1%; 5.6%) and don't know how to hang it (10.9%; 2.2%). Various other reasons were reported by less than 10% of respondents as shown in Table 5. The majority of nets were reportedly used by a household member the previous night in Abia (60.6%) and Plateau (80.4%), with use significantly higher in Plateau. Reasons why nets were not used last night are listed in Table 5. No

with prevalence highest in the 5-

In an effort to address these gaps, The Carter Center has developed behavior change communication (BCC) materials that emphasize strategies for increasing net use that were identified among consistent net users during focus group discussions conducted in Plateau State. In addition, BCC materials incorporate health education about lymphatic filariasis and malaria. This innovative, integrated health messaging approach was driven by the fact that both diseases share the same *A* vector and the belief that heightened awareness of LF-associated sequelae, which include swelling of the limbs (lymphedema, elephantiasis) and genital organs (hydrocele), is likely to promote increased net usage, particularly among adolescents and males.

As with any survey, there are limitations to note. Results from this study represent a single cross-sectional sample, which was collected during peak malaria season. We compared results with the 2010 MIS survey, which was conducted approximately one month after our survey. However, the DHS surveys of 2003 and 2008 were conducted during the months of March to August and June to October, respectively, which overlap periods of typically lower malaria transmission. Care should thus be taken when comparing our results with the DHS, particularly malaria parasite prevalence estimates, as well as utilization of malaria prevention measures, since net use has been observed to decline during dry seasons [43-45]. Studies of this type are also reliant upon self-reported data for many questions. In an effort to verify net ownership and ever-use of nets, survey teams visually inspected nets within households and observed whether the net was still sealed in its original packaging. However, it was not possible to verify use of net the previous night or other self-reported data. The survey was also conducted by independent groups of survey teams in each state, and unidentified sources of systematic error between teams may have biased state level estimates and the inferred differences between states. Likewise, slides from Abia and Plateau were read in separate laboratories. Although quality control was

11. Richards FO, Emukah E, Graves PM, Nkwocha O, Nwankwo L, Rakers L, Mosher A, Patterson A, Ozaki M, Nwoke BE, Ukaga CN, Njoku C, Nwodu K, Obasi A, Miri ES:

