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TRENDS IN OUTPATIENT MALARIA CASES, FOLLOWING MASS LONG LASTING INSECTICIDAL NETS (LLIN) DISTRIBUTION IN EPIDEMIC PRONE AND ENDEMIC AREAS OF KENYA
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B. MACHINI, E. WAQO, W. KIZITO, J. K. EDWARDS, P. O. OWITI and K. C. TAKARINDA

ABSTRACT

***Background*: There were over 6 million case of malaria reported in Kenya in 2015 and it remains a major public health priority despite significant investments in interventions to control and prevent infections in high risk areas.**
***Objectives*: To analyse trends from 2011-2015, and report i) outpatient department (OPD) malaria case prevalence, ii) the proportion of confirmed malaria cases of all OPD cases stratified by age category, and iii) the proportion of the population potentially protected by long-lasting insecticidal nets (LLINs), following mass distribution of LLINs in malaria epidemic prone and endemic areas.**
***Design*: A retrospective study.**
***Setting*: Kenya's Coast endemic, Lake endemic and Highland epidemic zones.**
***Subjects*: All outpatient malaria cases reported in the District Health Information System.**
***Results*: The proportion of people who received mass LLINs ranged from 80-95% in epidemic prone and endemic areas of Kenya. The coastal endemic zone had the lowest number of reported malaria cases at almost 840,000 in 2011, compared with the lake endemic zone which reported 4.3 million total cases. Confirmed malaria cases of all the OPD morbidity increased by 1%, 20% and 4% in the Highland epidemic prone, the Lake and Coast endemic region in 2011 to 2015, respectively. There was a trend towards fewer cases across all three high risk regions from 2012-2013, but this reversed with increasing cases being reported in 2014-2015.**
***Conclusion*: Despite a high LLIN coverage malaria cases increased over time. There is need for patient-level studies to assess if LLINs are being used appropriately and to look towards other complimentary malaria prevention strategies.**

INTRODUCTION

Malaria remains a major public health problem in areas of endemicity. In 2015 there were an estimated 214 million cases of malaria globally, of which 88% were reported from sub-Saharan Africa. During the same period, the disease led to an estimated 438 000 deaths globally of which the majority (70%) were children aged less than five years and 90% of all deaths were from Africa (1). Results from the 2010 Kenya Malaria Indicator Survey (KMIS) showed that malaria accounted for a staggering 30% of all outpatient attendance, 19% of all inpatient admissions and 3-5% of inpatient deaths (2).

Long lasting insecticidal nets (LLIN) reduce malaria prevalence if used appropriately. A study completed in western Kenya found that insecticide treated nets (ITN) were cost effective and reduced the prevalence of malaria infection amongst household members who utilised them by 63% (3). ITNs were also found to reduce malaria morbidity among children on the Kenyan Coast by 44% and a further 33% reduction in childhood mortality (4) whilst in Togo malaria morbidity was reduced by 50% (5).

The fight against malaria remains one of Kenya's national health sector priorities. In response, the

National Malaria Control Program (NMCP) has targeted measures that are being scaled up from 2009-2018. The NMCP goals include preventing at least 80% of people living in the malaria risk areas from acquiring malaria. The preventive malaria measures implemented include distribution of long-lasting insecticidal nets (LLINs), indoor residual spraying (IRS) and use of intermittent preventive treatment in pregnancy (IPTp) (6).

The Ministry of Health (MOH) in Kenya uses a tripartite approach in the distribution of the LLINs: 1) routine distribution to pregnant women in antenatal care (ANC) and children under one year in child welfare clinics, 2) social marketing at a subsidised price and 3) more commonly mass net distribution campaigns done every three years to populations in epidemic prone and endemic areas of the country. The Malaria Vector Control Sub-unit in Kenya has also issued guidelines on integrated vector management (IVM) that advocate for appropriate use of LLINs and indoor residual spraying (IRS) (8).

There is limited information on the trends of reported malaria cases and the mass LLIN coverage within the different malaria epidemiological zones of Kenya. The goal of this study was to analyse from 2011-2015, the trends in number and proportions of reported outpatient malaria cases (confirmed and clinical) stratified by age group and compared to mass LLIN coverage in the different malaria epidemiological zones of Kenya

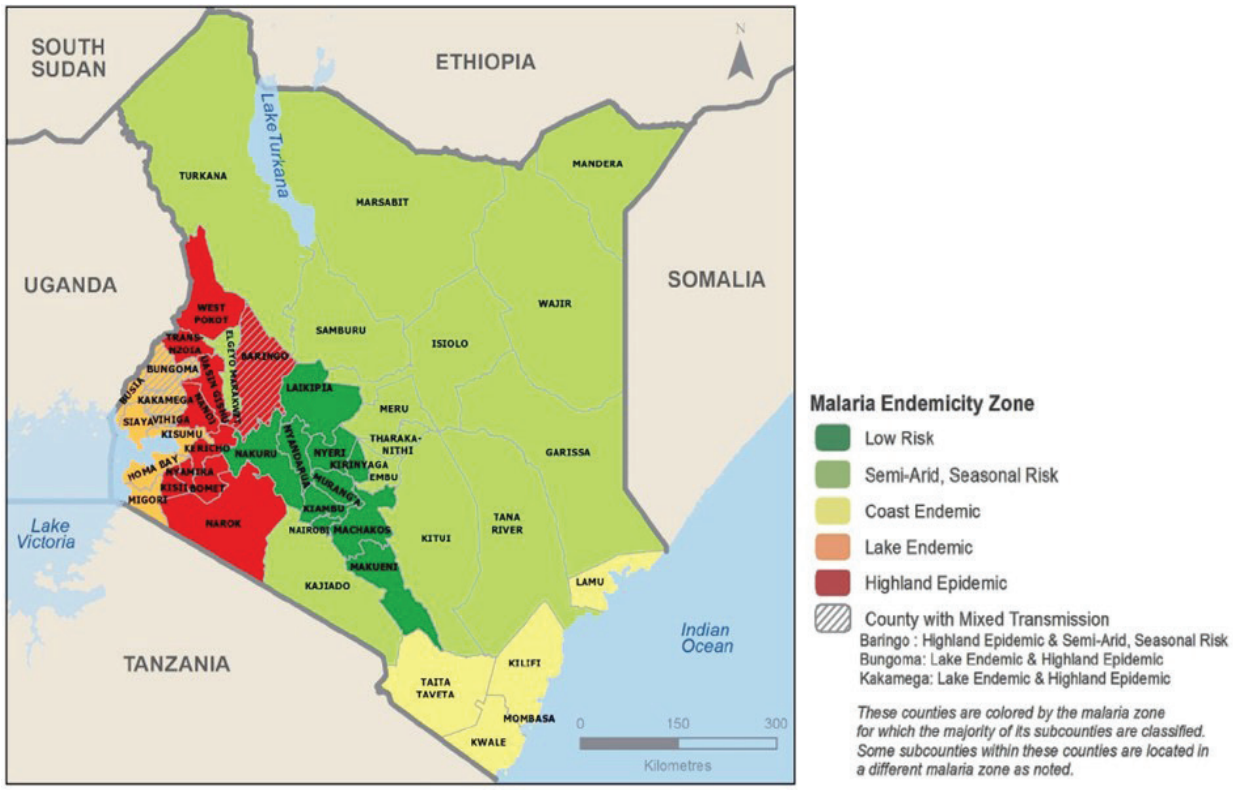
MATERIALS AND METHODS

Study design: A retrospective study using routinely reported national programme data.

Setting: In 2014, Kenya had an estimated population of 44 million, with a growth rate of 2.8%. (7). Kenya is an east African country that straddles the equator, where the diverse ecosystems are influenced by altitude, rainfall and proximity to Lake Victoria and the Indian Ocean and these have an effect on the malaria epidemiological zones (8).

Malaria Epidemiological zones: The malaria epidemiological zones are divided into four:1) epidemic prone areas, 2) seasonal transmission areas, 3) endemic areas which are further divided into Lake Endemic and coastal endemic and 4) low risk areas (Figure 1). These zones are determined by altitude, rainfall patterns and temperature as well as the malaria prevalence (9).

Figure 1
The map of Kenya showing the different type and distribution of malarial epidemiological zones (source: KMIS 2015)



Study site: This study focused on cases reported from health facilities within endemic and epidemic prone areas. Endemic zones are those areas of stable high malaria burden, with intense transmission throughout the year and have altitudes ranging between 0 to 1300 meters around Lake Victoria in western Kenya and in the eastern coastal regions.

Epidemic zones occur with seasonal malaria transmission, typically in the arid and semi-arid areas of northern and south-eastern parts of Kenya that experience short periods of intense transmission during the rainfall season. Temperatures are usually high and water pools created during the rainy season provide abundant malaria vector breeding sites. However, the epidemic zones have considerable year-to-year variation, depending upon climatic conditions which favor sustainable vector breeding and subsequent increased malaria transmission.

Malaria surveillance: The malaria data is routinely collected at the health facility level using standard outpatient and laboratory registers (MOH 204 and MOH 240). The data is summarised monthly using MOH 705A (for children under 5 years) and MOH 705B (for 5years and above) reporting forms, and sent to the sub-county administration where it is uploaded into the district health information system software (DHIS2).

Mass net distribution campaign: The NMCP and partners have been implementing a rolling free mass campaign in the epidemic prone and endemic areas every three years, providing treated LLINs that are effective for three years. To achieve the universal coverage of one LLIN for every 1.8 people, the World Health Organisation (WHO) recommends that nets should be distributed for free to all people at risk, (10). The LLIN distribution campaigns were completed in Kenya during 2007-2008, 2011-2012 and 2014-2015, with an estimated 13 million nets being distributed during the last campaign.

Study Participants: All outpatient malaria cases reported in the DHIS2 from epidemic prone and endemic areas from 2011-2015.

Data Sources and Variables: The study used anonymous routine malaria surveillance data that were downloaded from the DHIS2 which has inbuilt data validation checks. The LLIN data was collected from activity reports sourced from NMCP. The data were cross-checked for consistency before being analysed. Aggregated study variables included: age, number of confirmed malaria cases by microscopy or rapid diagnostic tests (RDTs), number of clinical malaria cases without laboratory confirmation, year of diagnosis, the number of LLINs distributed and malaria zone.

Analysis and Statistics: All data were entered and analysed using Excel (Microsoft Inc., Seattle, Washington). Descriptive statistics were used for describing trends in reported malaria cases and LLINs coverage.

Ethics Approval: Formal ethics approval was granted by the Institutional Research Ethics Committee (IREC) of Moi University/ Moi Teaching and Referral Hospital, Eldoret, Kenya and the Ethics Review Board of Médecins sans Frontières, (Geneva, Switzerland), on behalf of Structured Operational Research and Training Initiative. Permission to undertake the study was obtained from the Ministry of Health, Nairobi, Kenya.

RESULTS

From 2011 to 2015, following mass distribution interventions within the malaria epidemic and endemic areas in Kenya, the proportion of people who reported receiving LLINs ranged from 80-95%, (Figure 2). The lowest proportion of LLIN coverage was in the coastal region at 80% in 2011-12. On average, the population in the high risk regions that were protected by LLINs in 2011/2012 was 86% and in 2014/2015 the coverage was 90%. The LLIN coverage for those living in the lake epidemic zone remained relatively constant in 2011-2015 at 88%. The proportion of people who reported receiving LLINs in a given year per region was calculated by assuming that each LLIN distributed protected 1.8 persons for three years.

The reported increase of malaria cases in the period 2011-2015, varied significantly depending on the malaria epidemiological zone in Kenya, (Figure 3). The coastal endemic zone had the lowest number of cases at approximately 840,000 cases in 2011, compared with the lake endemic zone which reported 4.3 million total cases. There was a trend towards fewer cases across all three high risk regions from 2012-2013, but this reversed with increasing cases being reported by 2014-2015. Additionally, there was a significant shift across all reporting regions with a steady increase in laboratory confirmed malaria cases by RDT or microscopy versus clinical cases.

The proportion of confirmed malaria cases of all OPD morbidity, increased by 4%, 1% and 20% in the Coast, Highland and Lake regions from 2011 to 2015, respectively (Figure 4). The confirmed malaria cases were higher in under 5 years than over 5 years across all regions.

Figure 2

The proportion of population potentially protected with long-lasting insecticidal nets (LLIN) distributed in the epidemic prone and endemic areas, Kenya 2011-2015

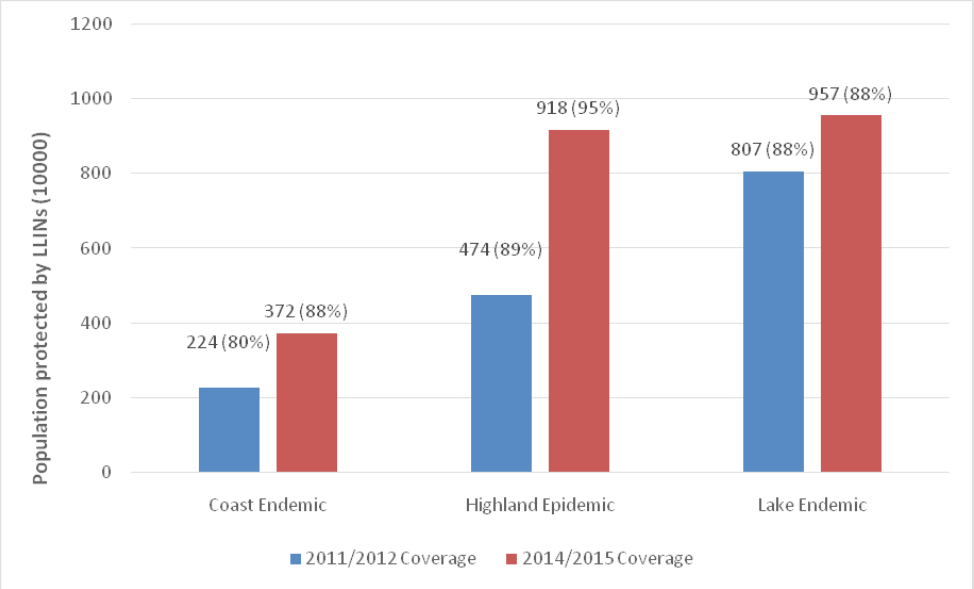


Figure 3

Total number of confirmed malaria cases (by rapid diagnostic test or microscopy) versus clinically diagnosed malaria cases reported by year in the epidemic prone and endemic areas of Kenya, 2011-2015

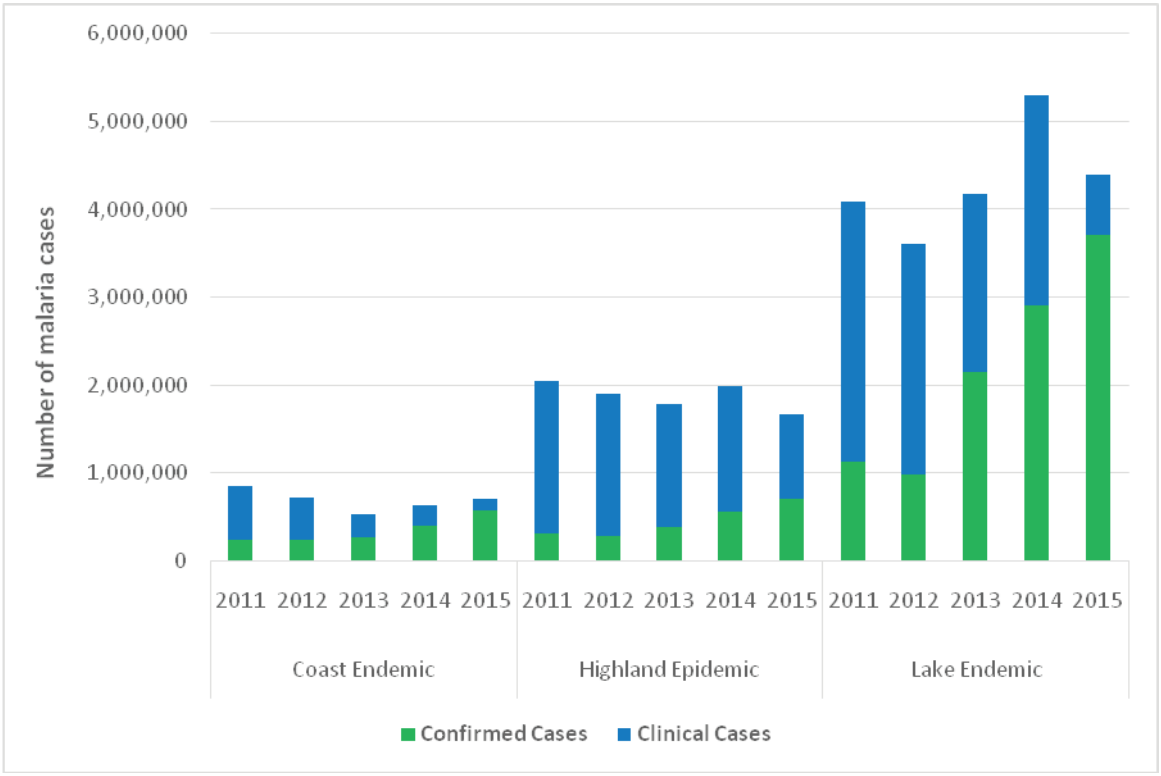
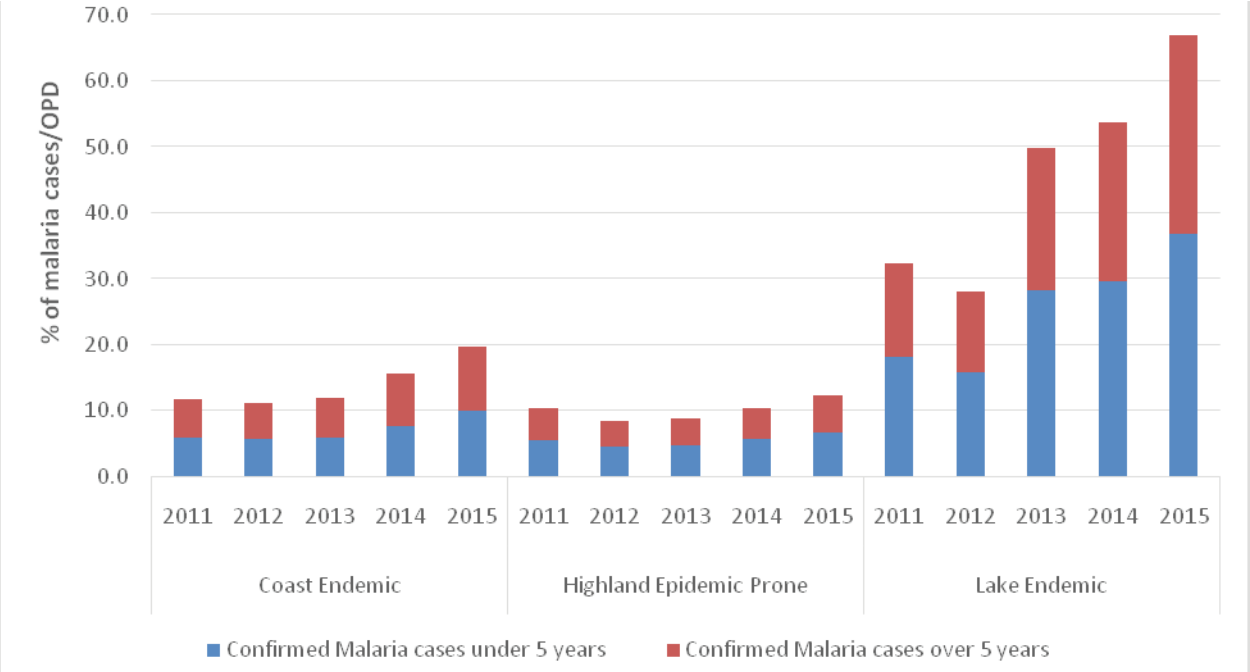


Figure 4

The proportion of confirmed malaria cases of all the outpatient department (OPD) cases stratified age category in the epidemic prone and endemic areas of Kenya, 2011-2015



DISCUSSION

The LLIN coverage was sustained in the endemic and epidemic prone areas during the 2011-2015 period. Comparing yearly reporting, the population protected increased in the latter years. Mass distribution campaigns have been repeated every three years and continuous LLIN distribution are provided through antenatal clinics (ANCs) for pregnant women and through child welfare clinics (CWCs) for children under one year, with the goal to maintain high levels of coverage in the highest malaria risk regions of Kenya.

The WHO recommends that LLINs be distributed for free, to achieve universal coverage of one LLIN for every 1.8 people in the target population (10). LLINs have the potential to reduce malaria transmission to low levels provided usage levels are high and sustained (11). Our results are consistent with the Kenya Malaria Indicator Survey, which found that households with at least one LLIN within the Coast, Highland and Lake regions were 73.3%, 72.9% and 86.8% respectively (12). This suggests that almost one in four of people who receive LLINs in highland epidemic and lake regions may not use them consistently, thus increasing their risk for malaria infection.

Despite the high level of LLIN coverage, malaria cases increased over time, which questions whether there are other contributing factors. A recent survey in Kenya revealed that percentage of households who slept under an LLIN the night prior to the day of the survey was 54%, 67%, and 59%, for Highland, Lake and Coast regions, respectively (12).

Additionally, the number of confirmed malaria cases likely increased due to improved diagnostics using RDTs, enhanced health workers' capacity to treat and diagnose malaria and adherence to 'Test, Treat and Track' policy (10). However, in the Highland areas, there appeared to remain an over-reliance on clinical malaria diagnosis, likely leading to over-reporting of true malaria cases. Targeted enhanced training could increase the use of laboratory diagnostics for this region, leading to improved outcomes and cost savings. Per the KMS for 2014-2018, all suspected malaria cases should be managed in accordance with National Malaria Treatment Guidelines, which requires laboratory confirmation of diagnosis.

Infants, children under five years of age, pregnant women and patients with HIV/AIDS are at significantly higher risk of malaria infection and subsequent complications, including mortality (1). Based upon our results, it appears that improved efforts are required to prevent malaria, especially in these higher risk groups, which will likely lead to improved outcomes within Kenya.

The strength of this study was that health facility malaria data were accessed from the DHIS2 after undergoing data validation processes in order to ensure quality reporting of data. The primary challenge was that reporting rates of malaria cases

were not 100%. Lastly, the system was not able to capture the actual ages but categorised the age groups and it was not possible to determine the co-morbidities.

In conclusion, during the study period LLIN coverage was high, however, malaria cases increased over time. The MOH and partners need to step up measures to sustain distribution of the LLINs to attain universal coverage. Other malaria interventions like IRS should be reintroduced as well as advocate for IPTp uptake. Further investigations need to be conducted to assess if LLINs are being used as required in households and communities. Finally, the Highland epidemic prone areas need to further support to scale-up use of laboratory confirmation of malaria cases according to current Kenya national guidelines.

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