MINISTRY OF HEALTH

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Evaluation of the impact of malaria interventions on all-cause mortality in children under five in Kenya, 2003-2015

Summary of Preliminary Key Findings

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KEMRI | Wellcome Trust

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Foreword

This is the first summary evaluation report produced by the National Malaria Control Programme (NMCP), which covers a large part of the Millennium Development Goals era from 2003 to 2015. The full report of the effects of the program will be available later in 2016. The evaluation is designed to analyze the magnitude of the effects that the increase in malaria intervention programmes has had on the epidemiology of the disease in Kenya, as well as its effects on morbidity and mortality of the most vulnerable population—children under five years of age. The report shows the progress made in achieving targets of coverage of malaria interventions agreed upon by Heads of State and Governments in Abuja in 2000 and again in 2006; the targets are consistent with global targets for malaria control and elimination. The evaluation provides all stakeholders in malaria control in Kenya with an accountability mechanism for the investments made over the period and highlights the vulnerability of success when intervention methods falter due to lack of resources. Ultimately, this evaluation will help the Ministry of Health, the NMCP, partners, and stakeholders to improve on-going programmes and determine what additional tools are required to further reduce the burden of malaria in the country. This evaluation will inform the development of the next malaria strategic plan after 2018.

Dr Waqo Ejersa

Head, National Malaria Control Program

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The malaria burden in Kenya is not homogenous. According to unpublished data from the Ministry of Health (MOH) in 2015, malaria accounts for 16 percent of outpatient visits to health facilities nationally.

Photo by National Malaria Control Programme Kenya

Background

Overview of Malaria in Kenya

Malaria remains a significant cause of morbidity and mortality in Kenya, particularly among young children, and three-quarters of the population is at risk of the disease. The malaria burden in Kenya is not homogenous. According to unpublished data from the Ministry of Health (MOH) in 2015, malaria accounts for 16 percent of outpatient visits to health facilities nationally. From 2003–2015, the Government of Kenya (GoK) and partners increased funding for malaria control significantly, which resulted in expansion of key interventions, such as insecticide-treated nets (ITNs), indoor residual spraying (IRS) in selected areas, intermittent preventive treatment during pregnancy (IPTp), and prompt and effective malaria case management (diagnosis and treatment with effective antimalarials). Measuring the effects of these investments is necessary to inform the National Malaria Control Programme (NMCP) and partners, and to provide information for evidence-based decision making for future policies, strategies, and activities to reduce the burden of malaria further. Kenya's Ministry of Health and the United States President's Malaria Initiative (PMI), on behalf of the Roll Back Malaria (RBM) Partnership, co-commissioned this evaluation to measure the effects of expansion of key malaria interventions on all causes of mortality in children under five years of age during the evaluation period from 2003–2015. The evaluation is timely, because the NMCP plans a program review in 2017 to inform the next malaria strategic plan. This summary report presents the key findings of the evaluation.

In Kenya, since 2000, there has been a rapid expansion of malaria control interventions, such as insecticide-treated nets (ITNs), intermittent preventive treatment in pregnancy (IPTp), and prompt and effective malaria case management (diagnosis and treatment with effective antimalarials) due to increased investments. Policy changes and new interventions have been informed by global and regional recommendations and changes in the malaria situation in Kenya.

Photo by Population Services Kenya

Objectives

The main objective of the evaluation was to measure the impact of the expansion of key malaria interventions from 2003 to 2015. The specific objectives were to:

1. Measure the degree to which malaria control interventions have been implemented and expanded in Kenya.

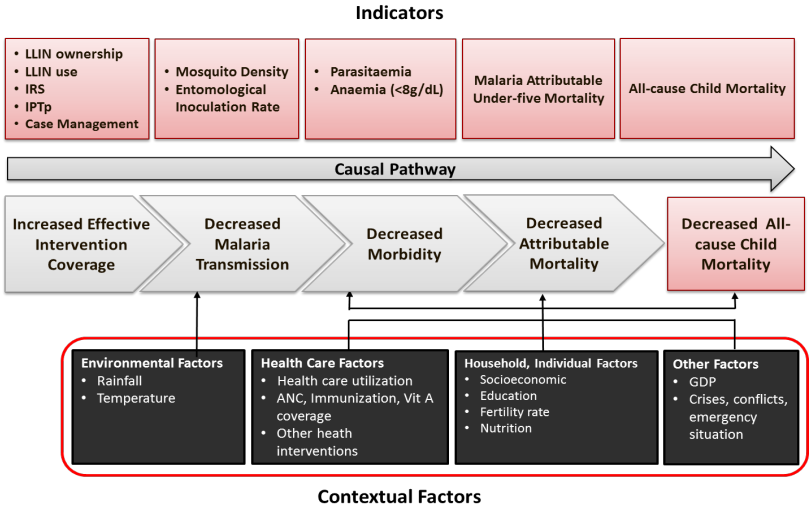
2. Assess malaria-related morbidity and mortality, and contextual factors before, during, and after expansion of malaria control interventions in Kenya.

3. Assess the plausible contribution of the expansion of malaria control interventions to changes in malaria-related morbidity, all-cause mortality and malaria-related mortality among children under five years of age in Kenya.

Design

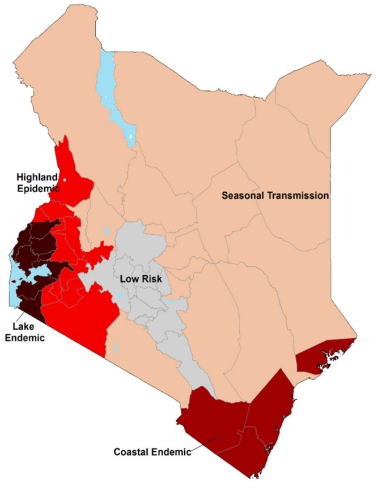
The evaluation was based on a pre-and-post intervention assessment, which used a plausibility framework to measure changes in malaria intervention coverage, and malaria-related morbidity, and mortality among children under five years of age, hereinafter referred to as children under-five, while documenting key contextual determinants of child survival during the evaluation period (Figure 1). The primary measure of impact was all- cause under five mortality. In addition, Kaplan-Meier survival curves were estimated to compare the survival probability of children under-five before (2000-2004), during (2005–2009), and after (2010–2014) the expansion of malaria interventions. Due to the variability in malaria transmission in Kenya, the analyses were conducted at the national level and disaggregated by malaria epidemiological zones (Figure 2).

Figure 1: Framework for evaluating the impact of malaria control interventions on all-cause under-five mortality, Kenya—2003–2014



Note: *LLIN–long lasting insecticidal net; IRS–indoor residual spraying; ANC–antenatal care; GDP–gross domestic product; IPTp–intermittent preventive treatment of malaria in pregnancy; Vit.A–vitamin A*
Source: *Guidance for Evaluating the Impact of National Malaria Control Programs in Highly Endemic Countries, 2014 (RBM-MERG, 2014)*

Figure 2: Malaria epidemiological zones in Kenya



Source: *The epidemiology and control profile of malaria in Kenya: Reviewing the evidence to guide the future of vector control (Noor, 2012)*

Data Sources

Mortality, morbidity, and intervention coverage data were obtained primarily from nationally representative, population-based household surveys including the Kenya Demographic and Health Surveys (DHS) in 1998 (CBS, 1999), 2003 (CBS, 2004), 2008/9 (KNBS, 2010) and 2014 (KNBS, 2015) and the Malaria Indicator Surveys (MIS) in 2007 (DOMC, 2009), 2010 (DOMC, 2011) and 2015 (NMCP, 2016). Data from other sources including the routine Health Management Information System (HMIS), Health and Demographic Surveillance Systems (HDSS) and research studies were used to complement and triangulate findings and/or as vignettes of sub-national changes.

Photo by National Malaria Control Programme Kenya

Milestones in Malaria Control

The launch of the RBM Initiative by the World Health Organization (WHO) in 1998 led to renewed global interest in malaria, and increased financial investment in malaria control worldwide. In Kenya, renewed commitment enabled a gradual increase and implementation of interventions (Figure 3). From 2001, ITNs were distributed routinely to pregnant women and young children through maternal and child health clinics, were provided at a subsidized price through the private sector, and sold at full cost commercially. From 2010, free mass ITN distribution campaigns that targeted all households were conducted in endemic and epidemic zones to achieve universal coverage (one net for every two persons at risk of malaria). IRS was conducted annually from 2006 to 2009 to prevent epidemics in epidemic-prone districts. Guided by surveillance data, IRS was conducted only in areas identified as high-risk for outbreaks from 2010 to 2012. IRS was also implemented in select malaria endemic districts as part of burden reduction. Increased funding also enabled the roll-out of the recommended artemisinin-combination treatments (ACTs) at no cost in the public sector in 2006, and enabled parasitological diagnosis of malaria before treatment with the introduction of easy-to-use rapid diagnostic tests (RDTs) in 2010. Kenya was one of the first countries to introduce IPTp as a strategy for prevention of malaria during pregnancy in 1998, but only implemented the strategy from 2001. Following a review of the programme, and consistent with the WHO policy to implement IPTp in areas of moderate to high transmission, Kenya changed its national IPTp policy in 2009 to target only pregnant women living in the lake and coastal endemic zones.

Figure 3: Milestones in malaria policy adoption and implementation in Kenya

Year	Milestones
1980s	Increasing chloroquine resistance and no effective sustained vector control method resulted in the rebound of malaria
1992	World Bank re-emphasizes the significance of malaria control for economic and social development; The Global Malaria Control Strategy adopted at the WHO Ministerial Conference in Amsterdam; Ministry of Health (MOH) develops the National Malaria Plan of Action 1992-1997
1994	Malaria Control Unit (MCU) is set up in the Division of Vector Borne Diseases (DVBD) as the operational National Malaria Control Programme
1998	Malaria epidemics occur in the western highlands after the 1997/1998 El Niño Southern Oscillation Cycle; Sulphadoxine-Pyrimethamine (SP) replaces chloroquine as the first-line treatment for malaria; Indoor Residual Spraying (IRS) adopted as a strategy for malaria epidemic prevention and response; Intermittent Preventive Treatment in pregnancy (IPTp) with SP adopted; *Demographic and Health Survey conducted*
1999	First Health Sector Strategic Plan (HSSP) 1999-2004 recognizes malaria as the highest priority public health issue for prevention and treatment
2000	The MCU in DVBD is elevated to a division within the Ministry of Health and renamed the Division of Malaria Control (DOMC)
2001	The first National Malaria Strategy 2001–2010 is developed; Subsidized ITNs distributed to pregnant women and children under- five at maternal and child health clinics (MCH) under a cost-sharing mechanism
2003	*Demographic and Health Survey conducted*
2004	Artemisinin-based Combination Treatments (ACTs) are adopted as a first-line treatment for malaria, with amodiaquine as interim first-line before ACTs become available in the public sector; ITNs distributed free to pregnant women and children under- five at MCH clinics; Distribution of subsidized nets to community members commenced as part of social marketing
2005	Conventional ITNs (which need retreatment with insecticide at intervals) replaced with long lasting insecticidal nets (LLINs)
2006	ACTs become available in the public sector at no cost to patients; Conducted first free mass net distribution campaign targeting children under- five and pregnant women
2007	*Malaria Indicator Survey conducted*
2008	Post-election violence results in population displacements, and movement between different transmission risk zones, as well as disruption of health services; Pharmacy and Poisons Board bans importation and sale of non-recommended antimalarials, including oral artemisinin monotherapies
2009	*Demographic and Health Survey conducted;* Malaria Program Review conducted and second National Malaria Strategy 2009-2017 developed; IRS adopted as a strategy for malaria burden reduction in endemic areas; IPTp implementation restricted to malaria endemic areas
2010	*Malaria Indicator Survey conducted;* MoH enacts policy for the parasitological confirmation of all malaria cases before treatment; Introduction of subsidized ACTs in the private sector through the pilot phase of Affordable Medicine Facility–malaria
2011	Free universal mass net distribution campaign conducted in Nyanza, Western, and parts of Rift Valley Provinces
2012	Rapid diagnostic tests become available in public health facilities; Free universal mass net distribution campaign conducted in Coast and parts of Rift Valley Provinces
2013	Devolution of Health Services to County level and the creation of County Health Management Teams to manage health services; Artesunate replaces quinine as first-line treatment for severe malaria
2014	*Demographic and Health Survey conducted;* Free universal mass net distribution campaign conducted in Nyanza and West Pokot counties; Malaria Program Review and revision of the Kenya Malaria Strategy, 2009-2018
2015	*Malaria Indicator Survey conducted;* Free universal mass net distribution campaign conducted in counties in former Western and parts of Rift Valley and Coast Provinces. Note that for operational reasons, the provinces were consistent with the 2011/12 free mass net campaign


During the evaluation period, ownership of at least one ITN per household at the national level increased substantially, from 6 percent in 2003 to 63 percent in 2015.
Ministry of Health
USAID
CDC
USAID
President's Malaria Initiative
Photo by Population Services Kenya

Trends in Coverage of Interventions

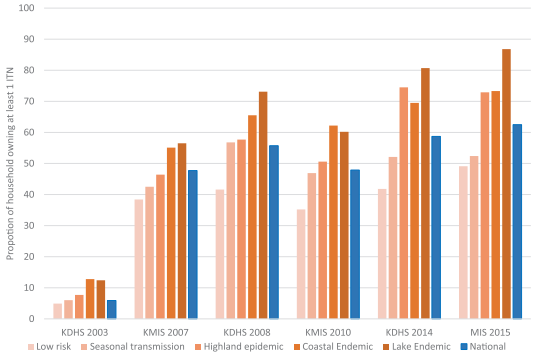
Vector Control

Insecticide treated nets

By 2006 the national target for ITN use was specific to pregnant women and children under-five with at least 60 percent sleeping under an ITN. From 2009, the new target was to have 80 percent of the population at risk sleep under an ITN by 2013. During the evaluation period, ownership of at least one ITN per household at the national level increased substantially, from 6 percent in 2003 to 63 percent in 2015. In malaria endemic and highland epidemic zones where ITN distribution has been concentrated, ownership increased from 13 percent in 2003 to 73 percent in 2015 in the coastal endemic zone, from 8 percent to 73 percent in the highland epidemic zone, and from 12 percent to 87 percent in the lake endemic zone (Figure 4).

In households with at least one ITN, use among children under five years of age increased from 71 percent in 2003 to 79 percent in 2015.

Figure 4: Household ownership of insecticide-treated nets (ITNs) by endemic zones in Kenya

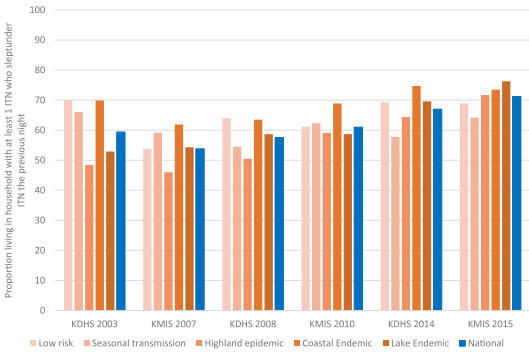


Source: *Kenya Demographic Health Survey (KDHS); Kenya Malaria Indicator Survey (KMIS)*

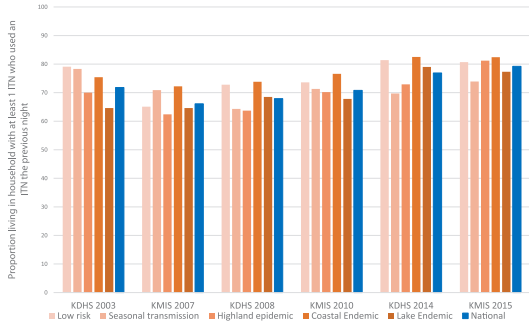
In 2003, only 6 percent of households owned an ITN. At national level, in households owning at least one ITN, use increased from 60 percent in 2003 to 71 percent in 2015. In households with at least one ITN, use among children under-five increased from 71 percent in 2003 to 79 percent in 2015, while use among pregnant women increased from 70 percent in 2007 to 82 percent in 2015. Due to the small number of pregnant women in households with ITN in 2003, it was not possible to determine with certainty the use of ITNs by pregnant women stratified by epidemiological zones. (Figure 5).

Figure 5: Use of ITNs the night before survey in households with at least one ITN in Kenya

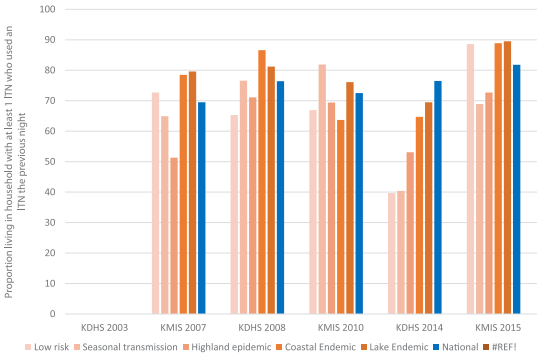
a) All household members



b) Children under-five



c) Pregnant women



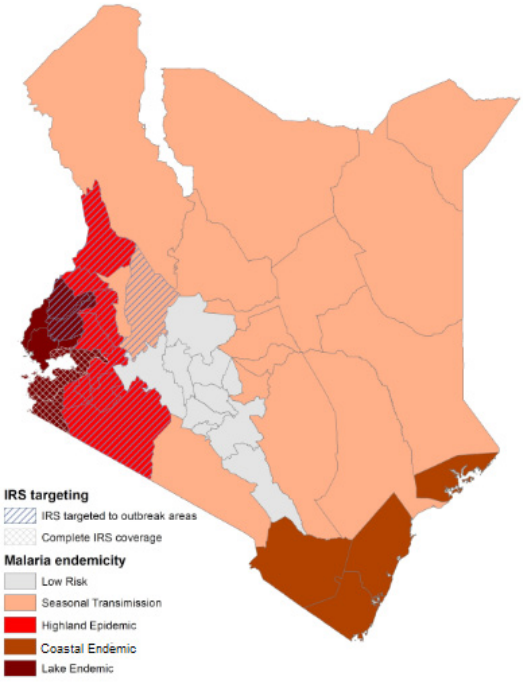
Source: *Kenya Demographic Health Survey (KDHS); Kenya Malaria Indicator Survey (KMIS)*
Note: *KDHS 2003 had only 48 pregnant women in households with ITNs*

Indoor residual spraying

Following the malaria epidemics in 1998, non-governmental organizations and NMCP implemented IRS for epidemic response in parts of the highland epidemic and seasonal transmission zones starting in 1999. In 2005, the government introduced a coordinated approach for implementing IRS to prevent epidemics in highland epidemic zone. IRS for epidemic prevention was conducted in the highland epidemic zone only in the sub-counties affected. From 2010, however, IRS was conducted in some selected lake endemic sub-counties bordering the highland epidemic counties for vector control and malaria burden reduction (Figure 6). The population protected by IRS annually in targeted areas increased from 276,000 in 2005 to 2,435,836 in 2012. IRS has not been implemented since 2012 due to insecticide resistance, resource constraints, and programme priorities.

In 2005, the government introduced a coordinated approach for implementing IRS to prevent epidemics in highland epidemic zone.

Figure 6: Malaria epidemiological zones showing counties covered by IRS implementation in Kenya from 2005 to 2012



Note: *IRS for epidemic prevention and response did not target all parts of a county. Similarly, IRS for burden reduction did not cover whole county*

Intermittent Preventive Treatment of Malaria in Pregnancy

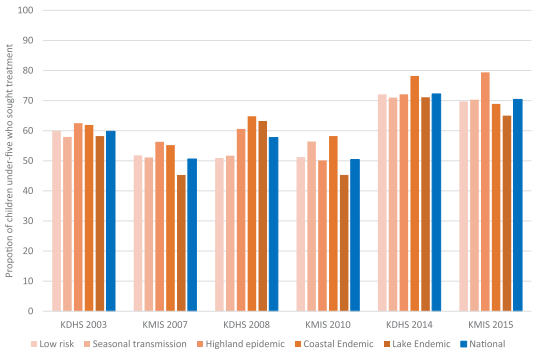
The IPTp targets were at least 60 percent of pregnant women receive two doses of IPTp (IPTp2) by 2006 and 80 percent by 2013. From 2003 to 2008, coverage with IPTp2 at the national level increased from 4 percent to 15 percent. In 2009 IPTp intervention has been targeted to pregnant women in malaria endemic zones (coastal and lake endemic) consistent with WHO recommendations (WHO, 2002 & 2014). The coverage of IPTp2 in the targeted zones has increased considerably from 22 percent in 2010 to 56 percent in 2015.

Malaria case management

Care seeking

Care seeking from appropriate providers for children under-five with fever improved during the evaluation period. At the national level, the percentage of children under-five who sought care from appropriate providers was greater than 50 percent in 2003 and increased to more than 70 percent in 2014 and 2015 (Figure 7).

Figure 7: Treatment seeking from an appropriate provider among children under-five with fever in Kenya

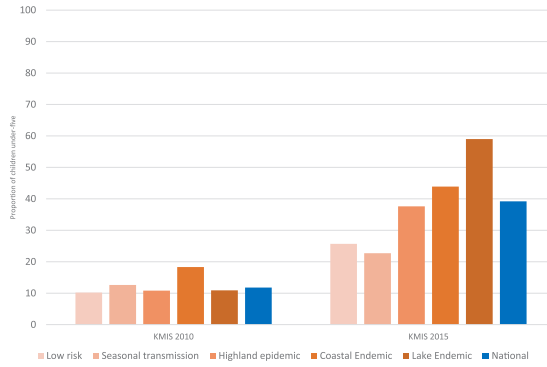


Source: *Kenya Demographic Health Survey (KDHS); Kenya Malaria Indicator Survey (KMIS)*
Note: *Appropriate providers include public, private, and faith-based health facilities, community health workers, pharmacies, and drug stores*

Diagnosis

Universal parasitological diagnosis to confirm malaria before treatment was introduced in 2010. However, malaria RDTs were not available widely until 2014. Prior to 2010, presumptive treatment for malaria was the norm, particularly among children under-five. During national surveys, diagnostic testing was measured at the population level using a proxy indicator defined as the proportion of children under-five with fever who had blood taken from a finger or heel stick. At the national level, the proportion of children tested was 12 percent in 2010 and increased to 39 percent in 2015. The lake and coastal endemic zones experienced the largest increases in diagnostic testing of children. In the lake endemic zone, diagnostic testing increased from 11 percent in 2010 to 59 percent in 2015, and in the coastal endemic zone, testing increased from 18 percent in 2010 to 44 percent in 2015 (Figure 8).

Figure 8: Diagnostic testing for malaria among children under-five with fever in Kenya



Source: *Kenya Malaria Indicator Survey (KMIS)*
Note: *Parasitological confirmation before treatment for all suspected cases was made policy in 2010*

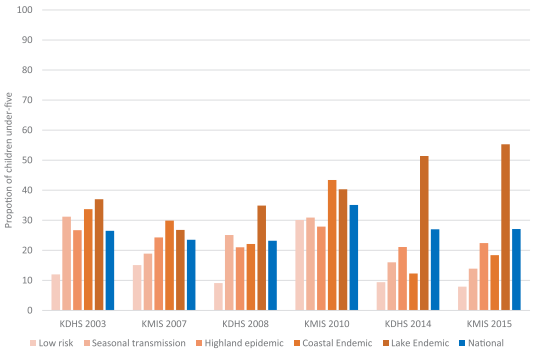
Treatment

At the national level, the proportion of children under-five with fever who received any antimalarial treatment remained consistently low at approximately 26 percent throughout the evaluation period with a slight increase to 35 percent in 2010. However, in the lake endemic

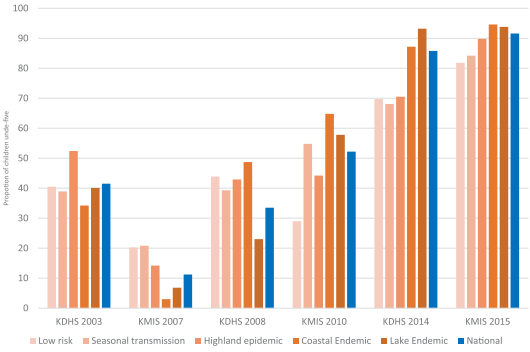
area, children with fever who received any antimalarial increased from 37 percent in 2003 to 40 percent in 2010 and 55 percent in 2015 (Figure 9a). The reduction in use of antimalarials to treat fever in other epidemiological zones might reflect the decline in the prevalence of malaria and the use of parasitological diagnostic tools. The proportion of children treated for malaria who received the recommended first-line antimalarial treatment decreased initially from 42 percent in 2003, when SP was the first-line antimalarial, to a low of 11 percent in 2007 one year after ACTs were introduced. The proportion of children with fever treated for malaria who received the first-line ACT, artemether-lumefantrine (AL), increased to 92 percent in 2015, partly because of the contribution of the subsidy program AMFm (Figure 9b).

Figure 9: Treatment with antimalarials among children under-five with fever in Kenya

a) Any antimalarial treatment



b) Recommended antimalarial treatment among children who received any antimalarials



Source: *Kenya Demographic Health Survey (KDHS); Kenya Malaria Indicator Survey (KMIS)*
Note: *Recommended antimalarial in 2003 was SP, and was ACT from 2006*

The proportion of children with fever treated for malaria who received the first-line ACT, artemether-lumefantrine (AL), increased to 92 percent in 2015.

Data from the Kilifi County HDSS shows a decline in the proportion of admitted children under-five with malaria parasitaemia from 60 percent in 2000 to 46 percent in 2003 and to under 7 percent in 2009 before increasing gradually to about 20 percent in 2014.

Photo by Population Services Kenya

Trends in Morbidity

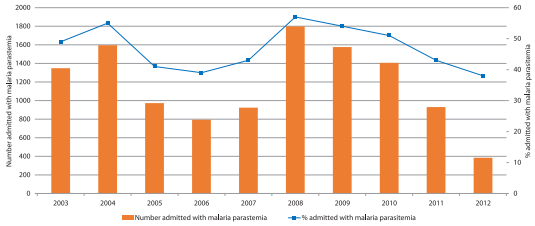
Parasite prevalence

Health and demographic surveillance sites

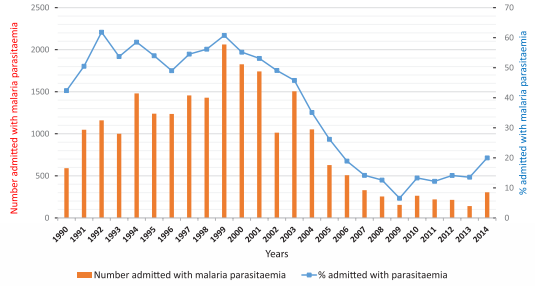
Figure 10 shows data from health and demographic surveillance system (HDSS) sites in the lake endemic and coastal endemic zones. Data from the Siaya County HDSS in the lake endemic zone (Figure 10a) shows that the proportion of children under five admitted to hospital with severe malaria or other morbidity, and malaria parasitaemia, increased from 49 to 55 percent in 2004 before decreasing to 40 percent in 2006. The proportion increased gradually to a peak of 58 percent in 2008 before declining to 38 percent in 2013. In the coastal endemic zone, data from the Kilifi County HDSS (Mogeni, 2016, *in press*: Figure 10b) shows a decline in the proportion of children under-five admitted with malaria parasitaemia from 60 percent in 2000 to 46 percent in 2003, and to less than 7 percent in 2009 before increasing gradually to approximately 20 percent in 2014.

Figure 10: Malaria morbidity among in-patient children under-five in malaria endemic HDSS sites in Kenya

a) Siaya County HDSS



b) Kilifi County HDSS



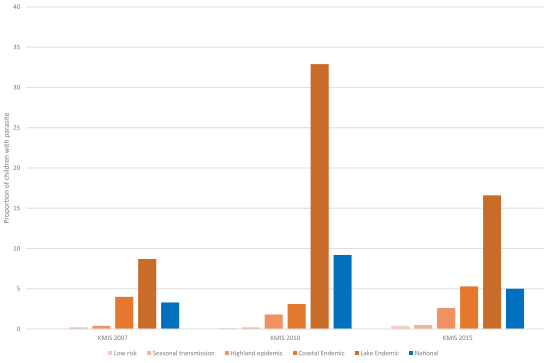
Source: *KEMRI/CDC HDSS (Siaya County); KEMRI-Wellcome Trust HDSS (Kilifi County)*
Note: Parasitaemia results based on microscopy

Photo by Population Services Kenya

National surveys

Overall, the national parasite prevalence in children under five, as diagnosed by microscopy, was 3 percent in 2007. It increased to 9 percent in 2010 and substantially decreased to 5 percent in 2015. Parasite prevalence was highest in the lake endemic zone, with an increase from 9 percent in 2007 to 33 percent in 2010, after which it decreased to 17 percent in 2015 (Figure 11). The increase in parasite prevalence in 2010 was driven largely by the increased prevalence in the lake endemic zone and might be attributable, in part, to delays in the mass LLIN distribution campaign re-scheduled from 2009 to 2011.

Figure 11: Malaria parasite prevalence among children 6-59 months in Kenya

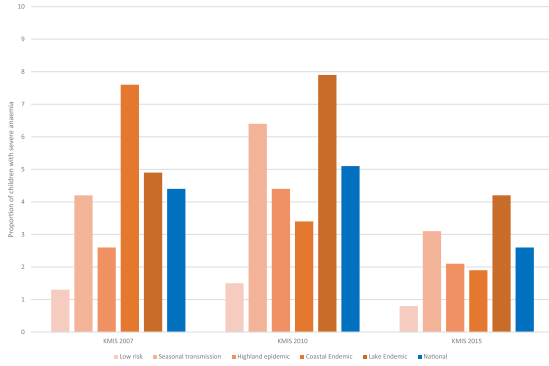


Note: *Results based on microscopy; Kenya Malaria Indicator Survey (KMIS)*

Anemia

Malaria is one of the causes of severe anaemia in malaria endemic areas. The prevalence of severe anaemia (i.e., Hb <8 g/dL) at the national level in 2007 was 4 percent, 5 percent in 2010 and decreased to 2 percent in 2015. As expected, there are disparities by endemic zone, with the low-risk zone having the lowest prevalence of severe anaemia and the lake endemic zone having the highest. The greatest decrease occurred in the lake endemic zone, where severe anaemia declined by half, from 8 percent in 2010 to 4 percent in 2015 (Figure 12).

Figure 12: Prevalence of severe anemia (Hb<8g/dL) in children aged 6-59 months of age in Kenya



Note: *Results based on haemoglobin measurement adjusted for altitude; Kenya Malaria Indicator Survey (KMIS)*

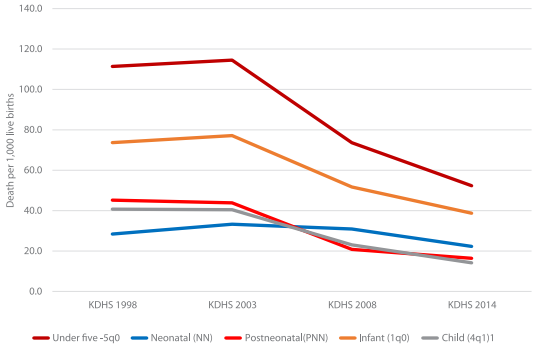
Trends in Mortality

Mortality rate

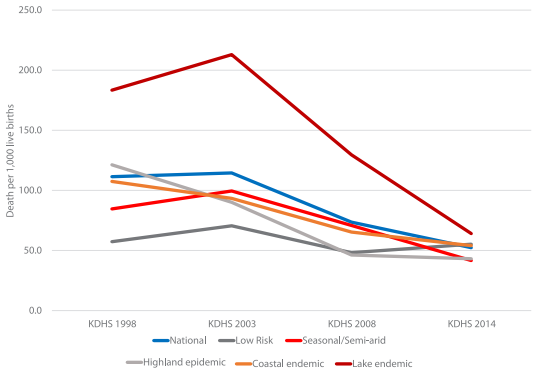
In Kenya, mortality among children under-five declined from 111 deaths per 1,000 live births in 1994–1998 to 52 deaths per 1,000 live births in 2010–2014. There were similar reductions in mortality rates among neonatal, post-neonatal, infant and child. The reduction in under-five mortality was greatest among children living in the highest malaria-risk zones compared to those in the lower risk zones. For example, the lake endemic zone had the highest child mortality, which increased from 125 deaths per 1,000 live births in the period before 1998, to 145 deaths per 1,000 live births in 1998-2003, and then decreased subsequently to 76 deaths per 1,000 live births in 2004-2008, and to 34 deaths per 1,000 live births in the period 2010-2014. This represents a relative reduction in child mortality of 76 percent over the evaluation period (Figure 13). Among the reasons for the accelerated decrease in under five mortality are improvements in the use of maternal healthcare services, increased health service delivery, improved health care seeking behavior for childhood illnesses, increased immunization coverage, vitamin A supplementation, and increased coverage with malaria prevention measures, in particular ITNs.

Figure 13: Trends in childhood mortality in Kenya

a) Childhood mortality rate by age category



b) Under-five mortality rates by malaria epidemiological zone



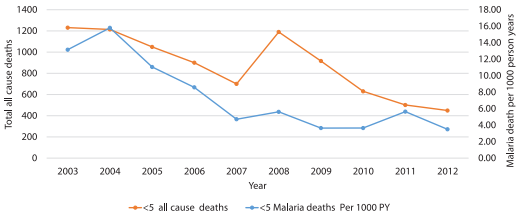
Source: *Kenya Demographic Health Survey (KDHS)*

Data from two HDSS sites in malaria endemic zones overall showed substantial reductions in child mortality. The Siaya County HDSS site in the lake endemic zone showed a declining trend in all causes of, and malaria-specific mortality, in

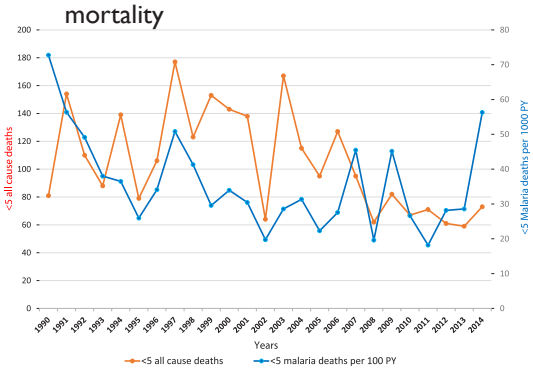
children under five from 2004 to 2012 (Figure 14). While there was an increase in all causes of mortality in children under five subsequent to the social and healthcare system disruptions following the 2007 post-election violence, malaria-specific mortality remained relatively constant and continued to decline through 2012. Data from in-patient records from the Kilifi County HDSS showed a declining trend in all causes of mortality from 2003 to 2013, with a rise in 2014. Malaria-specific mortality among in-patients remained constant, with peaks in 2007 and 2009, and a rise in 2014 similar to that for all causes of mortality.

Figure 14: Trends in malaria-specific mortality from HDSS sites in Kenya

a) Siaya County HDSS under-five mortality



b) Kilifi County HDSS in-patient under-five mortality

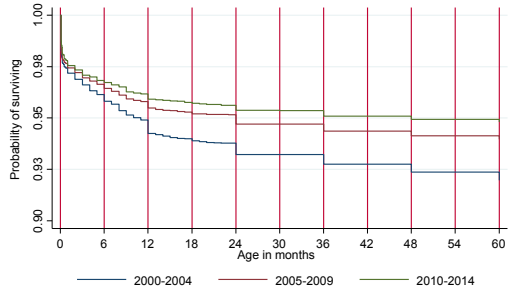


Source: *KEMRI/CDC HDSS (Siaya County); KEMRI-Wellcome Trust HDSS (Kilifi County)*
Note: *KEMRI/CDC HDSS mortality results based on verbal autopsy; KEMRI-Wellcome Trust HDSS results from hospital records.*

Child survival probability

Child survival improved during the evaluation period. At each age interval up to five years, the probability of surviving was higher during the period 2010–2014, after the increased coverage of malaria interventions, compared with the periods 2005–2009, during intervention expansion, and 2000–2004, before the increase in malaria interventions (Figure 15).

Figure 15: Kaplan-Meier survival curves for children under-five by malaria intervention expansion period in Kenya



Source: *Data from the Kenya Demographic Health Survey (KDHS, 2014)*

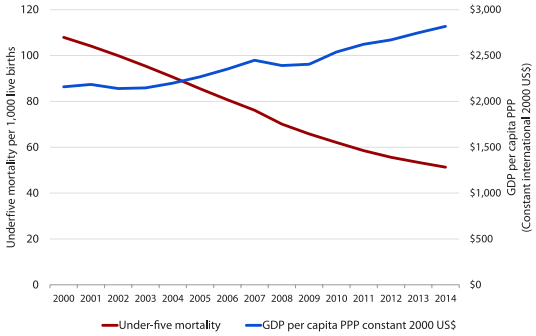
Child survival improved during the evaluation period. At each age interval up to five years, the probability of surviving was higher during the period 2010–2014, after the increased coverage of malaria interventions, compared with the periods 2005–2009, during intervention expansion, and 2000–2004, before the increase in malaria interventions

Photo by: Population Services Kenya

Contextual Factors

During the evaluation period, there were significant changes in fundamental and proximal determinants of child survival in Kenya. The gross domestic product (GDP) per capita purchasing power parity (PPP) increased from US $2,158 in 2000 to US $2,818 in 2014 (Figure 16). Similarly, most standard household attributes and ownership of consumer goods increased; the greatest increases were in access to improved sources of drinking water, improved sanitation, and telephone ownership. At the individual level, both women's literacy and the proportion of women completing primary-level education increased. Maternal health indicators, including ANC attendance, tetanus immunizations, skilled birth attendance, and facility births, improved from relatively low baseline values. For child health indicators, exclusive breastfeeding, immunization coverage, and Vitamin A supplementation all increased substantially, as did care seeking for acute respiratory infections and diarrhoea; the prevalence of stunted growth in children under-five declined by 28 percent from 2003 to 2014.

Figure 16: Trends in gross domestic product (GDP) per capita and under-five mortality, in Kenya



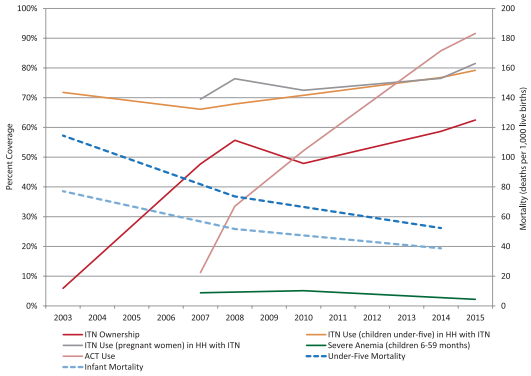
Source: *Mortality Data: UN Inter-agency Group for Child Mortality Estimation (IGME); GDP data: World Bank*
Note: *PPP: Purchasing power parity–constant 2000 international $*

Photo by MEASURE Evaluation PIMA

Evidence of Contribution of Interventions to Decline in Mortality and Conclusions

The findings in this report indicate that from 2003 to 2015, progress was made in increasing malaria prevention and control intervention coverage for populations at risk of malaria. Household ownership and use of ITNs among pregnant women, young children, and general household members increased, as did the diagnosis and treatment with appropriate first-line antimalarials in children with fever (Figure 17). The expansion of intervention coverage resulted in reductions in the prevalence of malaria parasitaemia and severe anaemia at the national level, with the greatest decline in the malaria endemic zones. During the same period, the country also experienced improvements in coverage and use of numerous non-malaria-related health interventions, as well as socioeconomic factors. However, these improvements alone are unlikely to account fully for the 55 percent reduction in under five mortality between 2003 and 2014. Based on malaria prevention and control intervention coverage patterns, patterns of under-five mortality in the malaria epidemiological zones and timing, malaria prevention, and control interventions might have contributed substantially to the decline in under five mortality in Kenya. The period of rapid reduction in under five mortality from 2003 to 2014 coincided with the rapid expansion of ITN distribution to pregnant women, children under five, and the general population and most importantly, the increased use of ITNs and ACTs.

Figure 17: Summary of trends in coverage of malaria control interventions, morbidity, and under-five mortality in Kenya



Source: *Data from the Kenya Demographic Health Survey (KDHS) and Malaria Indicator Survey (MIS)*

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