
Evaluation of the Impact of the Scale-up of Malaria Control Interventions on All-Cause Mortality in Children under Five Years of Age in Democratic Republic of Congo (DRC), 2005–2015

DRC Impact Evaluation Group

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Executive Summary – English



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Context

Malaria remains a major public health concern in the Democratic Republic of Congo (DRC). An estimated 97% of the Congolese population is exposed to endemic malaria transmission. In 2015, according to the World Malaria Report 2017, DRC reported about 16.5 million presumed and confirmed malaria cases and about 39,100 malaria deaths¹. Between 2005 and 2015, the country and its technical and financial partners invested significantly in malaria control strategies, including the use of insecticide-treated nets (ITNs), intermittent preventive treatment during pregnancy (IPTp), indoor residual spraying (IRS) in targeted areas, and prompt and effective case management. This report summarizes the impact of these investments on malaria morbidity and all-cause mortality among children under five years of age (hereafter referred to as children under five) between 2005 and 2015.

Objectives

- Measure the extent to which malaria control interventions have been implemented and expanded from 2005 to 2015 across DRC.
- Assess the trends of malaria-related morbidity and all-cause mortality in children under five from 2005 to 2015 in the DRC.
- Evaluate the plausible attribution of the expansion of malaria control interventions to changes in trends of morbidity and all-cause mortality in children under five from 2005 to 2015 in DRC, while considering various health-related contextual factors.

Concept

This evaluation is based on the premise that malaria contributes very substantially to child mortality in high malaria-endemic countries such as DRC. Therefore, improved coverage of malaria interventions (ITN, IRS, IPTp, case management) should result in a reduction in all-cause child mortality (ACCM), assuming other contextual factors have not substantially changed over the evaluation period. This “plausibility assessment,” suggested by Rowe and colleagues² and subsequently adopted by the Roll Back Malaria Monitoring and Evaluation Group³, is the current standard for assessing the impact of malaria control efforts in moderate and high transmission

¹ World Malaria Report 2017. Geneva: World Health Organization; 2017.

² Rowe, A. K., Steketee, R., Arnold, F., Wardlaw, T., Basu, S., Bakyaita, N., et al. (2007). Viewpoint: evaluating the impact of malaria control efforts on mortality in sub-Saharan Africa. *Trop Med Int Health*, 1524-1539.

³ Ye Y, Eisele TP, Eckert E, Korenromp E, Shah J, Hershey CL, Ivanovich E, Newby H, Carvajal L, Lynch M, Komatsu R, Cibulskis R, Moore Z, Bhattacharai A, 2017. Framework for Evaluating the Impact of Malaria Control Interventions in sub-Saharan Africa. *Am. J. Trop. Med. Hyg.* (in press)

settings over the past decade. The use of ACCM as the primary impact indicator provides a robust measure that accounts for direct and indirect malaria mortality. In addition to the mortality indicator, morbidity was assessed through measuring trends in severe anemia (<8 g/dl) prevalence among children aged 6–59 months from 2005 to 2015. Data on the prevalence of parasitemia among children aged 6–59 months were not available for the Demographic and Health Survey (DHS) 2007; therefore, it was not possible to assess trends during the evaluation period.

Data Sources and Analysis

The impact evaluation primarily used existing nationally-representative household survey data. The analyses are based on data from the DHS 2007⁴ and 2013⁵. The 2010 Multiple Cluster Indicator Survey (MICS)⁶ was excluded from the analysis because its methodology is different from DHS. These population-based data were triangulated with the routine and program data from the health information system, when possible.

Analytical approaches included descriptive and advanced analyses. Descriptive analysis consisted of calculating percentages and rates with 95% confidence intervals to assess trends between 2007 and 2013. Advanced analysis included Kaplan-Meier survival and Cox proportional hazard models to further examine the effect of malaria control interventions on the reduction of ACCM rates to support the plausibility argument. The results are interpreted at 5% (95% confidence intervals) statistical significance level.

Implementation of Malaria Control Interventions

During the evaluation period, DRC experienced significant changes in malaria control policy, including the adoption of IPTp in 2002 and its implementation in 2005; the adoption of artemisinin-based combination therapies (ACTs) as first-line treatment for uncomplicated malaria in 2005; the adoption of free mass distribution of long-

⁴ Ministère du Plan et Macro International. 2008. *Enquête Démographique et de Santé, République Démocratique du Congo 2007*. Calverton, Maryland, U.S.A. : Ministère du Plan et Macro International.

⁵ Ministère du Plan et Suivi de la Mise en oeuvre de la Révolution de la Modernité (MPSMRM), Ministère de la Santé Publique (MSP) et ICF International, 2014. *Enquête Démographique et de Santé en République Démocratique du Congo 2013-2014*. Rockville, Maryland, USA : MPSMRM, MSP et ICF International.

⁶ Institut National de la Statistique et Fonds des Nations Unies pour l'Enfance. *Enquête par Grappes a Indicateurs Multiples en République Démocratique du Congo (MICS – RDC 2010)*. Rapport final, Mai 2011.

lasting insecticide-treated nets (LLINs) in 2006; and the introduction of rapid diagnostic tests in 2007⁷.

Vector control

At the national level, the proportion of households owning at least one ITN increased significantly by 61 percentage points, from 9% in 2007 to 70% in 2013. Similar patterns were observed in all the provinces, with percentage point increases higher than the national increase in Equateur (79 percentage points), Bandundu (76 percentage points), Katanga (72 percentage points), and Sud-Kivu (64 percentage points).

The increase in ownership was associated with a significant increase of 49 percentage points in the use of ITNs in children under five in all households, from 6% in 2007 to 55% in 2013. As with ITN ownership, the highest increases were observed in the provinces of Bandundu (73 percentage points), Equateur (63 percentage points), Katanga (55 percentage points), and Sud-Kivu (55 percentage points). The use of ITNs by pregnant women also increased significantly by 53 percentage points from 7% in 2007 to 60% in 2013. In the general population (all ages), the percentage of people who slept under an ITN increased by 46 percentage points from 4% in 2007 to 50% in 2013.

IRS was supported by Mining companies in selected health zones where they are operating. For example, in 2013, IRS was initiated in the health zone of Saramabila. Two IRS sessions were conducted, and nearly 210,000 structures were sprayed, reaching 90% of intended structures. However, because the IRS program covered less than 1% (0.12%) of the general population, late in the evaluation period of interest, its impact on morbidity and mortality at the national level was likely minimal.

Intermittent preventive treatment during pregnancy

Since the introduction of IPTp in 2005, coverage has remained low, despite improvement in 2013. At the national level, the percentage of pregnant women who received at least two doses of sulfadoxine-pyrimethamine (SP) increased significantly, by 9 percentage points, from 5% in 2007 to 14% in 2013. At the subnational level, increases were observed in most provinces ranging from 18 percentage points (Bandundu) to 2 percentage points (Katanga) but were not

⁷ Programme National de Lutte contre le Paludisme (PNLP). (2016). *Plan stratégique national de lutte contre le paludisme 2016-2020*. Kinshasa: PNLP.

statistically significant, probably due to small sample size, except in the Oriental province, with an increase from 4% in 2007 to 18% (95%CI: 13-25%) in 2013.

Case management

DRC changed its treatment policy from SP to ACT in 2005, when artesunate-amodiaquine became the first-line treatment for uncomplicated malaria. In 2012, artemether-lumefantrine was introduced as an alternative first-line treatment. Community case management with ACT began in 2007. However, access to ACT remained very low in 2013, even though there was a slight improvement from 2007. In 2007, at the national level, less than 1% of children under five with a fever received artesunate; this increased to 6% in 2013. It should be noted that during the 2007 DHS, the response options for the question on treatment did not specify ACT, but simply included “artesunate.” In terms of diagnostics, the data were available for 2013 only, so we could not assess the trends. In 2013, at the national level, 19% of febrile children received a finger or heel stick, with significant variation (from 12% in Equateur province to 39% in Kinshasa) at the province level. Most provinces had percentages similar to the national level; however, the proportion of children who received a finger or heel stick was relatively high in Kinshasa (39%) and Bas-Congo (38%).

Impact

Morbidity

We examine the trends in the prevalence of severe anemia (<8g/dl) among children aged 6–59 months, an indicator of malaria-related morbidity in high endemicity areas⁸. At the national level, the prevalence of severe anemia in children decreased significantly, from 11% (95%CI: 9-13%) in 2007 to 6% (95%CI: 5-7%) in 2013. At the subnational level, a significant decrease in the prevalence of severe anemia among children was observed in the provinces of Equateur, from 16% in 2007 (95% CI: 10-24) to 5% in 2013 (95%CI: 3-8%), and Oriental, from 16% in 2007 (95% CI: 10-25%) to 8% in 2013 (95% CI: 5-13%). Other provinces also experienced decreases, except Sud-Kivu, which experienced an increase, but none of these changes were statistically significant.

Mortality

Demographic and health survey data show a decrease in ACCM rate between 2007 and 2013. The mortality rate among children under five decreased significantly by

⁸ World Health Organization (WHO). (2010). *Guidelines for the treatment of malaria, second edition*. Geneva, Switzerland.: WHO.

30%, from 143 per 1,000 live births in 2007 to 104 per 1,000 live births in 2013. The infant mortality rate also decreased significantly by 37%, from 92 per 1,000 live births in 2007 to 58 per 1,000 live births in 2013. A significant decrease (relative reduction of 36%) was observed in children aged 6–23 months, which is the age group most at risk for malaria-related mortality in high endemicity settings, compared to children aged 24–59 months (relative reduction of 12%). In terms of regions, the largest decreases (relative reductions ranging from 15% to 52%) were found in Bas-Congo, Bandundu, Maniema, and Oriental provinces, which also had the greatest improvements in malaria intervention coverage, particularly in ITN ownership and use.

Further analysis

Kaplan Meier survival probability analysis shows a significant improvement of the survival probability of children aged 1 to 59 months between 2004 and 2013. The survival probability was higher between 2009 and 2013, the period corresponding to the scale up of malaria control interventions, compared to 2004–2008 when the coverage of interventions was still low. The Cox proportional hazards regression examined the risk of mortality among children aged 1 to 59 months in relation to household ownership of ITN. Household ownership of at least one ITN reduced by 24% the risk of mortality among children aged 1 to 59 months during the 24-month period before the survey date (Risk Ratio [RR] = 0.76, 95% CI: 0.64–0.90).

Contextual Factors

During the evaluation period, some indicators of socioeconomic conditions and coverage of other health interventions also improved. Gross domestic product (GDP) increased by \$189.6 in 2004 to \$456.1 in 2015. Most indicators of living conditions and sanitation showed limited improvement from 2007 to 2013, such as access to drinking water (46% to 49%) and access to improved toilets (15% to 18%). In terms of climate, national rainfall and temperature data indicate no major change between 2005 and 2015 that could have affected trend of mortality at the national level.

From 2007 to 2013, most indicators of maternal and child health in DRC did not significantly improve. Two indicators of prenatal care, which were relatively high in 2007, improved modestly in 2013. The proportion of women who gave birth in a health facility increased from 70% in 2007 to 80% in 2013. The proportion of women assisted during childbirth by skilled personnel increased from 74% in 2007 to 80% in 2013. Regarding child health indicators, only two have seen at least modest increases between 2007 and 2013. Full vaccination increased from 31% in 2007 to 45% in 2013. Exclusive breastfeeding increased from 36% in 2007 to 48% in 2013.

Conclusion

The results of the evaluation show that there has been a decline in ACCM in the DRC. Significant progress has been made in improving the coverage of malaria prevention and case management interventions in DRC, particularly vector control, from 2007 to 2013. ITN ownership and use among children under five and pregnant women have increased to levels high enough to have a public health impact. The scale-up of this intervention was associated with a reduction in the prevalence of severe anemia at the national and provincial levels. During the same period, the country experienced a modest improvement in living conditions and maternal and child health indicators. It is therefore unlikely that these non-malaria contextual factors explain a large portion of the 30% reduction of ACCM from 2007 to 2015.

Mortality decreased more among children aged 6–23 months, the group at higher risk of malaria mortality and with greater potential to benefit from increased coverage with malaria interventions, than among those aged 24–59 months. The provinces with the largest improvements in coverage of ITN ownership and use also reported the largest decrease in ACCM, strengthening our plausibility assessment. Furthermore, the Kaplan Meier survival probability and Cox proportional hazards regression show a clear association between the increase in coverage of malaria control interventions and the reduction of mortality risk among children under five. Overall, these results support the conclusion that malaria interventions have partially contributed to the observed decrease in ACCM in DRC from 2005 to 2015.