

Revision of the epidemiological situation of malaria in Burundi and the potential implications for future control

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Introduction

In Burundi, malaria continues to be a major public health issue as the leading cause of health facility attendance, high levels of mortality and devastating malaria epidemics in highland areas. Since 2004, Burundi's National Malaria Control Programme (PNILP) has developed an integrated malaria control strategy. Since 2016, Médecins Sans Frontières (MSF), in collaboration with the PNILP, has implemented integrated malaria control interventions within two malaria endemic health districts located in the central highlands and eastern border regions.

Methods

We re-assessed epidemiological trends for malaria in Burundi to: (1) evaluate spatial heterogeneity and seasonality; (2) longitudinally describe trends in disease incidence for three epidemiological strata; and (3) assess the association between long-lasting insecticidal net (LLIN) mass distribution campaigns (MDC) and disease incidence. Analysis used malaria case data, routinely collected and reported weekly by PNILP from 2011-2019. Malaria cases were converted into incidence rates, using existing population data, and expressed per 1000 population at risk. Health districts (n=47) were categorized into three different strata based upon geographic elevation and endemic channels, using the quartile method. A generalized additive mixed model (GAMM) was implemented in R to analyze time-series data.

Ethics

This work met the requirements for exemption from MSF Ethics Review Board review, and was conducted with permission from Sebastian Spencer, Medical Director, Operational Centre Brussels, MSF.

Results

From 2011-2016, seasonality and intensity of malaria transmission was heterogeneous across the three epidemiological strata. The median incidence (cases/1000 population) for health districts <1200m elevation was 6.0 (interquartile range, IQR, 4.3-8.5); for those 1200-1850m, incidence was 12.3 (IQR 8.0-17.6); and for those >1850m, incidence was 2.1 (IQR 1.1-6.3). In contrast to the observed incidence rates for health districts within the endemic channels at <1200m and >1850m, health districts within the endemic channel at 1200-1850m showed marked seasonality, with a bimodal distribution. Health districts in these endemic channels, had peaks in median incidence of 17.6 cases/1000 and 15.1 cases/1000 population in weeks 26 and 52, respectively. GAMM analysis suggested an increasing trend in malaria incidence over the period 2011–2019. The analysis further revealed that LLIN-MDC campaigns were associated with a rapid reduction in malaria incidence, but the epidemiological impact was attenuated after one year. Specifically, comparing malaria incidence in three health districts adjacent to MSF's intervention area (1200-1850m channel), the 2017 LLIN-MDC was associated with a 44% reduction in clinical incidence one year post-distribution (RR 0.56, 95%CI 0.556-0.56), but no evidence for a reduction two years post-distribution was observed RR 1.10 (95%CI 1.092-1.099).

Conclusion

These findings highlight the effectiveness of LLIN as a malaria control intervention across different epidemiological strata in Burundi. However, the duration of functional effectiveness of LLIN is most definitely less than 3 years and may be shorter than one year in Burundi. The reasons underlying these findings are legion. Further operational research is needed to disentangle the dynamic interplay between operational, human behavioural, sociological, and entomological factors.

Conflicts of interest

None declared.



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A medical doctor since 2005, Jean Marie Mafuko worked in the Democratic Republic of Congo for 3 years before moving to Burundi where he now lives with his family. Since joining the MSF Burundi mission in 2017, he has held the Deputy Medical Coordinator position. He is interested and actively involved in research on various tropical and emerging infectious diseases. He has co-authored two articles describing Bartonella spp. and Simian herpes B virus and participated in several research projects as part of the MSF Burundi Mission.