

Estimating the Timing Interval for Malarial Indoor Residual Spraying: A Modelling Approach

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Abstract : Background: Indoor residual spraying (IRS) reduces vector densities and malaria transmission, however, the most effective spraying intervals for IRS have not been well established. We aim to estimate the optimal timing interval for IRS using a modeling approach. Methods: We use a generalized additive model to estimate the optimal timing interval for IRS using the predicted malaria incidence. The model is applied to post IRS cohort clinical data from children aged 0.5-10 years in selected households in Tororo, historically a high malaria transmission setting in Uganda. Six rounds of IRS were implemented in Tororo during the study period (3 rounds with bendiocarb: December 2014 to December 2015, and 3 rounds with actellic: June 2016 to July 2018). Results: Monthly incidence of malaria from October 2014 to February 2019 decreased from 3.25 to 0.0 per person-years in the children under 5 years, and 1.57 to 0.0 for 5-10 year-olds. The optimal time interval for IRS differed between bendiocarb and actellic and by IRS round. It was estimated to be 17 and 40 weeks after the first round of bendiocarb and actellic, respectively. After the third round of actellic, 36 weeks was estimated to be optimal. However, we could not estimate from the data the optimal time after the second and third rounds of bendiocarb and after the second round of actellic. Conclusion: We conclude that to sustain the effect of IRS in a high-medium transmission setting, the second rounds of bendiocarb need to be applied roughly 17 weeks and actellic 40 weeks after the first round, and the timing differs for subsequent rounds. The amount of rainfall did not influence the trend in malaria incidence after IRS, as well as the IRS timing intervals. Our results suggest that shorter intervals for the IRS application can be more effective compared to the current practice, which is about 24 weeks for bendiocarb and 48 weeks for actellic. However, when considering our findings, one should account for the cost and drug resistance associated with IRS. We also recommend that the timing and incidence should be monitored in the future to improve these estimates.

Keywords : incidence, indoor residual spraying, generalized additive model, malaria

Conference Title : ICPHSID 2020 : International Conference on Public Health Studies and Infectious Diseases

Conference Location : Athens, Greece

Conference Dates : April 09-10, 2020