

MATHEMATICAL EVALUATION OF THE IMPACT OF  
TRANSMISSION BLOCKING IMMUNITY ON  
MALARIA TRANSMISSION IN NATURE

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We have recently demonstrated that natural Plasmodium vivax malaria infections in man evoke anti-gamete transmission blocking antibodies which strongly influences the infectivity of malaria patients to the vector mosquito<sup>1,2</sup>. In the present study we have used a mathematical simulation to assess the impact of transmission blocking immunity in man on the transmission of vivax malaria during a single epidemic.

Data collected during a malaria epidemic which occurred at 'Bulathkohupitiya', a region in the wet zone of Sri Lanka was used in this study. The monthly malaria incidence, the past history in a sample of individual patients, and entomological data as man biting rates and habits of malaria vectors were available. Levels of transmission-blocking immunity in the sample of patients were inferred from their malaria experience, based on data obtained from previous studies.

Mathematical equations to describe malaria transmission accounting for transmission blocking immunity were developed from the basic equations of R.Ross<sup>3</sup>. Conditions at the beginning of the period of observation were used to derive the initial values for the mathematical simulation. The simulation then attempted to predict the malaria incidence in the subsequent months of the epidemic, with and without transmission blocking immunity. The predicted values under these different conditions were compared with observed values for the epidemic. Whereas when transmission blocking immunity was incorporated into the simulation the observed and predicted peak malaria incidence was almost the same, in the absence of transmission blocking immunity, the predicted peak malaria incidence was much greater than the observed incidence. Thus, the actual malaria incidence during the epidemic could be best generated by accounting for transmission blocking immunity. It therefore appears that the incidence of malaria during an epidemic is kept low by naturally occurring transmission blocking immunity in man.

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#### References

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