Malaria Control in the Greater Mekong Subregion: Immune Dynamics and Artemisinin Resistance

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Introduction

Artemisinin & ACTs
Artemisinin is an antimalarial used in the first-line treatment (i.e. artemisinin-based combination therapies or ACTs) for P. falciparum malaria and is the cornerstone of modern malaria elimination strategies. Artemisinin may reduce transmission at the population-level by decreasing the period of infectiousness; however, the effectiveness of artemisinin as a tool for malaria control, elimination and eradication has not been thoroughly investigated.1

A Case Study of Malaria Control in Vietnam
Following a major epidemic in the late 1980s, Vietnam implemented a new national malaria control program focused on using ACTs to treat individuals with P. falciparum malaria (i.e. ACT case management). Over the following decade, the incidence of malaria in Vietnam rapidly declined.1,2

Artemisinin Resistance in the GMS
In 2008, artemisinin-resistant malaria was reported in Cambodia and has since been detected in 4 other countries in the Greater Mekong Subregion (Laos, Myanmar, Thailand, Vietnam).3

Research Questions
1. What was the role of artemisinin in the decline of malaria in Vietnam? Is ACT case management an effective tool for combating malaria? (Part 1)
2. Does the effectiveness of ACT case management depend on transmission intensity and/or host immunity? (Part 2)
3. In Vietnam, how has the reduction in transmission intensity changed host immunity in the population? What does this change imply about the risk of severe infection if artemisinin resistance continues to spread? (Part 2)

Part 1: Methods
Provincial data on malaria cases and control interventions in Vietnam from 1991-2010 were collected from national annual reports and analyzed for temporal trends. Generalized estimating equations were used to investigate the association between ACT case management and malaria transmission in Vietnam, controlling for changes in urbanization and vector control.

Part 1: Results
Changes in the incidence of malaria in Vietnam

Changes in the use of artemisinin-containing antimalarials

Part 2: Results
Effect of Decreasing Treatment Failure Rate

Effect of Increasing Treatment Failure Rate

Conclusions
ACT case management was significantly inversely associated with the incidence of malaria in Vietnam between 1991 and 2010. The significant (P<0.001) inverse association between ACTs and malaria incidence was spatially consistent across provinces and was robust to changes in the outcome measures.

The population-level effects of artemisinin-based case management on incidence may be greater in low transmission settings in populations with low levels of acquired immunity. Reducing the threat posed by artemisinin-resistant P. falciparum. Reduced transmission intensity potentially resulting from ACT use may have resulted in lowered levels of immunity. Loss of artemisinin could have devastating impacts on current levels of malaria control.

References

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