Optimal Strategies for Pharmaceutical and Non-Pharmaceutical Interventions Considering Climate Change in Seoul: A Scenario-Based Analysis focused on *P. vivax* Malaria

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ABSTRACT

In 2024, the number of confirmed cases of Plasmodium vivax malaria in Korea surged by approximately 37% compared to the previous three-year average. Additionally, the index of malaria vector mosquitoes increased 2.5 times over the five-year average, which may be associated with rising regional temperature. The Korea Disease Control and Prevention Agency (KDCA) designated eleven additional districts in Seoul as malaria risk areas. In our study, we constructed a mathematical model of malaria transmission incorporating the impacts of climate change and drug interventions in Seoul. Furthermore, the Improved Multi-Objective Differential Evolution (IMODE) algorithm was implemented with a penalty method to solve constrained optimization problems in our model. This approach analyzes the effectiveness of non-pharmaceutical interventions and pharmaceutical interventions including tafenoquine. We propose intervention strategies aimed at reducing malaria cases and achieving over 30% reduction in relapse rate through the implementation of tafenoquine. Our research also suggests an optimal monthly strategy for the timing of tafenoquine interventions and the best strategies to be applied in different Shared Socioeconomic Pathways (SSP) scenarios.

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