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Mathematical Modeling of Co-Infection Dynamics of Malaria and Typhoid Fever with Control

Communication Info

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Abstract

Co-infection with malaria and typhoid fever poses a major public health challenge, especially in tropical regions [4, 5]. This study develops a mathematical model to analyze the co-infection dynamics, incorporating environmental sanitation and treatment interventions. The model uses differential equations to represent human populations in various disease states and derives the basic reproduction number (R_0) to assess disease persistence or eradication [2].

Stability analysis shows that when $(R_0 < 1)$, the disease-free equilibrium is stable, indicating eradication, while $(R_0 > 1)$ leads to a stable endemic equilibrium, signifying persistent co-infection [3]. Sensitivity analysis identifies key parameters influencing (R_0) and numerical simulations reveal that combining environmental sanitation and treatment significantly reduces co-infection prevalence [1]. The study provides insights for public health strategies by highlighting the effectiveness of integrated interventions in controlling both malaria and typhoid fever.

References

[1] Jaleta, S. F., Duressa, G. F., & Deressa, C. T. *A* mathematical modeling and optimal control analysis of the effect of treatment-seeking behaviors on the spread of malaria. Frontiers in Applied Mathematics and Statistics, (2025), Article 1552384.

[2] Lawal, O. F., Yusuf, T. T., & Abidemi, A. On the efficiency of optimal vaccination, environmental sanitation and treatment controls for typhoid fever: A mathematical study approach. Journal of Mathematical Analysis and Modeling, (2025), 6(1), 15–34.

[3] Ofomata, A. I., Agwu, C. O., Adeyemo, S. O., & Okereke, C. B. Mathematical model of drug-resistant malaria and typhoid fever co-infection with optimal control and cost-effectiveness analysis. EPRA International Journal of Research and Development, (2025), 10(8).

[4] Tchoumi, S. Y., Chukwu, C. W., Diagne, M. L., Rwezaura, H., & Tchuenche, J. M. Optimal control analysis of malaria and typhoid fever co-dynamics. Journal of Interdisciplinary Mathematics, (2025), 28(7), 2567–2600.

[5] Tsafack, T. J., Kum, C. K., Tassé, A. J. O., & Tsanou, B. Mathematical modelling of the dynamics of typhoid fever and two modes of treatment in a health district in Cameroon. Mathematical Biosciences and Engineering, (2025), 22(2), 477–510.