

ABSTRACT

OPTIMAL CONTROL MODEL TRANSMISSION DYNAMIC SCABIES DISEASE: A CASE STUDY AT MODERN ISLAMIC BOARDING SCHOOL

by

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Scabies is a contagious skin disease that commonly occurs in high density populations, such as Islamic boarding schools. This study aims to develop an SI_{EILR} (Susceptible, Early stage Infected, Late stage Infected, Recovered) mathematical model of scabies transmission, analyze its dynamical characteristics, and determine an optimal disease control strategy. The model distinguishes infected individuals into early stage and late stage infection compartments, enabling a more realistic representation of disease transmission dynamics. The analysis includes the proof of positivity and boundedness of solutions, determination of disease free and endemic equilibrium points, computation of the basic reproduction number using the Next Generation Matrix method, and local and global stability analyses. Furthermore, three time dependent control variables self prevention, early treatment, and advanced treatment are incorporated into the model and analyzed using the Pontryagin Maximum Principle, with numerical solutions obtained through the Runge Kutta method. The results demonstrate that the proposed model is mathematically and biologically valid, while the optimal control strategy effectively reduces the number of infected individuals and improves the effectiveness of scabies control in Islamic boarding school environments.

Keywords: *scabies, SI_{EILR} model, optimal control, Pontryagin's Maximum Principle, Islamic boarding school.*