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Analisis Model Penyebaran Penyakit Tuberkulosis Dua-Strain dengan Pengobatan Drug-Sensitive dan Drug-Resistant
Dewi Kartika Ening Tyas Kusumawardani, Dr.rer.nat. Lina Aryati, M.S.
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INTISARI

ANALISIS MODEL PENYEBARAN PENYAKIT TUBERKULOSIS DUA-STRAIN DENGAN PENGOBATAN *DRUG-SENSITIVE* DAN *DRUG-RESISTANT*

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Tuberkulosis (TB) merupakan salah satu penyakit menular kronis yang dihadapi oleh berbagai negara di dunia, termasuk Indonesia. TB dibagi menjadi dua jenis berdasarkan sensitivitas obat, yaitu TB sensitif obat (*drug-sensitive*) dan TB resistan obat (*drug-resistant*). Pada tesis ini, diperkenalkan model baru dengan 7 subpopulasi, yaitu: *Susceptible, Vaccinated, Infected with drug-sensitive, Treatment infected with drug-sensitive, Infected with drug-resistant, Treatment infected with drug-resistant*, dan *Recovered*. Penelitian ini bertujuan untuk membangun model penyebaran penyakit TB dengan pengobatan *drug-sensitive* dan *drug-resistant* dengan mempertimbangkan faktor kehilangan keefektifan pada vaksin BCG serta faktor kekambuhan. Selanjutnya, dilakukan analisis matematis dan berbicara tentang kestabilan. Bilangan reproduksi dasar ditentukan menggunakan metode *Next Generation Matrix*. Kemudian, dilakukan analisis sensitivitas untuk menentukan parameter yang paling berpengaruh terhadap penyebaran penyakit TB dan simulasi numerik untuk mengilustrasikan solusi perilaku model.

Hasil penelitian yang diperoleh adalah titik ekuilibrium bebas penyakit stabil asimtotik global jika $\mathscr{R}_0 < 1$ serta titik ekuilibrium endemik penyakit stabil asimtotik lokal jika memenuhi syarat-syarat tertentu. Selain itu, laju pengobatan TB sensitif obat dan laju pengobatan TB resistan obat memiliki nilai sensitivitas negatif terbesar. Hal ini menunjukkan bahwa laju pengobatan berperan penting dalam mengurangi penyebaran TB sensitif obat dan TB resistan obat.

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ABSTRACT

ANALYSIS OF A TWO-STRAIN TUBERCULOSIS SPREAD MODEL WITH DRUG-SENSITIVE AND DRUG-RESISTANT TREATMENT

By

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Tuberculosis (TB) is a chronic infectious disease faced by various countries worldwide, including Indonesia. TB categorized into two types based on drug sensitivity: drug-sensitive TB and drug-resistant TB. This thesis introduces a new model with seven subpopulations, namely: Susceptible, Vaccinated, Infected with drug-sensitive, Treatment infected with drug-sensitive, Infected with drug-resistant, Treatment infected with drug-resistant, and Recovered. This study aims to develop a new model that addresses the spread of TB with drug-sensitive and drug-resistant treatment by considering the losing effectiveness of BCG vaccine and relapse factors. Furthermore, a mathematical analysis was performed and stability was discussed. The basic reproduction number is determined using the Next Generation Matrix method. Subsequently, sensitivity analysis was conducted to determine the parameters that most influence the spread of TB, and numerical simulations were performed to illustrate the model's behavioral solutions.

The research results that can be obtained are the disease-free equilibrium point is globally asymptotically stable if $\mathscr{R}_0 < 1$, while the endemic disease equilibrium point is locally asymptotically stable if certain conditions are met. In addition, the treatment rate for drug-sensitive TB and the treatment rate for drug-resistant TB have the highest negative sensitivity values. This indicates that the treatment rate plays an important role in reducing the spread of drug-sensitive TB and drug-resistant TB.