Haruna Yudha Pratama, 2019, **Analisis Kestabilan Model Matematika Orde Fraksional Influenza dengan Dua Strain Virus dan Dua Vaksinasi**, Penyusunan skripsi ini di bawah bimbingan Dr. Mohammad Imam Utoyo, M.Si. dan Dr. Windarto, M.Si. Departemen Matematika, Fakultas Sains dan Teknologi, Universitas Airlangga, Surabaya.

ABSTRAK

Influenza merupakan penyakit menular yang disebabkan oleh virus RNA. Mudahnya mutasi pada kasus infeksi virus influenza menyebabkan beberapa penyebaran yang cukup parah pada masa lalu. Dalam skripsi ini dilakukan analisis kestabilan titik setimbang model matematika orde fraksional influenza dua strain virus dan dua vaksinasi dengan orde turunan fraksional $\alpha \in (0,1]$. Berdasarkan analisis model, terdapat empat titik setimbang yaitu titik setimbang bebas virus E_0, titik setimbang endemik tipe satu E_1, titik setimbang endemik tipe dua E_2, dan titik setimbang endemik virus influenza E_3. Eksistensi titik stimbang bergantung pada *Basic Reproduction Number* R_0, R_1, dan R_2. Titik setimbang bebas virus E_0 stabil asimstotis jika $R_0 < 1$, titik setimbang endemik tipe satu E_1 stabil asimstotis jika $(k_1\bar{V_1} + \beta_2\bar{S})/\omega_2 < 1$ dan $R_1 > 1$, titik setimbang endemik tipe dua stabil asimstotis jika $(k_2\ \bar{\bar{V_2}} + \beta_1\bar{\bar{S}})/\omega_1 < 1$ dan $R_2 > 1$, dan titik setimbang endemik virus influenza stabil jika $R_0 > 1$. Kemudian dilakukan analisis sensitivitas untuk mengetahui faktor yang paling berpengaruh dalam penyebaran virus influenza. Selanjutnya dilakukan simulasi numerik dengan variasi nilai orde fraksional α untuk mengetahui dinamika penyebaran virus influenza. Hasil dari penelitian ini menunjukkan bahwa pemberian vaksinasi terhadap strain virus satu berpengaruh menurunkan penyebaran infeksi virus influenza pada strain virus dua, dan berlaku sebaliknya.

Kata Kunci : Influenza, Model Matematika Orde Fraksional, Titik Setimbang, Kestabilan, Vaksinasi.

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ABSTRACT

Influenza is an infectious disease caused by the RNA virus. The ease of mutation in cases of influenza virus infection causes some quite severe spread in the past. This thesis analyzes the stability of the equilibrium point model of influenza fractional order two virus strains and two vaccination with the order of fractional derivative $\alpha \in (0,1]$. Based on the analysis of the model, there are four equilibrium points, namely the E_0 virus free equilibrium point, endemic type one E_1, endemic equilibrium point type two E_2, and endemic equilibrium point of influenza virus E_3. The existence of the equilibrium point depends on the *Basic Reproduction Number* $R_0, R_1,$ and R_2. Virus-free equilibrium point E_0 is asymptotic stable if $R_0 < 1$, endemic equilibrium point type one E_1 asymstotic stable if $(k_1\bar{V_1} + \beta_2\bar{S})/\omega_2 < 1$ and $R_1 > 1$, endemic equilibrium point type two E_2 asymptotic stable if $(k_2\ \bar{\bar{V_2}} + \beta_1\bar{\bar{S}})/\omega_1 < 1$ and $R_2 > 1$, and the endemic point of the influenza virus is stable if $R_0 > 1$. Then a sensitivity analysis was carried out to determine the most influential factors in the spread of influenza viruses. Furthermore, numerical simulations are performed with variations in the fractional order value α to determine the dynamics of the spread of influenza viruses. The results of this study indicate that vaccination against virus strain one has the effects of reducing the spread of influenza virus infection in a virus strain two, and vice versa.

Keywords : *Influenza, Fractional Mathematical Model, Equilibrium Points, Stability, Vaccination.*