Tazik'ul Yennis Suseno, 2017 **ANALISIS MODEL MATEMATIKA DAN KONTROL OPTIMAL PENYEBARAN PENYAKIT KOLERA.** Skripsi ini dibawah bimbingan Dr. Fatmawati, M.Si dan Dr. Miswanto, M.Si. Departemen Matematika, Fakultas Sains dan Teknologi, Universitas Airlangga, Surabaya.

ABSTRAK

Pada skripsi ini dibahas analisis model matematika penyebaran penyakit kolera dan kontrol optimal berupa usaha vaksinasi (U_1), pengobatan (U_2), dan sanitasi (U_3). Berdasarkan hasil analisis model tanpa kontrol diperoleh dua titik setimbang, yaitu titik setimbang bebas penyakit (E_0) dan titik setimbang endemik (E_1). Dari model matematika penyebaran penyakit kolera diperoleh *Basic Reproduction Ratio* (R_0)yang merupakan besaran yang menjadi tolak ukur terjadinya endemik penyakit kolera. Titik setimbang bebas penyakit (E_0) stabil asimtotis lokal jika $R_0 < 1$ dan titik setimbang endemik (E_1) cenderung stabil asimtotis lokal jika $R_0 > 1$. Masalah kontrol optimal pada model tersebut diselesaikan dengan metode Prinsip Maksimum Pontryagin. Selanjutnya hasil numerik menunjukkan bahwa pemberian kontrol berupa vaksinasi (U_1), pengobatan (U_2), dan sanitasi (U_3) dapat meminimalkan jumlah manusia terinfeksi kolera dan populasi bakteri *Vibrio Cholerae* dengan biaya minimal.

Kata Kunci : Model Matematika, *Vibrio Cholerae*, Vaksinasi, Pengobatan, Sanitasi, Kestabilan, Kontrol Optimal.

Tazik'ul Yennis Suseno, 2017, **ANALYSIS AND OPTIMAL CONTROL OF THE SPREAD OF CHOLERA DISEASE MODEL.** This undergraduate thesis is supervised by Dr. Fatmawati, M.Si and Dr. Miswanto, M.Si. Mathematics Department , Faculty of Science and Technologi, Airlangga University, Surabaya.

ABSTRACT

In this thesis we presents an analysis of the spread of cholera disease model with vaccination (U_1), medicinal treatment (U_2), and sanitation (U_3) as the optimal control. Based on the analytical model without control, there are two equilibriums, those are the disease-free equilibrium (E_0) and the endemic equilibrium (E_1). Based on the mathematical model of the spread of cholera disease we get Basic Reproduction Ratio (R_0) which is determine the endemic in cholera spreading. The disease-free equilibrium (E_0) tend to asymptotically stable if $R_0 < 1$, and the endemic equilibrium (E_1) will be asymptotically stable if $R_0 > 1$. Here we obtain the optimal control by applying the Pontryagin Maximum Principle. Finally, the numerical simulation shows that the combination of vaccination (U_1), medicinal treatment (U_2), and sanitation (U_3) will decrease the population of human with cholera infection and the population of *Vibrio Cholerae* bacteria with the effective cost.

Keyword : Mathematical Model, *Vibrio Cholerae*, Vaccination, Medicinal Treatment, Sanitation, Stability of Linear System, Optimal Control.