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Despite a tremendous volume of research made to better understand the spread of COVID-19, how the human immune system responds to SARS-CoV-2 has not been yet fully understood due to limited analysis of the experimental or clinical information to date. To meet the pressing need while alleviating some limitations, we develop a mathematical model of the immune response to SARS-CoV-2 in order to better understand the role of various molecular pathways in successful viral clearance and the key mechanisms responsible for disease severity exhibited by some patients. Specifically, our in-host model, formulated in a system of coupled ordinary and delay differential equations, explicitly represents the virus, innate immune cells, selected cytokines, and their interactions. After conducting the parameter estimation using experimental data available, we investigate qualitative and quantitative behaviors of the model via numerical simulations. Using this model, we then determine the implications of variation of parameters by sensitivity analysis. Our model results demonstrate key aspects of immune response to SARS-CoV-2, specifically its sensitive pathways, which might be responsible for differences in disease severity exhibited by COVID-19 patients.