



Available online at <http://scik.org>

Commun. Math. Biol. Neurosci. 2022, 2022:31

<https://doi.org/10.28919/cmbn/7147>

ISSN: 2052-2541

## A COMPARISON OF DETERMINISTIC AND STOCHASTIC MODEL ON THE DYNAMICS OF HIV AND CD4<sup>+</sup> T-CELLS INTERACTIONS

ALFIANDHANI SUCI MUTIARA<sup>1</sup>, KASBAWATI<sup>1,\*</sup>, ANDI KRESNA JAYA<sup>2</sup>, ANISA<sup>2</sup>, RUSNI SAMSIR<sup>1</sup>

<sup>1</sup>Department of Mathematics, Faculty of Mathematics and Natural Sciences, Hasanuddin University, Makassar, Indonesia

<sup>2</sup>Department of Statistics, Faculty of Mathematics and Natural Sciences, Hasanuddin University, Makassar, Indonesia

Copyright © 2022 the author(s). This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

**Abstract:** This study aims to present a comparison of deterministic and stochastic approaches on the interaction of HIV and CD4<sup>+</sup> T-cells with effects of HAART treatment. A three-dimensional nonlinear model is formulated with randomness that is considered as a Brownian motion coming from the uncertainty of the death rate of cells and viruses. We establish sufficient conditions for stability of endemic and nonendemic solutions that associate with an early reproductive threshold value of HIV infection which is linearly negative depending on the HAART treatment parameters. Non-negative stochastic solutions are also analysed. Numerical simulations show that HAART parameters have a significant effect in reducing HIV infection. The smaller value of treatment parameter, the more infected cells, which is also indicated by a threshold value that is greater than one. It also results in high fluctuations in the stochastic solutions. If the treatment parameter increases due to regular treatment, the number of infected cells and viruses decreases. It also reduces high fluctuations in the stochastic solutions which on average follow the decreasing trend

---

\*Corresponding author

E-mail address: [kasbawati@gmail.com](mailto:kasbawati@gmail.com)

Received January 5, 2022