# INTISARI

## PEMODELAN MATEMATIKA PADA PERKEMBANGAN *DIFFUSE LARGE B-CELL LYMPHOMA* (DLBCL) DAN ANALISIS DATA KLINIS SEBAGAI FAKTOR PROGNOSIS

Oleh

SULASRI SUDDIN

21/485445/SPA/00808

Penelitian ini bertujuan untuk memahami *diffuse large B-cell lymphoma* (DLBCL), subtipe limfoma non-Hodgkin yang paling umum dan agresif, melalui pendekatan multidisipliner yang menggabungkan pemodelan matematika dan analisis statistik data klinis. Model matematika berbasis sistem persamaan diferensial dikembangkan untuk menggambarkan dinamika pertumbuhan sel DLBCL di *germinal center* kelenjar getah bening, dan dianalisis melalui penentuan titik ekuilibrium, kestabilan lokal, serta studi bifurkasi guna mengevaluasi perubahan dinamika akibat variasi parameter biologis. Analisis sensitivitas dilakukan untuk mengidentifikasi parameter yang paling berpengaruh terhadap dinamika awal pertumbuhan sel DLBCL, dan simulasi numerik diterapkan untuk memvisualisasikan perilaku solusi model, termasuk skenario bifurkasi. Secara paralel, pendekatan statistik digunakan pada data rekam medis pasien DLBCL di RSUP Dr. Sardjito dengan metode analisis survival, distribusi campuran, regresi logistik, dan analisis faktor, untuk mengidentifikasi faktor prognosis signifikan seperti biomarker laboratorium dan faktor demografi, serta mengevaluasi akurasi model prediksi terhadap *overall survival*. Penelitian ini mengintegrasikan data klinis dan model melalui *matching scenario* dan survival dinamik. Pada *matching scenario*, pasien terbagi menjadi fase stabil/non-kritis dan fase kritis, dengan stadium klinis sebagai indikator utama. Analisis survival dinamik menggunakan model hazard logistik memberikan representasi realistis pola risiko DLBCL, meskipun masih bersifat eksploratif dan keterbatasan data tetap ada, sehingga perlu dikaji lebih lanjut dengan faktor klinis tambahan. Program MATLAB, R, dan Python untuk keperluan implementasi dan visualisasi. Penelitian ini diharapkan dapat menjembatani kesenjangan antara teori dan praktik klinis, serta memberikan wawasan tambahan terkait prognosis pasien.

**Kata-kata kunci:** *diffuse large b-cell lymphoma* (DLBCL), pemodelan matematika, pemodelan statistika, analisis prognosis

# ABSTRACT

## MATHEMATICAL MODELING IN THE DEVELOPMENT OF *DIFFUSE LARGE B-CELL LYMPHOMA* (DLBCL) AND CLINICAL DATA ANALYSIS AS PROGNOSIS FACTORS

By

SULASRI SUDDIN

21/485445/SPA/00808

This study aims to understand diffuse large B-cell lymphoma (DLBCL), the most common and aggressive subtype of non-Hodgkin lymphoma, through a multidisciplinary approach that integrates mathematical modeling and statistical analysis of clinical data. A mathematical model based on a system of differential equations was developed to describe the dynamics of DLBCL cell growth within the germinal center of lymph nodes. The model was analyzed by determining equilibrium points, conducting local stability analysis, and performing bifurcation studies to evaluate dynamic changes resulting from variations in biological parameters. Sensitivity analysis was carried out to identify the most influential parameters on early tumor growth dynamics, and numerical simulations were employed to visualize model behavior, including bifurcation scenarios. In parallel, statistical analysis was applied to the medical records of DLBCL patients at Dr. Sardjito General Hospital using survival analysis, mixture distribution modeling, logistic regression, and factor analysis. These methods aimed to identify significant prognostic factors, including laboratory biomarkers and demographic variables, and to evaluate the predictive accuracy of the models for overall survival. This study integrates clinical data and mathematical modeling using a matching scenario and dynamic survival analysis. Patients are categorized into non-critical and critical phases, with clinical stage as the primary indicator. The logistic hazard model provides a realistic representation of DLBCL survival risk patterns, although findings remain exploratory and limited by available data. Additional investigation considering clinical factors is needed. Implementation and visualization were carried out using MATLAB, R, and Python. Overall, this research aims to bridge the gap between theoretical modeling and clinical practice, while offering additional insights into patient prognosis.

**Keywords:** diffuse large B-cell lymphoma (DLBCL), mathematical modeling, statistical modeling, prognostic analysis.