

## Title: Joint Modeling and Prediction of Lung and Colorectal Cancer Mortality in the United States Using VAR Techniques

This study applies multivariate time series analysis to compare age-standardized death rates for lung and colorectal cancer in the United States from 1950 to 2021, using data from Our World in Data. Lung cancer, the leading cause of cancer mortality, and colorectal cancer, the second most common, are analyzed to uncover long-term trends, potential seasonal patterns, and interdependencies. Vector Autoregression (VAR) models capture joint dynamics, with cointegration analysis to detect long-run equilibrium relationships and Granger causality tests to assess predictive relationships between the series. Impulse response functions and variance decomposition explore how shocks in one series affect the other. The study also generates forecasts for future years, offering insights into potential trends in cancer mortality. Hypothesis testing assumes stationarity (verified via Augmented Dickey-Fuller tests), no residual autocorrelation (checked with Ljung-Box tests), and, where applicable, normality of residuals (assessed using Jarque-Bera tests). Structural breaks, potentially linked to policy changes, are examined using Chow or Bai-Perron tests. Findings will inform public health strategies, highlighting advanced time series methods for addressing cancer mortality challenges.