

**NETWORK-BASED INVESTIGATION INTO TUBERCULOSIS
SPREAD IN NUWARA ELIYA DISTRICT, SRI LANKA**

P.N.M. Perera^{*} and K.K.K.R. Perera

Department of Mathematics, Faculty of Science, University of Kelaniya, Sri Lanka
**nelumikamanjaree@gmail.com*

Tuberculosis (TB) remains a major health challenge in low- and middle-income countries like Sri Lanka, requiring ongoing control and elimination efforts. This study focussed on the Nuwara Eliya District, a popular tourist destination that highlights the need for targeted TB control measures due to the high number of visitors. The primary objective was to forecast TB patients for 2024 by gender, age group, and TB type using ARIMA models for descriptive analysis while constructing a synthetic dataset that includes gender, age, TB type, and relationship based on the forecast results. This dataset was validated through k-fold cross-validations and then converted into a network, where the nodes represent patients and edges represent patient contact relationships. The constructed network was analysed using centrality measures, cluster analysis, and Technique for Order of Preference by Similarity to the Ideal Solution (TOPSIS) methods. Data collection involved annual data from 2012 to 2021 obtained from the National Programme for Tuberculosis Control and Chest Disease website and primary data from Nuwara Eliya Hospital for 2022 and 2023. The ARIMA model was applied solely for forecasting. The synthetic dataset constructed by taking percentages of forecasting data, underwent k-fold cross-validation, achieving an accuracy of approximately 66.39%, supporting the reliability of the forecasting model. Centrality analysis identified influential nodes crucial for disease transmission, while cluster analysis revealed low local clustering but a robust community structure, suggesting that targeted interventions within specific groups could enhance TB control efforts. The TOPSIS method ranked the top ten most influential patients, offering strategic targets for intervention. These findings underscore the importance of tailored control measures to effectively manage TB in high-visitor areas.

Keywords: ARIMA, Cluster analysis, TOPSIS method, Tuberculosis