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Humanities and Social Sciences*

**Faculty of Arts
University of Colombo
Sri Lanka**

IConArts 2024 | Afternoon Session 2.A | Faculty of Arts, University of
Colombo, Sri Lanka

Session 2.A (12.30 pm - 1.35 pm) Venue: 118 Lecture Hall, Faculty of Arts, University of Colombo Theme: Urban issues, migration and mobility Session Chair: Emeritus Professor K. A. P. Siddhisena	
12.30pm – 12.40pm	Social integration and happiness of immigrants in Europe: How do integration dynamics influence social cohesion and happiness of immigrants? <i>S. Udayanga and L.S.D. Zoysa</i>
12.40pm – 12.50pm	Spatial distribution of crimes in urban areas with special reference to Galle Municipal Council area <i>R.T.N.U. Sewwandi</i>
12.50pm – 01.00pm	Investigating position and noise accuracy of crowdsourcing devices for data collection in Smart Cities <i>V. Poslončec-Petrić, Ž. Bačić, I. Cibilić and L. Šlabek</i>
01.00pm – 01.10pm	Emerging trends in the spatio-temporal epidemiology of tuberculosis in Sri Lanka (2021-2023) <i>U.T.G. Perera and F. Ruzaik</i>
01.10pm – 01.35pm	Discussion

Spatio-temporal characteristics and the epidemiology of tuberculosis in Sri Lanka from 2021 to 2023

By

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Tuberculosis (TB) remains a critical global health challenge, affecting a substantial portion of the population worldwide. Despite efforts to control it, TB persists as a leading cause of mortality among infectious diseases, with significant burdens especially in developing countries. Sri Lanka, historically with a low TB prevalence, faces persistent challenges despite improvements in public health infrastructure. This study aims to explore the spatial-temporal characteristics and epidemiology of TB in Sri Lanka from 2021 to 2023, employing time series analysis and spatial mapping techniques. TB incidence data spanning three years were collected from Sri Lanka's Epidemiology Unit. Statistical analyses included ANOVA to assess temporal variations and choropleth mapping in ArcGIS to visualize spatial patterns. Time series analysis was conducted to forecast future trends in TB incidence across nine provinces. ANOVA revealed significant temporal and provincial differences in TB cases ($F = 42.92$, $p < 0.05$), highlighting varying burdens across Sri Lanka. Choropleth maps identified clusters in the Central and Western provinces, consistently reporting higher incidence rates. Time series analysis indicated a positive trend in TB cases for all provinces, influenced by factors such as rapid urbanization and environmental conditions. The study underscores the increasing trend of TB in Sri Lanka from 2021 to 2023, with notable geographic clusters and future projections suggesting continued challenges. Addressing TB effectively requires comprehensive understanding and integration of socioeconomic, climatic, and demographic factors into future research and policy frameworks. Enhanced surveillance and proactive interventions are crucial to mitigate TB's impact and improve public health outcomes in Sri Lanka.

Keywords: Tuberculosis, Sri Lanka, epidemiology, spatial-temporal analysis, time series analysis, public health

1. Introduction

Tuberculosis (TB) remains a major challenge on global public health. It is estimated that approximately 10.6 million people with potential tuberculosis infection, or 23% of the world's population, are at risk of developing TB disease during their lifetime (WHO, 2023). Furthermore, the World Health Organisation (WHO) estimates a global burden of 133 new cases per 100,000 people each year. It is also one of the top ten causes of death, accounting for an estimated 1.3 million deaths in 2012 and killing more people than any other infectious disease in recent decades (WHO, 2023).

Sri Lanka has always been one of the countries with a low prevalence of TB. Due to the continuous attention to public health and increasing investment in resources, Sri Lanka's Tuberculosis epidemic has significantly controlled in recent years. However, Tuberculosis is the second leading infectious

disease in Sri Lanka apart from dengue (Ministry of Health Sri Lanka, 2018). The highest number of deaths among infectious diseases is reported for TB patients in Sri Lanka which is around 500 – 600 annually. According to WHO estimates, nearly 14 000 TB patients should be identified annually.

Currently, Sri Lanka has conducted national epidemiological investigations to find the epidemiological characteristics of Tuberculosis. However, the spatiotemporal distributions of Tuberculosis cannot be evaluated continuously, and the survey was unable to measure other important indicators of the severity of the epidemic. The mathematical models may help to better understand the epidemiological characteristics of Tuberculosis.

Some of the studies mainly focused on the medical aspect of the transmission of Tuberculosis (Basnyat et al., 2018; Wijesinghe et al., 2013), while others focused on the social-economic factors (Senanayake et al., 2018). There is no model that assesses the spatiotemporal characteristics and the epidemiology of Tuberculosis among the whole population in Sri Lanka over last few years. The aim of this study was to observe the spatial temporal characteristics and the epidemiology of Tuberculosis in Sri Lank from 2021 to 2023. The incidence trend of the TB was observed by the Time series analysis. Chorapleth maps were employed to analyse the spatial autocorrelation of TB cases.

2. Materials and Methods

Tuberculosis incidence data were extracted from the epidemiology unit Prevention (<https://www.epid.gov.lk/weekly-epidemiological-report/weekly-epidemiological-report>) in 09 provinces of Sri Lanka from 2021 to 2023. The data were aggregated to 156 weekly counts across the years.

Statistical analysis was performed using SPSS 16.0 software, especially for the temporal distribution analysis in TB cases. Annual, monthly and weekly variations of TB cases have been compared using analysis of variance (ANOVA Test), which emphasized the temporal disease outcomes in provincial level. The results were considered statistically significant when the error was less than 5% ($p < 0.05$).

In epidemiology, spatial analysis was used to identify the clustering regions and observe geographic variation (Auchincloss et al., 2012; Gatrell et al., 1996). Using Arc GIS 10.1, chorapleth maps were prepared to identify the spatial clustering patterns of TB incident rates. The incidence rate (IR) calculation was made by taking the number of new cases per 100,000 population in each province. Future trends of the spread of the disease was identified through a time series analysis which focused on the positive or negative nature of future TB outbreaks. The Time-series analysis consisted of identification, estimation, diagnostic checking and forecasting and also provided an accurate way to predict the Future impact of a disease.

3. Results and discussion

Analysis of Variance (ANOVA) test for the temporal distribution of TB cases demonstrated a significant difference of TB cases in terms of provincial level as well as year (F value = 42.92406244,P

value=9.73E-62). Provincial differences can be identified through the choropleth maps of the Sri Lanka, where central province reported the highest number of incident rates in all three years (Figure 1). Western province reported the second highest number of TB incident rates in all three years and northern and north central provinces also reported significant rates in all three years (Table 1). Significant differences emphasize the temporal distribution differences among provincial level in Sri Lanka.

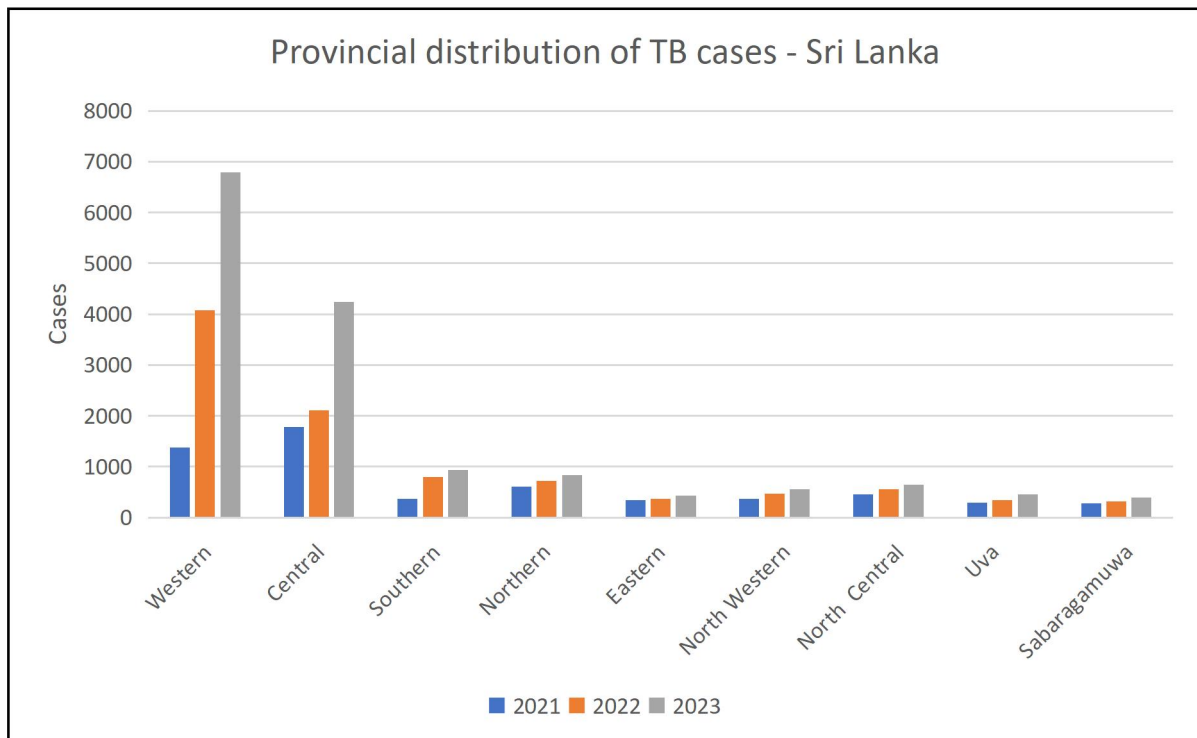


Table 1: TB cases in Sri Lanka from 2021-2023 – Provincial level

Source: Prepared by the author using the TB data -Epidemiology unit, 2024

The Time series analysis on TB prediction demonstrated a positive trend for all the provinces, where all the regions can be considered as areas with an increasing number of TB cases in the near future too (Figure 2). The rapid urbanization with poor air quality would be the main factor for the increasing number of TB cases in the study area. These results were similar to the previous studies on developing countries such as China (Zuo et al., 2020), India (Agnihotri et al., 2013) and Indonesia (Puspita et al., 2021) where TB cases depicts an increasing trend in the recent years.

Provincial distribution of TB from 2021 - 2023

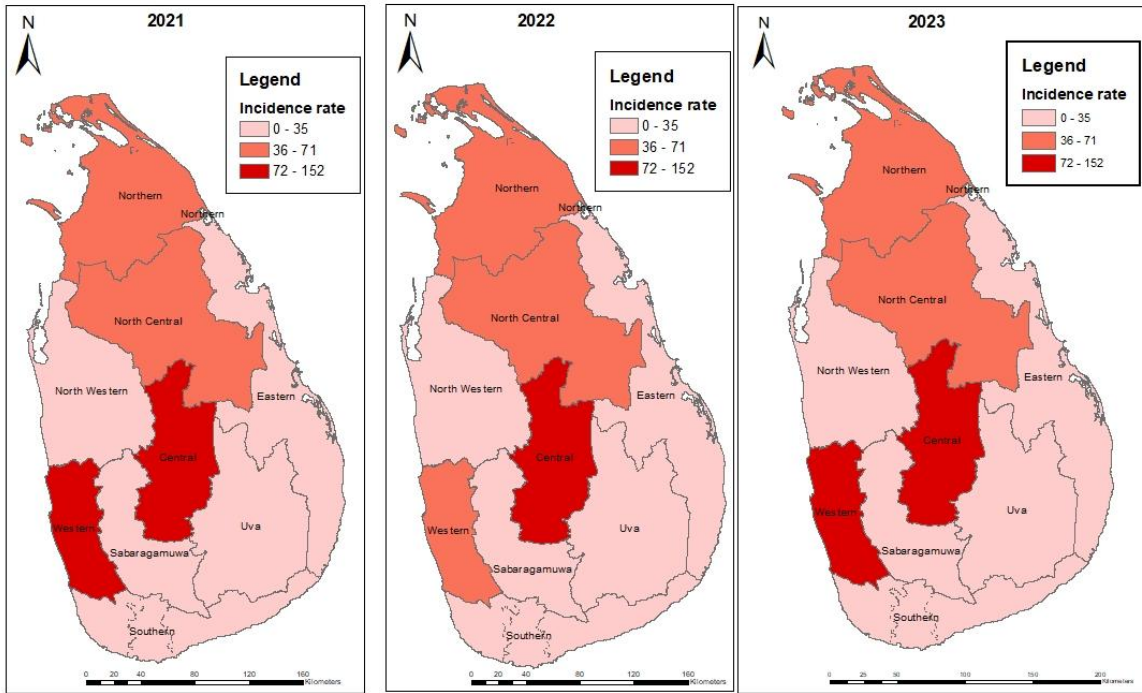


Figure 1: Time series analysis of TB cases in Sri Lanka from 2021-2023

Source: Prepared by the author using the TB data -Epidemiology unit, 2024

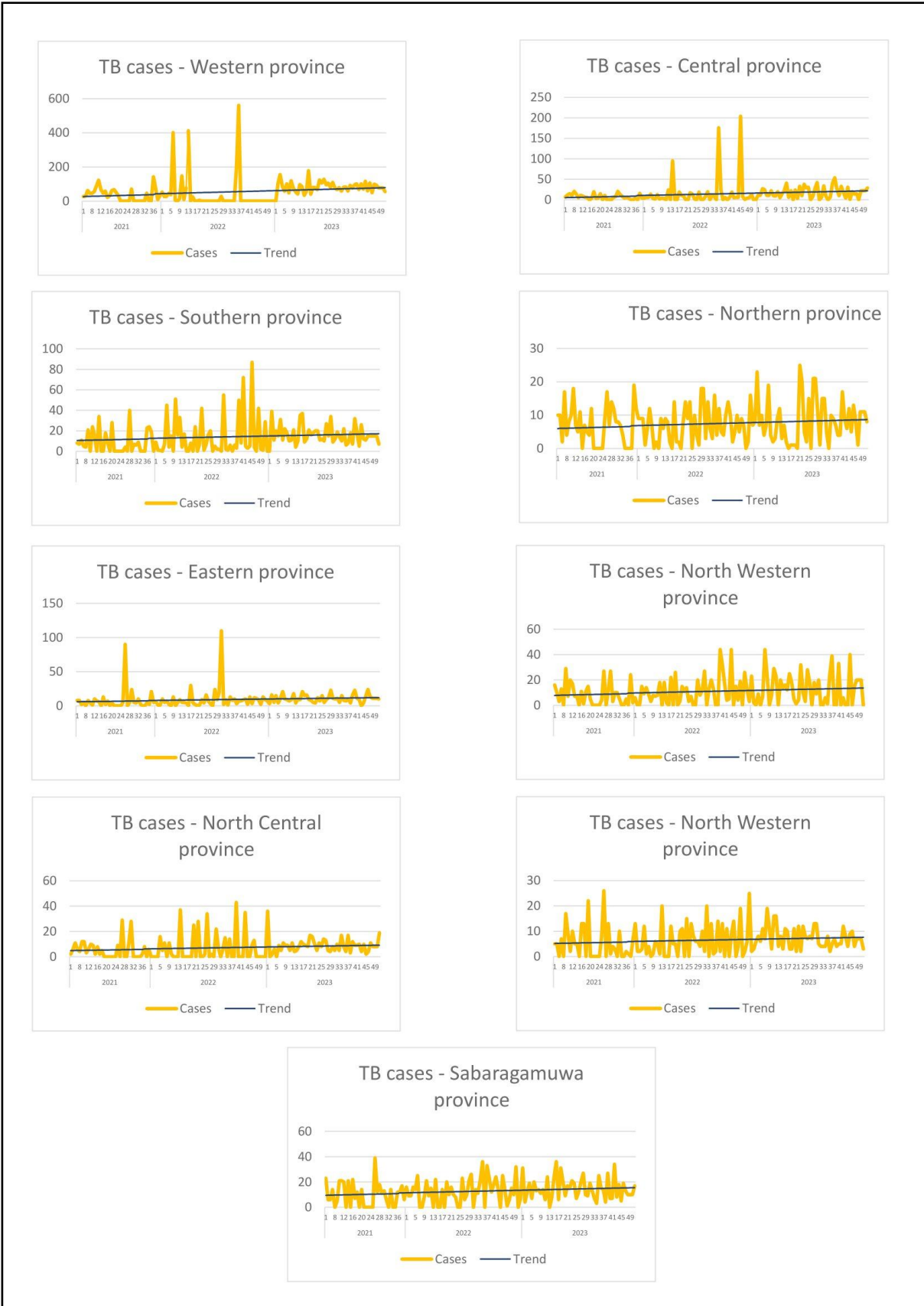


Figure 2: Time series analysis of TB cases in Sri Lanka from 2021-2023

Source: Prepared by the author using the TB data -Epidemiology unit, 2024

This study had few limitations where the weekly TB data from 2021 to 2023 did not collect some risk factors including socioeconomic status, climatic factors, gender, age, and human activities. The relationship between the incidence of TB and these factors was still unknown. These factors should be included in the future studies in order to get an accurate multivariate time series model.

4. Conclusion

In conclusion, Sri Lanka still has a significant number of TB incidence. However, the incidence rate of TB was significantly increasing from 2021 to 2023 in Sri Lanka. Obvious geographical clusters were observed in Western and Central Province. The relative importance component of TB driving transmission was distinguished from the time series model. For every province over the past three years, a positive trend was identified in TB cases. This statistical analysis plays a leading role in recognizing the future impact of TB cases which need to enhance the early protective implementation.

5. References

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