

**UNIVERSITI TEKNOLOGI MARA**

**INVESTIGATION ON THE EFFECT  
OF ENVIRONMENTAL FACTORS  
ON THE PATTERN OF COVID-19  
CASES IN SELANGOR, MALAYSIA**

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## ABSTRACT

This study examines the significant role of environmental factors in shaping the pattern of COVID-19 cases during the global pandemic. Specifically, it investigates the effects of temperature, relative humidity, wind speed, rainfall amount, and population density on the transmission and distribution of COVID-19 cases. The analysis focuses on the Selangor region, comparing confirmed cases from October 1, 2020, to October 30, 2021. Using the Global-Moran Index and Geographic Information System (GIS), the study identifies hotspot and cold spot areas at the district level, revealing spatial clusters of COVID-19 cases. Hotspots are predominantly found in high-density areas, while cold spots are concentrated in low-density areas. The study further examines the duration of the spread and decay stages using the Spearman rank correlation coefficient and the bell-shaped model method. The analysis indicates variability within hotspot areas, with adjusted  $R^2$  values of 0.32 and 0.18 for the spread and decay stages, respectively, highlighting the influence of population density. Employing the general additive model (GAM), the study explores the relationship between environmental factors and COVID-19 transmission. The findings demonstrate the statistical significance ( $p < 0.05$ ) of all factors in relation to COVID-19 cases. Average temperature and humidity exhibit an S-shaped exposure response relationship, with COVID-19 cases peaking within the range of 25°C to 30°C. Conversely, wind speed, rainfall, and the index of wind effect (K) display a linear decreasing relationship with COVID-19 cases, suggesting a negative association. The study also identifies a significant linear increasing relationship between the Temperature Humidity Index (THI) and COVID-19 cases. Overall, this investigation highlights the critical role of environmental factors in shaping the pattern of COVID-19 cases in Selangor. Understanding these factors can inform effective strategies and interventions to mitigate the impact of the virus.

**Keywords:** environmental factor, COVID-19, spatial, spread and decay.

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# CHAPTER 1

## INTRODUCTION

### 1.1 Background of Study

In late December 2019, a cluster of severe pneumonia occurred in humans in Wuhan, Hubei Province, China (Huang et al., 2020; Wu et al., 2020; Zhu et al., 2019). The pathogen responsible for the disease was identified as a novel coronavirus known as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (Gorbalenya et al., 2020; Shang et al., 2020; Zheng, 2020; Zhou et al., 2020). The epidemic spread rapidly throughout the world and caused global public health concern; it was later named coronavirus disease 19 (COVID-19) (Chen et al., 2020; Xu et al., 2020). Fever, cough, shortness of breath, and fatigue are the most common clinical signs of COVID-19. Some individuals developed radiographic abnormalities of the lungs and died of acute respiratory distress syndrome (ARDS) (Huang et al., 2020; Wang et al., 2020). The World Health Organisation (WHO) declared COVID-19 a global pandemic on March 11, 2020 (WHO, 2020). COVID-19 symptoms range from mild to severe and primarily include fever, cough, and difficulty breathing. Severe cases of pneumonia and hypoxemia have a high mortality rate. Adults and the elderly are at highest risk for infection, but newborns and children can also be infected with SARS-CoV-2. Individuals over 65 years of age who already have chronic disease are at higher risk for serious consequences of SARS-CoV-2 infection. The incubation period for clinical signs is reported to be 2-5 days, and the infected person can virtually transmit the virus to others during this time. There is usually 14 days between the onset of symptoms and the onset of disease problems (Chan et al., 2020). The most important COVID-19 complication in children is multisystemic inflammatory syndrome (MIS) (Yasuhara et al., 2021). COVID-19 in adolescent mortality is low, ranging from 0% to 13%. However, emerging evidence suggests that the impact of this condition in the paediatric population is likely to vary across and within countries (Huang et al., 2020).