中文摘要

流行性感冒病毒是一種最主要的呼吸道致病源，且能導致嚴重之病症。全球每年流行約有 3 至 5 百萬人感染流感後導致嚴重病症與 25 萬至 50 萬人之死亡。在溫帶地區，流感的發生呈現明顯季節性的變化，然而，此趨勢在熱帶地區尚未明確定義。本研究目的為評估亞熱帶台灣地區流感致病率所造成之衝擊，與流感亞型 A/H3N2 所貢獻之類流感病症之季節性動態行為。本研究使用波以松 (Poisson) 季節迴歸模式擬合台灣疾病管制局 1999 至 2007 年間每週流感相關之致病率。此模式對於流感相關之致病率校正每年之趨勢、季節性、溫度、相對濕度、與流感亞型 A/H1N1、A/H3N2、B 型，以及呼吸道融合病毒之盛行率作為自變項。本研究亦使用一以季節性驅動之易感–感染–復原–易感模式，並整合此正弦曲線之驅動，解釋季節性及流行動態，並量化不同季節之基本再生數 (R_0)。此外，採用一相平面圖調查流感之季節動態及調節此流感週期性流行之閾值。研究結果顯示，流感相關之致病率與溫度呈現顯著之相關性，與相對濕度則無明顯之相關性。本研究亦指出，流感亞型 A/H3N2 為最主要貢獻流感相關致病率之病毒亞型(50%)，其次為 B 型流感 (39%) 及 A/H1N1 (11%)。本研究所擬定之流行病學模式指出季節性與輕微流行振盪之關係，其估計自身振盪期間約為一年。本研究指出，局部易感人數之最低值 (S_0=0.30) 大於此理論上之閾值(S_c=0.015)，意謂隔年會有流感流行之爆發。本研究提供了波以松回歸模式分析亞熱帶台灣地區流感所造成的負荷，對於季節性 A/H3N2 貢獻的類流感病症動態，以及使用此閾值做為預測其後的流行或跳脫之依據有更佳的了解。

關鍵詞：流行性感冒；致病率；季節動態；傳輸率；台灣；亞熱帶；易感–感染–復原–易感 (Susceptible–Infectious–Recovery–Susceptible)模式

Abstract

Influenza virus is a major viral respiratory pathogen that can cause severe illness. The annual epidemics are thought to result in between three and five million cases of severe illness and between 250,000 and 500,000 deaths every year around the world. In temperate regions, there are clear seasonal variations in the occurrence of influenza, nonetheless, seasonality is less defined in tropical regions. The purpose of this study was to assess the impact of influenza on morbidity and seasonal dynamical behavior accounted for influenza A/H3N2-contributed influenza-like illness (ILI) in subtropical Taiwan. This study employed a Poisson seasonal regression model to fit weekly influenza-associated morbidity collected from the Center for Diseases Control, Taiwan (Taiwan CDC) during 1999 to 2007. The proposed models allow this study to adjusting influenza-associated morbidity for independent variables as annual trend, seasonality, temperature, relative humidity, viral circulation such as influenza A/H1N1, A/H3N2, type B, and respiratory syncytial virus (RSV). This study also employed a seasonally forced susceptible-infectious-recovery-susceptible (SIRS) model incorporated with sinusoidal forcing to examine the seasonality and epidemic dynamics including season-specific basic reproduction number (R_0). A phase plane diagram was used to investigate the seasonal dynamics and critical threshold that regulate the influenza recurrent epidemics. The results indicate that there are stronger association between influenza-associated morbidity and temperature than that of relative humidity. Influenza A/H3N2 was the predominant virus subtype during the study period and had a nearly 50% contribution followed by type B (39%) and A/H1N1 (11%) on influenza-associated morbidity. The proposed epidemiological model demonstrated that seasonality produces mild amplitude epidemics, which the estimated intrinsic period of oscillation was approximated to one year. This study

showed that the local minimum number of susceptibles (S_0=0.30) was higher than that of theoretical critical threshold level (S_c=0.015), implicating there was an epidemic outbreak in the following year. This study provided a better understanding of Poisson regression modeled influenza burden guideline, seasonal A/H3N2-contributed ILI dynamics, and used the critical threshold level to predict the occurrence of subsequent epidemic or skip in subtropical Taiwan.

***Keyword*:** Influenza; Morbidity; Seasonal dynamics; Transmission rate; Taiwan; Subtropics; Susceptible–Infectious–Recovery–Susceptible (SIRS) model