中文摘要

流行性感冒為目前引起急性呼吸道疾病之最常見原因，且流感具影響所有年齡族群之能力。全球每年流感流行造成嚴重地致病率及死亡率。因此，需實質控制策略以降低流感散佈。本研究目的為推估自然史與傳輸參數並推求相關關鍵流行病學參數已了解不同型別與亞型之流感病毒。本研究數據來源為近期發表之病毒排出與症狀計分動態實驗數據並對齊重新進行分析，且發展一套最適切之統計模式以連結人體流感感染實驗與流行病學因子。本研究藉由病毒排出與時間之曲線下面積訂定門檻值，經擬合後之病毒排出模式可得特定病毒之傳輸率 (β)、復原率 (γ)、感染率 (σ)及基本再生數 (R_0)。本研究亦利用疊圖法將特定病毒之 R_0 與病毒排出數據推求時變之傳染力並以時變之症狀計分為基礎推求無症狀之機率。結果顯示 A (H3N2)曲線下面積之病毒負載值 (6.09)較B型 (3.78)及A (H1N1) (2.81) 為高，易導致相對應支復原率 (γ)依序為0.17, 0.20及0.30 d^{-1}，及感染率 (σ)分別為 0.39, 0.42 及 0.40 d^{-1}。跟具參考文獻訂定 A (H1N1) β 值為 0.51 d^{-1}，推估A (H3N2)之 β 與 R_0 分別為 1.11 d^{-1} 及 6.5 及 B 型之 β 與 R_0 分別為 0.69 d^{-1} 及 3.4。本研究結果亦指出 A(H1N1)之 R_0 推估值為 1.74，符合文獻數據值 1.7 – 2.0 間。最後，本研究以劑量與反應關係連結病毒力價與症狀計分實驗數據，再以症狀計分與接觸率之相關性疊合接觸率與病毒力價。本研究提供一有效之分析工具不僅能連結特定病毒之人體流感實驗數據以推求其自然史與傳輸參數，亦能推求相關關鍵流行病學因子。

關鍵詞：流行性感冒；病毒排出；症狀；流行病學；基本再生數；傳輸

Abstract

Influenza is currently the most frequent cause of acute respiratory illness, affecting all age groups. The severe morbidity and mortality worldwide were due to annual epidemic of influenza. It is substantially requiring control measures to reduce the spread of influenza. The purpose of this study was to estimate the natural history and transmission parameters estimations and to relate it to key epidemiological parameters for understanding influenza virus type and subtypes. The recent published experimental data of viral shedding and symptom score dynamics were reanalyzed. A simple statistical algorithm was developed for linking between experimental human influenza infection and epidemiological factors. This study calculated threshold-adjusted area under the viral shedding versus time curve (AUC) of the fitted viral shedding models to obtain the virus-specific transmission rate (β), recovery rate (γ), infectious rate (σ), and basic reproduction number (R_0). We used the mapping technique on virus-specific R_0 and vital shedding data to estimate the infectiousness. The asymptomatic probability based on temporal variation of symptom scores was constructed. Results indicate that A (H3N2) had the highest viral load AUC value (6.09) than those of type B (3.78) and A (H1N1) (2.81), leading to the corresponding recovery rate (γ) were estimated to be 0.17, 0.20, and 0.30 d^{-1} and infectious rate (σ) were 0.39, 0.42, and 0.40 d^{-1}, respectively. Based on a reference value of β = 0.51 $d^{-1}$of A (H1N1), mean β and R_0 for A (H3N2) were estimated to be 1.11 d^{-1} and 6.5, respectively, whereas β = 0.69 d^{-1} and R_0 = 3.4 were estimated for type B. Results also indicate that the estimated R_0 = 1.74 for A (H1N1) is consistent with published data ranged from 1.7 – 2.0. Finally, this study linked both the dose- response relationship between experimental symptom scores and viral titer and the relationship between symptom scores and contact rate to map contact rate to viral titer. This study could

offer a useful analytical tool not only to link virus-specific experimental human influenza data to natural history and transmission parameter estimates but also to relate it to key epidemiological factors.

***Keywords*:** Influenza; Virus shedding; Symptoms; Epidemiology; Basic reproduction number; Transmission