

Respiratory and circulatory deaths attributable to influenza A & B

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Objective

To estimate mortality attributable to influenza adjusted for other common respiratory pathogens, baseline seasonal trends and extreme temperatures.

Introduction

Assigning causes of deaths to seasonal infectious diseases is difficult in part due to laboratory testing prior to death being uncommon. Since influenza (and other common respiratory pathogens) are therefore notoriously underreported as a (contributing) cause of death in death-cause statistics modeling studies are commonly used to estimate the impact of influenza on mortality.

Methods

Using primary cause of death (Statistics Netherlands) we modeled weekly timeseries of

- 1) respiratory deaths (ICD10 codes J00-J99) and
- 2) circulatory deaths (ICD10 codes I00-I99).

We used regression models with an identity link and Poisson error to relate mortality to counts of influenza A & B diagnoses. We adjusted for other common respiratory pathogens (all pathogen data was at population level from the national laboratory surveillance), temperature (from the Dutch Royal Meteorological Institute), and baseline linear and cyclical (i.e. seasonal) trends. To account for the yearly variation in the severity of the main circulating influenza A strain we used time dependent variables for influenza A (fixed at lag 0 – assuming a direct effect of influenza. For influenza B and the confounding pathogens we considered a 0 tot -4 time lag (thus allowing infection to precede death for up to 4 weeks). We performed the analyses separately per death cause group and by 3 different age groups (0-64, 65-74, 75+ years) over a 14-year time-period (mid 1999-mid 2013, thus 14 complete winter seasons).

Results

In the Netherlands on average 2,636 all cause deaths occur per week varying by season (lower in summer min: 2,219 and higher in winter max: 3,564) with yearly incidence ranging from 20/10,000 in 0-64 year olds to 885/10,000 in 75-plus year olds.

Circulatory mortality (31% of total deaths) was higher than respiratory mortality (10% of total deaths) and both showed clear seasonality in all age-groups. Overall, 0.14% of all deaths were actually coded as influenza deaths.

Preliminary model estimates showed that the proportion of respiratory deaths attributable to influenza A were quite similar for 0-64 and 65-74 year olds but higher in 75+ (5.1%, 5.7%, 7.0% respectively) while this proportion was stable across age-groups for circulatory deaths (approximately 1.5% in all agegroups for influenza A). Influenza B was significantly associated with respiratory deaths and circulatory deaths in the oldest age group of 75+ years (with proportions of 0.7% and 0.2% respectively) while in the 65-74 year olds it was associated only with circulatory deaths (0.2%). Influenza B was not significantly associated with either respiratory or circulatory mortality in the 0-64 year age group.

On average, yearly in the 75+ age group 70/10,000 respiratory deaths and 39/10,000 circulatory deaths were attributable to influenza

A. For influenza B the incidences were 7 to 10 fold lower (7/10,000 and 6/10,000 respectively).

Conclusions

Influenza A was significantly associated with respiratory and circulatory mortality in all age groups while influenza B was significantly associated with respiratory and circulatory mortality in the elderly only.

Keywords

mortality; Influenza; Respiratory

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