Respiratory Syndrome in the Netherlands in Relation to Pathogen Activity

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OBJECTIVE

As a validation for syndromic surveillance we studied whether respiratory syndromes indeed reflect the activity of respiratory pathogens. Therefore we retrospectively estimated the temporal trend of two respiratory syndromes by the seasonal dynamics of common respiratory pathogens.

BACKGROUND

Syndromic surveillance may be suited for detection of emerging respiratory disease elevations that could pass undiagnosed. The syndromes under surveillance should then retrospectively reflect known respiratory pathogen activity. To validate this for respiratory syndromes we analyzed dutch medical registration data from 1999-2003 (national hospital discharge diagnoses and causes of death). We assume that syndromes with a good reflection of pathogen activity have the potential ability to reflect unexpected respiratory pathogen activity in prospective surveillance.

METHODS

Respiratory syndromes were defined for the hospital and causes of death data using the CDC syndrome grouping of ICD9 codes as a guidance. Time series of respiratory pathogens (Respiratory syncytial virus (RSV), influenza A+B, Rhino virus, Mycoplasma pneumoniae, parainfluenza virus, S.pneumoniae) from the same 5 year period were extracted from routine laboratory surveillance (weekly counts of positive results). Likewise data on patient syndromes were aggregated by week. We used multiple linear regression to model the relationship between the trend in the respiratory syndromes and respiratory pathogens. We evaluated current and lagged pathogen counts (-5 up to +5 weeks) as explanatory variables. A forward stepwise regression approach was used, by selecting those lags and pathogens that contributed most to the model fit (assessed with Akaike's Information Criterion). Each pathogen was included in the model only once. Pathogens that correlated negative with the syndromes were excluded.

In order to discriminate between S. pneumoniae as a primary infection or a super infection after an infection with another pathogen, we first used a linear regression model that explained the temporal trend of S. pneumoniae with the other pathogens as explanatory variables. Instead of the S.pneumoniae counts we then used the residual values of this model as an explanatory variable in the above described models for the respiratory syndromes, characterizing the relationship between so defined *primary* S.pneumoniae infections and the respiratory syndromes. We checked for autocorrelation (AC) in the residual of the described models with hierarchical time series models.

RESULTS

All respiratory pathogens and the residual values for S.pneumoniae were included as predictors of the respiratory syndrome in hospital data. For the causes of death only influenza A + B, RSV and the residual values for S.pneumoniae were included as predictors of the respiratory syndrome. No significant AC was present in the residuals of the models. The adjusted R-square for the hospital model was 0.84 and for the causes of death model 0.75, indicating that the respiratory syndromes reflect the respiratory pathogen activity well.

Figure 1 shows the actual counts of the hospital syndrome (black curve) together with the model predictions based on the pathogens (blue curve) and the 95% confidence intervals for new observations (red curve. The causes of death syndrome showed similar results. Using the estimated beta-values we assessed that according to the models RSV and influenza A+B contributed most to the winter peaks of the respiratory syndromes.

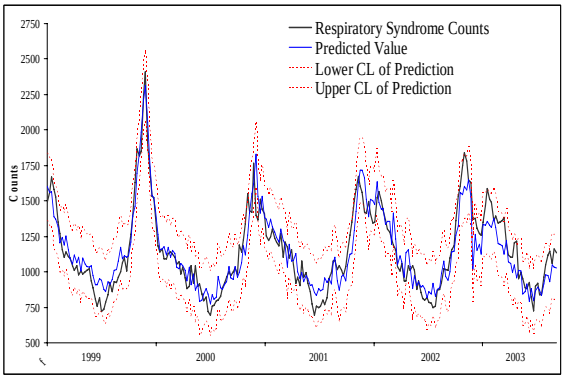

Figure 1 –Respiratory Syndrome (weekly hospitalizations).

CONCLUSIONS

The temporal trends of the hospital and causes of death derived respiratory syndromes give a good reflection of known respiratory pathogen activity. The actual ability to detect unknown respiratory disease elevations with these syndromes will be further investigated.

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