Modelling the Contribution of Infectious Pathogens to the Seasonality of Syndromic Data.

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Objective

1) To provide weekly estimates of the proportions of NHS Direct respiratory calls attributable to common infectious disease pathogens.

Background

Calls to NHS Direct (a national UK telephone health advice line) which may be indicative of infection show marked seasonal variation, often peaking during winter or early spring[1]. This variation may be related to the seasonality of common viruses[2]. There is currently no routine microbiological confirmation of the cause of illness in NHS Direct callers. Modelling trends in NHS Direct syndromic call data against laboratory data may help by attributing the likely cause of these calls the and surveillance 'signals' generated by syndromic surveillance.

Multiple linear regression has been used previously to estimate the contribution of rotavirus[3] and RSV[4] to hospital admission for infectious intestinal disease and lower respiratory tract infections respectively. We applied a similar regression model to NHS Direct syndromic surveillance data and laboratory reports.

Methods

Data were collected on the weekly numbers of NHS Direct calls about 'cold/flu', fever, cough and difficulty breathing (England and Wales - all ages and 0-4 years - October 2002 to October 2004) (outcome variables); and the weekly numbers of laboratory reports of the main respiratory pathogens (explanatory variables). Laboratory data are subject to some case ascertainment bias.

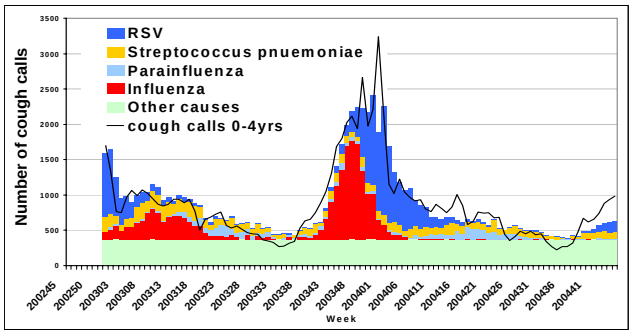
Multiple linear regression models were constructed for each syndrome with variables (pathogens) that contributed little to the model removed by backward stepwise regression. The formula used for estimating the number of NHS Direct calls in week j due to pathogen i was $Y_j = C + \sum \alpha_i L_j$ where L_j = number of lab reports in group i (e.g. influenza) in week j, α_i = the number of NHS Direct calls associated with each lab report (i remains constant throughout the year), and C = constant number of calls due to other causes.

Results

The models explained 79%, 81%, 23% and 9% of the temporal variation in cold/flu, cough, fever, and difficulty breathing calls respectively (all ages). The equivalent figures for the 0-4 year age group were 70%, 82%, 77% and 45%.

The main significant explanatory variables were influenza and RSV: estimated to account for over half of NHS Direct cold/flu and cough calls during short-lived winter periods, and streptococcus pnuemoniae: with an estimated year round background contribution to calls about respiratory syndromes.

Figure 1. Estimate of the contribution of RSV, streptococcus pneumoniae, parainfluenza, influenza and other causes to NHS Direct cough calls (0-4 years: 2002-2004), using a regression model.



Conclusions

This relatively straightforward modelling technique has provided weekly estimates of the proportions of syndromic data due to specific microbiological causes.

This information will be useful - throughout the year – when interpreting syndromic surveillance signals.

These data can also be used to provide estimates of the burden of infectious diseases reported to NHS Direct and has implications for the advice offered by NHS Direct nurses.

References

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