Limited impact of the 7-valent pneumococcal vaccine on paediatric empyema in the North of England

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On behalf of North East of England Paediatric Respiratory Infection Study Group

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Aim

To assess the impact of the 7 valent pneumococcal vaccine (PCV-7) on the incidence of empyema in the North of England using an interrupted time series analysis.

Background

- The incidence of empyema has been increasing in children over the last 15 years.[1] However a recent report has suggested that cases in the UK may now be declining.[2]
- *Streptococcus pneumoniae* is the predominant cause of childhood empyema in the UK, with up to 65 % of cases attributable to pneumococcal infection.[3]
- PCV-7 was introduced to the UK routine immunisation schedule in September 2006.
- Previous reports have suggested that the vaccine may have only a limited impact on empyema but it's impact has not been formally studied in the UK using clinical data.[4]

Methods

- Monthly rates of empyema in children aged <15 years who were managed in the regional management centre for NE England & Cumbria from May 1995 to April 2010 were calculated.
- A total of 298 cases of empyema were identified.
- Average monthly temperature measurements for the region were used to account for seasonality.
- Five variables including mean monthly minimum temperature, month from study start, presence of vaccine programme, month from immunisation programme start and an interaction term between temperature and month from study start were used.
- All models were fitted using a least squares regression approach.

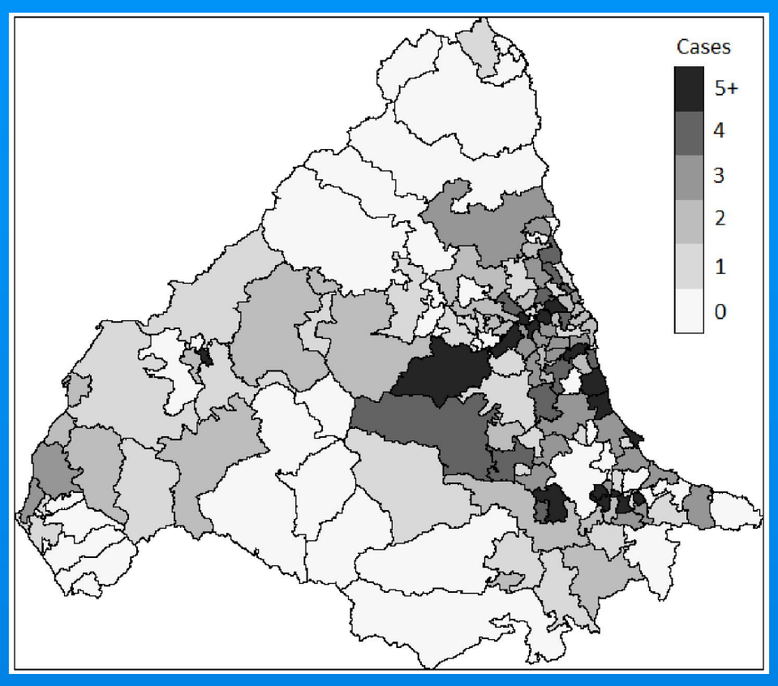

Figure 1: Map of study area with cases per postcode district from 1995 to 2010 demonstrated

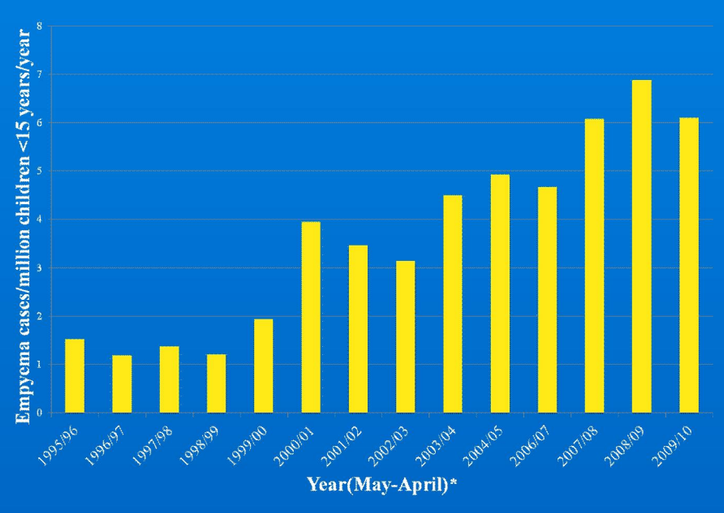

Figure 2: Yearly rate of empyema cases 1995 to 2010

** 2005/06 not shown due to missing data*

	Co-efficient	95 % Confidence Intervals	p-value
Mean Monthly Minimum Temperature / ºC	-0.043	-0.091 to 0.0056	0.08
Time From Study Start	0.0099	0.0061 to 0.014	<0.0001
Vaccine programme present	0.16	-0.033 to 0.65	0.53
Month From Vaccine Programme Start	-0.010	-0.028 to 0.0072	0.25
Interaction Term (Month From Study Start * Mean Monthly Minimum Temperature)	-0.00049	-0.00098 to -0.00001	0.045

Table: Results of interrupted times series analysis

Results

- Cases of empyema in the North of England increased significantly from a mean monthly rate of 1.1 cases per million children (<15 years) in 1995/96 to 5.2 cases per million in 2009/10 ($p<0.0001$).
- No significant impact was observed on the number of cases from either the introduction of PCV-7 ($p=0.52$) or time from the introduction of PCV-7 ($p=0.24$).

Discussion

- Our results suggest that the introduction of the PCV-7 immunisation has had no impact on the incidence of empyema in the North of England.
- Serotype replacement may have contributed to this lack of impact. However, it is more likely that PCV-7 serotypes did not contribute significantly to these cases. Other factors such as the circulation of epidemic strains of serotype 1, changes in organism virulence or an increase in the underlying cases of pneumonia may be responsible.
- The interaction term between temperature and time was significant demonstrating that winter case numbers increased through time, to a greater degree than did summer case numbers.
- Further work is required to establish whether this finding is generic across the UK.

Conclusion

The introduction of PCV-7 was not associated with a decrease in the incidence of paediatric empyema.

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