Rationale: The association between hospital admissions of pediatric asthma and concentrations of individual aeroallergen species is not well understood. Two different modeling approaches were evaluated and compared. These were generalized linear model (GLM) and generalized additive model (GAM).

Methods: Records of daily asthma visits were retrieved from Cincinnati Children’s Hospital Medical Center. Selected aeroallergens were total pollen, ragweed pollen, oak/maple pollen, pinus pollen, total fungi, Alternaria, Aspergillus fumigatus, and daily ozone and PM concentration levels. Predicted response was used to examine the relationship. Factors known to be related with asthma occurrence were modeled first and the residuals were then analyzed with respect to the aeroallergen concentrations. GLM modeled the non-linear covariate effects through indicator variables, while GAM modeled through smoothing functions. Lagged effects of aeroallergens on asthma were examined as well.

Results: GLM and GAM provided similar findings. The aeroallergens found to be significantly related (P<0.05) with asthma were oak/maple pollen, ragweed pollen, pinus pollen, Alternaria, and Aspergillus. Their relative risks on asthma admission for a 100/m increase in concentration were in the range of 1.03 - 1.50. Their effects were delayed by 3 or 5 days.

Conclusions: Different aeroallergen species have different relative risks on pediatric asthma exacerbation. Both GLM and GAM are capable of analyzing the time series studies in environmental health research. However, GAM is more flexible and parsimonious approach than GLM in model fitting.

Methods:

- The period for this time series study was from March to October, 2002
- Generalized linear model
- Nonlinear covariate effects of season, weather and other air pollutants were modeled categorically through indicators
- Initial category number was picked from scatter plots, where daily asthma visit is plotted against the categories respectively
- Type I analysis was used to judge the significance of adding extra number of categories
- Generalized additive model
- Nonlinear covariate effects were modeled through cubic smoothing spline
- Auto-correlation between residuals were examined
- Sensitivity of results to extreme values was checked

Future Work:

- Bayesian hierarchical model to compute regional/national relative risk of aeroallergens on pediatric asthma
- Bayesian hierarchical regression to investigate the influence of city-specific factors on the relative risk
- Synergistic effects between aeroallergens and other pollutants

Acknowledgements:

- Different types of pollen and fungal spores have different influences on the childhood asthma exacerbation, and their delayed effects vary
- Both GLM and GAM provide good fit; estimated coefficients are similar for the significant predictors found in the two models
- GAM is more flexible and parsimonious approach than GLM; covariate control in GAM is more efficient and straightforward
- Estimation in GAM is more powerful due to the reduced degrees of freedom in model fitting
- Dose response can be explored further with the smoothing functions in GAM

Funded by NEIHS Grants: ESI11270