



Seminar Invitation

Epidemiology meets Toxicology. The Bitterfeld Project – A success story

Joachim Heinrich, Helmholtz Zentrum München, Institut für Epidemiologie I,
München, Germany, heinrich@helmholtz-muenchen.de

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Background: Environmental epidemiological studies commonly face its limits, when causality issues are discussed. Additional toxicological experiments, animal or human exposure studies might help to justify the interpretation of epidemiological findings as causal.

Objectives: The Bitterfeld project is a cohort study on long-term effects of ambient air pollution exposure on several health parameters in children. Three areas differing in air pollution levels were included. In addition to the cross-sectional study design temporal changes of the health status in children were investigated while air quality was strongly improving. In addition to this observational study, ambient particulate matter, collected from these different areas, was used for an animal experiment and a human exposure study in order to study consistency between findings from observational studies and experimental work.

Methods: The study consists of three repeated regional cross-sectional studies of children aged five to fourteen years examined at the beginning, middle and end of the 1990 years in East Germany. In parallel, ambient air samples were collected and particles were used for experimental studies.

Results: We found a strong improvement of non-allergic respiratory health including lung function in parallel with the improved air quality in terms of a decline of ambient levels of SO₂ and PM. However, allergic diseases like asthma, hay fever, and in addition prevalence of allergic sensitization was not declining (Heinrich et al. Epidemiology 2002a). In addition, the regional differences for these allergic disease entities remained stable although there was a strong converge of ambient air pollutant levels between the three areas (Heinrich et al. 2002b). We speculated that the increased levels of allergic diseases in one area might be caused by the high emissions of heavy metals from copper plants. Collected PM₁₀ and PM_{2.5} particles were therefore applied to a mouse model. We found that particles from the mining area showed stronger signals in ovalbumine sensitized mice for allergic reactions compared to particles collected from the control area with a much lower content heavy metals (Gavett et al. 2003). Human exposure studies instilled tiny amounts of

particles from the mining and from the control area in the right and the left lobe of lungs of volunteers and inflammatory responses were measured (Schaumann et al. 2004). The instilled amount of particles was similar to the deposited particles inhaled on a normal winter day. Also this study showed consistently a stronger signal for the particles collected from the mining areas compared with particles from the control area. It was concluded that particles from the mining area are more allergenic than particles from the control area.

Conclusion: The consistency between findings from observational studies and experimental experiments indicates that the composition of particles and in this case in particular the content of heavy metals in the ambient aerosol might be the cause of the increased prevalence of allergic diseases in one of the study areas apart from particle mass.

References

1. Heinrich J, Hoelscher B, Frye C, Meyer I, Pitz M, Cyrus J, Wjst M, Neas L, Wichmann HE. Improved air quality in reunified Germany and decreases in respiratory symptoms. *Epidemiology* 2002a; 13(4):394-401.
2. Heinrich J, Hoelscher B, Frye C, Meyer I, Wjst M, Wichmann HE. Trends in prevalence of atopic diseases and allergic sensitization in children in Eastern Germany. *Eur Respir J* 2002b; 19/6:1040-1046.
3. Gavett SH, Haykal-Coates N, Copeland LB, Heinrich J, Gilmour MI: Metal Composition of Ambient PM_{2.5} Influences of Allergic Airways Disease in Mice. *Environmental Health Perspectives* 2003; 111(12): 1471-1477.
4. Schaumann F, Borm PJA, Herbrich A, Knoch J, Pitz M, Schins RPF, Luettig B, Hohlfeld JM, Heinrich J, Krug N. Metal-rich Ambient Particles (Particulate Matter_{2.5}) Cause Airway Inflammation in Healthy Subjects. *Am J Respir Crit Care Med* 2004; 170:898-903.