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Childhood social position and associations between environmental exposures and health outcomes

Barbara Hoffmann[a,*], Bita Kolahgar[a], Knut Rauchfuss[b], Georg Eberwein[b], Isabelle Franzen-Reuter[c], Martin Kraft[c], Michael Wilhelm[d], Ulrich Ranft[e], Karl-Heinz Jöckel[a]

[a]*Institute for Medical Informatics, Biometry and Epidemiology, University Hospital Essen, University of Duisburg-Essen, Germany*
[b]*North Rhine-Westphalia State Agency for Nature, Environment and Consumer Protection, Essen, Germany*
[c]*Ministry of the Environment and Conservation, Agriculture and Consumer Protection of the State of North Rhine-Westphalia, Düsseldorf, Germany*
[d]*Department of Hygiene, Social- and Environmental Medicine of the Ruhr-University of Bochum, Bochum, Germany*
[e]*Environmental Health Research Institute of the University of Düsseldorf, Düsseldorf, Germany*

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Abstract

Background: Growing evidence indicates that environmental exposures are more prevalent among socially disadvantaged groups. We investigated the distribution of environmental exposures and health outcomes in preschool children, and examined the role of social position on their associations.

Methods: We analysed data from a cross-sectional study on 968 preschool children from three districts in the Ruhr Area and one rural community in North Rhine-Westphalia in 2000. Parents filled in a questionnaire on socio-demographic characteristics, environmental exposures, respiratory infections and allergic diseases. Residential annual total suspended particulate matter (TSP) mass concentrations were derived from a small-scale interpolation model. Lung function, allergic sensitisation and immunologic function were assessed. We analysed the associations between environmental exposures and health outcomes in social subgroups with logistic regression.

Results: High TSP concentrations at the home address and unfavourable living conditions were more prevalent in the socially disadvantaged groups, while allergic and respiratory infectious diseases were reported more frequently in the privileged groups. The odds ratio for the association between TSP and history of allergic diseases was 1.17 (95% CI 0.95–1.45) in children without immigration background and 0.71 (95% CI 0.53–0.95) with immigration background. Heterogeneity for exposure–outcome associations was also seen between TSP and lung function as well as unfavourable living conditions and allergic diseases.

Conclusions: We found evidence for an influence of social position on environment–health associations. Possible explanations for heterogeneity include social group-specific over- and underreporting and effect measure modification, which need to be taken into account when designing and analysing environmental health studies.

Keywords: Environmental justice; Socioeconomic position; Air pollution; Epidemiology; Bias

*Corresponding author. Tel.: +49 201 723 4463; fax: +49 201 723 5933.
E-mail address: barbara.hoffmann@uk-essen.de (B. Hoffmann).

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Introduction

Social position is a determinant of health, with gradients for multiple health outcomes (Beckett et al., 1996; Mackenbach et al., 1997; Marmot, 2001; O'Neill et al., 2003). Low social position has also been found to be positively associated with numerous hazardous environmental exposures, including environmental risk factors concerning respiratory and allergic diseases like exposure to ambient and indoor air pollutants and allergens (Bolte et al., 2006; Bolte, 2006; Chaix et al., 2006; du Prel et al., 2005; Evans and Kantrowitz, 2002; Gunier et al., 2003; Lannerö et al., 2002).

Recent studies have focused on examining the associations between socioeconomic status (SES) and environmental health, hypothesising that groups of lower SES carry a disproportionate burden of environmentally related diseases (Bolte and Mielck, 2004; Evans and Kantrowitz, 2002; O'Neill et al., 2003). Studies examining the effect of air pollution on health have found higher effect sizes in low SES groups (Jerrett et al., 2004; Ponce et al., 2005; Pope, III et al., 2002). Several explanations might account for these differences: (1) higher and multiple hazardous exposures among socially disadvantaged groups cause an amplification of negative health effects and (2) biologic interaction between hazardous exposures and individual as well as contextual characteristics and behaviours lead to an increase in vulnerability (Bolte et al., 2005).

In contrast to the generally higher susceptibility of low SES groups, a lower prevalence of allergic diseases has been reported for socially disadvantaged children, even though the prevalence of environmental risk factors for allergic diseases is higher (Chaix et al., 2006; du Prel et al., 2006; Emanuel, 1988; Lannerö et al., 2002). However, severe asthma has been shown to be more prevalent in low SES groups (Heinrich et al., 1998). This raises questions regarding the validity of the results, often based on self-report, which show a positive association between high socioeconomic position and prevalence of respiratory or allergic disease in children in Germany (Heinrich et al., 1998). One possible explanation for this discrepancy may be reporting bias (Kuehni et al., 2006; Mackenbach et al., 1996). It has been hypothesised that a low parental social position is associated with a higher threshold for defining illness and that therefore self-reported morbidity might underestimate the true burden of disease in socially disadvantaged children (Mackenbach et al., 1996). Other investigators, however, did not find socioeconomic differences in responses to commonly used self-reported measures of chronic illness or found more over-reporting among lower socioeconomic groups (Heliövaara et al., 1993; Lindholm et al., 2002; Macintyre et al., 2005).

The distribution of environmental exposures and health outcomes across different social groups has been little examined in Germany. There is also a lack of knowledge concerning the effect of social position on environment–health associations. To partly fill this gap, we made use of data from a study originally designed to assess internal exposures and health effects in children living in small areas adjacent to intensive industrial activity (Krause et al., 2004; Sugiri et al., 2006).

The aim of this study was (1) to examine the associations between the different indicators of social position and environmental exposures as well as broad categories of health outcomes in children, and (2) to investigate how social position can influence environment–health relationships in an observational study.

Methods

We analysed data from a cross-sectional survey on 968 preschool children that was conducted in three highly industrialised districts in the Ruhr Area (Duisburg-Nord, Duisburg-Süd, Dortmund) and in one rural community (reference area: Borken) in North Rhine-Westphalia in 2000. Details of this study have been reported elsewhere (Krause et al., 2004; Wilhelm et al., 2007). It was approved by the local ethics committee. In short, children belonging to school districts within the study region were identified through statutory lists of residence and contacted by the local health authorities. In combination with the invitation to the mandatory preschool health exam, parents were asked to participate, gave informed consent and received a questionnaire. At the time of the health exam, the accompanying parent, usually the mother, turned in the questionnaire (German or Turkish, the latter being the most frequent language besides German in the study area). It included questions on socio-demographic characteristics (parents' schooling and professional education, nationality, employment), environmental exposures (environmental tobacco smoke (ETS), dampness and mold exposure at home, proximity of the residence to high traffic) and respiratory/allergic diseases. Household income was assessed in a separate questionnaire with low overall response. Additional medical examinations were performed, including face-to-face interviews for the assessment of the medical history, blood and urine sampling for bio-monitoring, and clinical examinations. The response proportion, calculated as recruitment efficacy proportion among children who attended the preschool exam, was 65%.

Definition of social position

We constructed indicators of individual level social position from the database, comprising vertical as well