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Social and environmental causes of allergies

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Abstract

This paper assesses the impact of social factors on the development of allergic diseases in early childhood. Epidemiological research has shown increasing allergy rates with improvements in social economic status (SES). However, we argue that the pattern of social influences on allergies is too coloured to be reduced to mere correlations between allergy and SES only. We would suggest rather explaining effects of SES on allergic diseases by mediating factors of the social and the physical environment. Hence, in our study we analyzed infants with *atopic dermatitis* as well as infants with symptoms of *wheezing* for the influence of SES and other socioeconomic variables. Further, we examined whether SES and socioeconomic variables interact with several risk factors of the social and physical environment. Our results indicate that associations between socioeconomic variables and allergies point to hidden influences of the social and physical environment, which must be revealed in order to understand the social causes of allergies. As we did so we could provide evidence that SES is not a causal risk factor for allergies, as is imprecisely suggested by many epidemiological studies. Indeed, correlations between SES and disease outcomes are a powerful measure to indicate social influences on health and illness. But they might only be a first step in a multi-factorial research approach, which assesses the various pathways through which social factor and human health interact.

Keywords

allergy, children, social inequality, socioeconomic status, social epidemiology

1 Introduction

Throughout the last decades, the prevalence of environmental diseases such as allergies, asthma and atopic dermatitis has been dramatically increasing world wide. For Germany, sensitization rates of up to 48.1% of the population were reported recently (Schaefer et al. 2005). Children are at special risk of being affected by allergies. Atopic dermatitis, for example, was detected in up to 13% of children between 9 and 11 years, in the late nineties in Germany (Mutius 1999). In modern industrialized countries allergic asthma is the most common chronic disease in childhood (Joseph et al. 2000), It has therefore even been labelled as an expression of a 'new pediatric morbidity' (Landrigan et al. 1994). Large national and international epidemiological studies are carried out to examine the reasons for the high, though currently stagnating (Anderson et al. 2004, Toelle et al. 2004), allergy prevalence. They provide evidence for fundamental changes in human lifestyle, changes in human living conditions and changing exposures to indoor and outdoor air pollution being important risk factors. Since it is well proven that both health-resources and health-risks are unequally distributed throughout societies (Antonovsky 1967, Black & Davidson 1992, Whitehead 1992, Mielck 1994, Montgomery et al. 1996, Hradil 1997, Kunst et al. 1998, Laubach et al. 2000, Mielck 2000) the impact of social factors is also examined in those studies. But the findings, however, are somewhat contradictory.

There are a handful of studies mentioning no association between asthma and SES at all, for instance (Cunningham et al. 1996, Strachan et al. 1996, Squillace et al., 1997). Mielck and colleagues (1996) have detected international studies that both found no associations and either positive or negative correlations between asthma and socioeconomic status (SES). However, through their own examinations they found that *severe* asthma is more prevalent among socially deprived children (ibid.). This is in line with other studies which observed a nearly doubled proportion of asthma among the lowest income quintile in the late 1980s, whereas the prevalence among the highest income quintile was stagnating at the same time period (Weiss et al. 1993). On the one hand these results are supported by others as well (Duran-Tauleria & Rona 1999, Garcia-Marcos et al. 1999, Litonjua et al. 1999, Shaheen et al. 1999). On the other, there is a study based upon German data holding that asthma is even more prevalent among parents with a *high* SES, whereas this is not valid for their children (Bergmann et al. 2000). Other studies that distinguish between symptoms and diagnoses have shown stable and significant correlations between low SES and asthmatic symptoms (wheezing, nightly cough, bronchial spasms) but not so for medical diagnoses (Mitchell et al. 1989, Ernst et al. 1995, Miller 2001).

Surprisingly, with respect to social distributions of *atopic eczema* and *allergic rhinitis* much of the epidemiological research has proven these diseases as being more prevalent among the higher SES-groups (Williams et al. 1994, Strachan et al. 1996, Butland et al. 1997, Harrison 1998, Garcia-Marcos et al. 1999, Knopf et al. 1999, Harris et al. 2001). This is contrary to the

overall pattern of health inequalities, which is 'rather rich and healthy than poor and ill'. Of course there are hypotheses regarding the reasons for this inconsistent interaction between social situation and disease expression. But, especially with respect to the 'black box' linking human social conditions and allergic diseases, there are as many questions still unanswered. Hence, in this paper we will present a thorough step-by-step analysis of the link between social factors and health.

The concept of socioeconomic status is eventually derived from medical sociology. Although it is appropriate to indicate social inequalities in health it is not adequate to explain why inequalities in health occur. SES should thus be regarded as an indicative measure but not as a risk factor itself. Moreover, we hold that the concept of SES – that means the combination of at least two measures of education, professional class, and income – must necessarily be lacking in the explanation of socially mediated allergy risks. First of all, any socioeconomic index-measure – such as 'high class' – tells nothing about which one of the involved singular indicators – be it high income, high educational level, or high professional class – is causal to the manifestation of disease. Second, the basic assumption of the SES-paradigm, holding that higher educational levels 'automatically' result in a higher professional class and therefore increase the personal or household income, is no longer valid at all. Sociological research has proven that, due to individualization, pluralization and the frailty of individual life courses, social inequalities in modern societies are not satisfactorily to be gathered using only the SES paradigm. What is required are alternative concepts of social inequality, such as approaches to lifestyle, habit, or setting (Elvers 2005, Hradil 1999). All the more, this holds for individual health effects of the social structure.

Hence, we argue that sociological methods and indicators are not successfully to be applied to the investigation of health and illness by simply computing statistical correlations of SES and disease. As we will demonstrate in this paper, the causal linkage of social factors to the development of allergic diseases is to be revealed stepwise. We suggest differentiating between indicators of socio-economic status (macro-scale social differentiation of disease), physical environment (significant exposure scenarios) and social environment (significant living conditions) which later are to be analyzed for their inter-relations as well as for their influence on the manifestations of allergies. This approach highlights that social living conditions as well as environmental influences are of the same significance for the development of health and disease. Moreover, we argue that both social and physical environments are mediating variables between SES and the prevalence of allergies. Hence, our main hypothesis is that correlations between social variables and allergic diseases are due to living conditions which both affect allergic manifestations and depend on social differentiation as well.

2 Methods

The following calculations were realized using data from the German longitudinal cohort-study 'Influence of Lifestyle and Behavior on the Development of Allergic Diseases' (LISA-study). For the LISA-study 3.097 newborns of the year 1998 were recruited in birth centres of the cities Munich and Leipzig as well as in the Rhineland in order to assess parameters of health development on the one hand and various influencing factors of the close environment on the other. No child was included into the study without written consent of the parents guaranteeing voluntary participation. The study was approved by the Ethic Committees of the University of Leipzig and the Bavarian Medical Association (Borte et al. 2001).

Allergic diseases considered were atopic eczema, food intolerance, urticaria, allergic rhinitis, wheezing, obstructive bronchitis, and asthma. Frequencies were both obtained by parent-reported medical diagnoses as well as by asking for symptoms of allergic diseases in the questionnaires. While diagnoses were obtained by asking the question: 'Did a medic diagnose one of the following diseases during the past … months?' the respective symptoms were obtained by environmental medical questions that later were combined into distinct variables by experts.

The socioeconomic status of the children was indicated by combining the respective levels of educational and occupational degree of the parent with the highest degree. The resulting scores were then transformed into an SES-index with four categories – low, middle, high, very high (see Joeckel et al. 1998) – according to scientific advice given by the 'German Working Group for Methodology in the Epidemiologic Sciences' (Ahrens et al. 1998). No data were available for the occupation itself (whether one is jobless or not), and for the occupational class (whether one works according to his/her degree, above, or below, respectively). In order to guarantee a satisfactory number of cases for further sub-group analyses we focused on the four most common allergic diseases among the children (wheezing, symptoms of atopic dermatitis, diagnoses of atopic dermatitis, and diagnoses of obstructive bronchitis) in our analysis. All included variables were coded binary for purposes of logistic regressions.

We have been focusing on questionnaire-data from the first two years of life of the Leipzig birth cohort, albeit the birth cohorts have been followed up for 6 years now (N=976).

All calculations were computed by STATISTICA 6.0, StatSoft® Inc., Tulsa, USA.

3 Results

3.1 SES and allergy prevalence

The lifetime prevalence of the considered allergies is shown in table 1. Aside from wheezing – which is not an allergic picture but rather an asthmatic symptom – the results reflect the

common pattern of frequency peaks of atopic dermatitis in early childhood (Statistisches Bundesamt 2000).

Table 1: Lifetime-prevalence of allergies in the first 2 years of age

diseases	**prevalence**
wheezing – symptoms	21% (201/976)
atopic dermatitis – symptoms	18% (179/976)
atopic dermatitis – diagnoses	16% (152/976)
obstructive bronchitis – symptoms	12% (115/976)
food intolerance – symptoms	9% (91/976)
food intolerance – diagnoses	7% (70/976)
urticaria – symptoms	6% (55/976)
allergic rhinitis – symptoms	3% (32/976)
urticaria – diagnoses	3% (29/976)
rhinitis – diagnoses	1% (11/976)
asthma – diagnoses	0,3% (3/976)

As described above, we selected the four most common diseases. In order to assess whether there is any kind of social variability, correlations between several singular socio-economic indicators as well as the SES-index with these four allergic diseases were computed in a first step (see table 2). Significant results ($p \leq .05$) are tagged in the table.

With respect to the SES-index the only significant result could be found for wheezing, by which children out of the low and middle SES group are more frequently affected. Weak tendencies towards more prevalent diagnoses and symptoms of atopic dermatitis were obtained for the children out of the high and very high SES groups, although these were not significant. According to obstructive bronchitis, no variability of the frequency by SES could be found.

With respect to either educational or occupational degree of mother or father, respectively, the allergy prevalence varies only with mother's degree. Whereas wheezing is more common in children from the lower educated mothers, dermatitis is more prevalent among children from higher educated ones. With respect to diagnoses for atopic dermatitis, mother's occupational degree seems to better discriminate than her educational degree. Again, no correlation could be detected for obstructive bronchitis.

Although correlations between allergic diseases and income were only weak, they nevertheless underline the results regarding the other SES variables. Hence, wheezing is more frequent in children of rather poor families, whereas atopic dermatitis is more frequent in children of better-situated families.

Table 2: Allergic diseases within the first 2 years of life and social indicators[1]

	wheezing $_S$	**dermatitis** $_S$	**dermatitis** $_D$	**bronchitis** $_S$
SES +	**24%** (114/480)	26% (121/468)	22% (108/494)	16% (76/491)
SES –	**32%** (82/258) *	24% (57/235)	18% (43/243)	15% (36/245)
Educational degree $_M$ +	**23%** (69/305)	26% (77/302)	22% (69/314)	16% (50/310)
Educational degree $_M$ –	**30%** (128/432) *	25% (100/400)	19% (81/422)	15% (62/425)
Occupational degree $_M$ +	***22%*** (76/342)	27% (91/338)	**24%** (84/351)	15% (54/351)
Occupational degree $_M$ –	***28%*** (96/343) *	23% (73/318)	**17%** (56/336) *	15% (49/336)
Educational degree $_F$ +	26% (80/307)	28% (83/301)	21% (66/316)	17% (53/313)
Educational degree $_F$ –	25% (93/377)	24% (85/348)	21% (75/364)	14% (527368)
Occupational degree $_F$ +	23% (72/313)	25% (79/313)	20% (66/324)	15% (50/324)
Occupational degree $_F$ –	26% (90/345)	25% (79/312)	20% (66/330)	15% (48/332)
Household-net-income +	23% (59/253)	25% (64/255)	22% (57/263)	16% (41/260)
Household-net-income –	26% (87/340)	26% (80/314)	19% (65/337)	13% (42/337)

$_S$: symptoms; $_D$: diagnoses | $_M$: mother; $_F$: Father | **+**: high; – :low | *: p≤0.05; (*): p<0.1

[1]The variables were coded as follows: *high SES*: categories "very high" and "high" of the SES-index variable; *low SES:* categories "low" and "middle" of the SES-index variable – *high educational degree:* 12th grade (baccalaureate, advanced technical college entrance qualification); *low educational degree:* no degree up to 10th grade (O-level) – *high occupational degree:* technical college-, advanced technical college-, or university-degree; *low occupational degree:* skilled (non) manual degree, other – *above-average household-income:* income above 95%-CI of the mean value (>765€); *below-average household-income:* income below 95%-CI of the mean value (<721€).

Resuming these first results, we have to stress selective social indicators – be it educational degree, occupational degree, or even income – to be closer to various allergic diseases than the SES-index is.

3.2 Environmental influences on allergies

Our main hypothesis was that possibly hidden correlations between SES and certain significant environmental conditions could explain varying allergy rates with SES. Hence, we continued our analyses by looking for environmental influences on allergies in childhood, adopting our proposed distinction between physical and social environment.

First, we tested nearly 30 variables out of various questionnaires, which were completed during the first two years of life, for their correlation with the selected allergic diseases. These variables covered both physical (outdoor and indoor exposure), and social environment (family characteristics, demographic variables). Most associations were obtained for medical diagnoses of atopic dermatitis and for symptoms of wheezing. Consequently, we chose these two as the dependent variables for further analyses. Out of the pool of nearly 30 variables which were correlated with these allergic diseases, we chose the significant ones as the

independent variables. The resulting correlations between the independent variables and the two allergic manifestations are given in table 3.

Table 3: Correlations between allergies and possible independent variables

Independent variables	**Atopic Dermatitis: YES**		**Wheezing: YES**	
	"yes"	***"no"***	***"yes"***	***"no"***
Are the parents (one or both) affected by allergies themselves?	**26%** (85/330)	**16%** ** (67/418)	30% (96/326)	25% (105/423)
Was the mother a single parent at birth?	21% (138/673)	18% (13/72)	**44%** (32/73)	**25%** *** (168/673)
Was the pregnancy welcomed?	20% (134/671)	25% (18/72)	**26%** (171/667)	**37%** * (28/76)
Was the child in day care at nursery from the 7th month of living on?	24% (21/87)	20% (123/626)	**44%** (38/86)	**24%** *** (148/625)
Was the mother exposed to tobacco smoke during pregnancy?	23% (49/212)	20% (100/501)	**34%** (73/218)	**23%** ** (116/498)
Was the dwelling intensely renovated during pregnancy?	**28%** (39/140)	**18%** * (105/572)	30% (41/139)	26% (146/571)
Are there regular traffic jams in front of the house?	20% (20/101)	20% (130/641)	***34%*** (33/97)	***25%*** (*) (161/643)
Is there a point source of perceptible air pollution near the house?	16% (11/68)	21% (138/669)	**43%** (29/68)	**25%** ** (164/668)

Reading guide: 26% of the children from allergic parents (that is "*Yes"* in column 2, row 3) are affected by atopic dermatitis, whereas 16% of the children from parents without any allergy (that is "*No"* in column 3, row 3) are affected by atopic dermatitis. In general: First choose the dependent variables, than choose which independent variable you want to observe, and than choose the type of exposure ("*Yes"* or "*No"*).

(*) $p \leq 0.1$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

As the table indicates, children are much more likely to be affected by atopic dermatitis when one or both of their parents are allergic themselves (hereditary aspect). However, the proportion of affected children *without* having allergic parents was remarkable high (16%). As this is attributed to the strong impact of factors other than hereditary ones, it stresses the high relevance of the environment on the development of allergic diseases in childhood.

Additionally, we observed a higher proportion of wheezing in children whose mothers were single parents at the time of birth, as well as for children whose mothers declared their pregnancy as 'not welcomed'. Surprisingly, the strongest association with wheezing was obtained for children who were at day care in nursery schools from their 7th month of living on. This is to be discussed later.

We observed different significant influences regarding the two allergic diseases with respect to indicators of indoor exposure. Wheezing, on the one hand, was substantially enhanced if

the mother was exposed to tobacco smoke during pregnancy. This effect is already well proven (Cook & Strachan 1997, Gergen et al. 1998, Lux et al. 2000). Atopic dermatitis, on the other hand, was more frequent when an intensive restoration of the flat during pregnancy was carried out. This is supported by other works as well (Herbarth et al. 1998, Diez et al. 2000, Herbarth 2003).

Regarding indicators of outdoor exposure, there were only few associations with respect to wheezing. The frequencies were increased when families have lived close to an industrial spot with perceptible air pollution – this might even be a gas station. Also, living in a house with regular traffic jams in front of it was associated with a higher wheezing prevalence. Such zones with traffic jams might be roads with high traffic density, intersections, or highly frequented gateways either.

These results support our first findings regarding the associations between SES and allergies (table 2), insofar as both – the prevalence of atopic dermatitis and wheezing – are associated with different influences of social factors. Moreover, exposure to ambient air pollution – indoors and outdoors – varies between the two allergic diseases as well. Now, in order to explain the correlation between SES and the prevalence of allergic diseases (table 2), the analyses were continued by examining the correlation between SES measures and these indicators of the social and physical environment.

3.3 Environmental factors and SES-index

In order to prove whether the presented different environmental influences might mediate the relationship between SES and the allergic diseases, we correlated the SES-index with the environmental variables (see table 4). Hereby, we tried to verify our initial indications for the explanation of the varying prevalence of allergies in the various SES groups, which later were to be proven by multivariate analyses (see section below).

As expected, the frequency of allergic parents significantly differs between the SES groups. Among the highly educated parents, 10% more are affected by allergies as compared to the lowest SES group. On the other hand both the factors ‘single parent’ and ‘pregnancy not welcomed’ are more frequent within the lower SES groups, and the proportion is declining steadily by declining social status. Additionally, they are correlated: about 39% of the lone living mothers declared their pregnancy as ‘not welcomed’, compared to only 7% of the mothers who have lived in a partnership ($p<0.001$). Hence, the prevalence of wheezing according to these social factors corresponds to the prevalence of wheezing according to SES.

Table 4: SES-index and environmental variables

Dependent variables	**SES-index**			
	"low"	***"middle"***	***"high"***	***"very high"***
The parents (one or both) are affected by allergies themselves. ***	**35%** (25/71)	**33%** (102/309)	**46%** (87/191)	**47%** (180/384)
The mother was a single parent at birth. ***	**30%** (21/71)	**13%** (39/309)	**11%** (21/190)	**6%** (23/384)
The pregnancy was not welcomed. ***	**28%** (19/68)	**14%** (43/307)	**15%** (28/191)	**9%** (30/382)
The child was in day care at nursery from the 7th month of living on. ***	**8%** (3/40)	**6%** (13/230)	**16%** (26/162)	**15%** (52/340)
The mother was exposed to tobacco smoke during pregnancy. ***	**67%** (42/63)	**52%** (151/288)	**29%** (55/187)	**20%** (73/375)
The dwelling was intensely renovated during pregnancy.	21% (10/48)	19% (49/260)	22% (39/176)	19% (68/356)
There are regular traffic jams in front of the house. ***	**33%** (17/51)	**17%** (45/271)	**13%** (23/184)	**9%** (35/371)
There is a point source of perceptible air pollution near the house.	18% (9/50)	10% (27/268)	10% (19/185)	8% (30/371)

*** $p<0.001$

Otherwise, the proportions of children who were at day care in a nursery from the 7th month of living on make up a contradictory pattern. Children out of the lower SES-groups were less frequently at day care in nurseries (table 4) than those of the higher SES, albeit wheezing was found to be related to lower SES (table 2), and the early day care at nurseries was strongly related to the development of wheezing (see table 3). Hence, other influences than an early day care at a nursery must be causative for the higher amount of wheezing among children of the lower SES groups.

Exposure to environmental and/or tobacco smoke, industry, traffic, or indoor air pollution, respectively certainly is one of these factors. Mainly children from lower social groups are exposed to tobacco smoke, or high outdoor pollution due to high traffic density near the house. Emissions from point sources of air pollution (manufactures, petrol stations, etc.) are a bit more common in residential areas of the rather poor as well, although this correlation is not significant (table 4). Since these three factors are strongly related to wheezing, it can be assumed that the higher wheezing prevalence among children from the less privileged families might be attributed to them.

Further on it was analyzed whether the frequency of an intensive renovation of the dwelling varies with SES, but there was no noteworthy variability. This is in line with the lacking variability of atopic dermatitis with respect to social status. The only association of atopic dermatitis with social differentiation was found in the occupational degree of the mother.

Hence, the latter one was checked for associations with intensive restorations (results not shown), but results did show no remarkable variability between mother's occupational degree and the frequency of intensive restorations during pregnancy.

Recapitulating the results up to this point, we found some associations between SES and allergies that obviously are caused by several factors of the social or physical environment. In order to verify these assumptions and to elaborate upon the causal factors, for both wheezing and atopic dermatitis we calculated multiple logistic regression models.

3.4 SES, environment and allergy-prevalence

Wheezing

The causal influences on wheezing were elaborated stepwise. Table 5 presents the main steps by which the final results were deduced. This is mainly to demonstrate how singular factors which seem to be significant at a first glance can loose their influence when others are added. Hence, although multivariate analyses are useful to elucidate causal influences while excluding auto correlation, it is always the hypotheses of the researcher which eventually determine the outcomes to be gained.

In order to analyze which of the different SES indicators are strongest related to wheezing, we included the educational degree of the mother, her occupational degree, and the SES-index into the initial model. Since these indicators were correlated, none of them had an outstanding effect. In order to find out the factor with the strongest singular association to wheezing, each was then proven in single calculations. Although all of them were modestly associated to wheezing, we chose the SES index to remain within the calculations, since its Odds Ratio was the most significant (p=0.01) (table 5, model *I*).

Besides the SES variables, there were some other associations with the social and physical environment with respect to wheezing (see table 3). Regarding the social environment these were mother's single-parenthood and her statement that the pregnancy was not welcomed. Concerning the physical environment we found tobacco exposure, traffic jams on a regular basis and living near a point source of air pollution being important risk factors. It is not easy to determine whether the early day care at a nursery is a factor of the social or the physical environment. However, in this particular case, we decided to attribute it to the social environment since there must be considerable social reasons for leaving a new-born in a nursery from the seventh month on.

In order to examine how far the influence of high SES could be explained by the social environment, both SES and social environment-variables were calculated by an exceeded model (table 5, model *II*). Herein the effect of SES remained stable after adjustment for the other three factors. The social environmental factors 'single parent' and 'day care at nursery' remained significant too. Only the fact that the pregnancy was not welcomed had no independent effect any more.

To what extent the effect of SES could be explained by the physical environment was analyzed in a third step (table 5, model *III*). We found the strongest independent effect on the manifestation of wheezing in a 'point source of (industrial) air pollution', and SES was not significant any more in this case. Moreover, tobacco exposure and traffic jams on a regular basis had no significant independent effects any more as well, but did show *tendencies* towards disease expression at least.

Table 5: Logistic regression models, *dependent variable:* wheezing

Independent Variables	**Odds Ratios and 95%- confidence intervals**			
	model I	***model II***	***model III***	***model IV***
Constant	**0.5** *** [0.4-0.6]	**0.3** *** [0.1-0.5]	**0.3** *** [0.2-0.5]	**0.3** *** [0.2-0.4]
High and very high SES	**0.7** * [0.5-0.9]	**0.7** * [0.5-1.0]	0.8 [0.6-1.2]	***0.7*** (*) [0.5-1.0]
Pregnancy not welcomed	/	1.3 [0.7-2.3]	/	/
Mother is single parent at birth	/	**1.9** * [1.1-3.4]	/	**1.9** * [1.1-3.2]
Day care at nursery from the 7th month of living on	/	**2.8** *** [1.7-4.6]	**/**	**2.8** *** [1.7-4.6]
Point source of air pollution near the house	/	/	**2.2** ** [1.3-3.8]	**2.2** ** [1.3-3.8]
Tobacco exposure of mother during pregnancy	/	/	1.3 [0.9-2.0]	/
Regular traffic jams in front of the house	/	/	1.3 [0.8-2.1]	/
p	*p<0.05*	*p<0.01*	*p<0.001*	*p<0.0001*

(*) p≤0.1; * p<0.05; ** p<0.01; *** p<0.001

Finally, in order to asses all influences SES, physical, and social factors were finally put together (table 5, model *IV*). Single-parenthood remained an independent social risk factor, and was even stronger than SES. This is noteworthy, especially under consideration of the stable effects of both day care at a nursery and industrial air pollution, which was indicated by a point source of air pollution near the house. The impact of the SES-index in the last model was weak (p<0.1), but under consideration of the other factors noteworthy at least.

Resuming these calculations, we assume that the variability of wheezing due to social status is partly explained by a single-parenthood of the mother, living near a point source of air pollution, and an early day care at a nursery. Except for the latter one, all other factors were more frequent in the lower SES groups. But irrespective of that, there remains a weak causal

association between low SES and wheezing which is explained neither by the social nor physical environment.

Atopic dermatitis

For atopic dermatitis the calculations were transformed stepwise as well, as was done with wheezing, and table 6 shows the respective results.

With respect to the development of atopic dermatitis in the first two years of life only few independent effects were found (see table 3). The only significant indicator of social status was the occupational degree of the mother. Out of the variables of the physical environment, a noteworthy effect was only obtained regarding an intensive renovation during pregnancy. Additionally, we found dermatitis in children being more likely if one or both of the parents were allergic themselves. Beyond that, no further impact of the social or physical environment was detected.

Table 6: Logistic regression models, dependent variable: atopic dermatitis

Independent Variables	**Odds Ratios and 95%- confidence intervals**			
	model I	***model II***	***model III***	***model IV***
Constant	**0.2** *** [0.1-0.3]	**0.2** *** [0.1-0.2]	**0.2** *** [0.1-0.2]	**0.1** *** [0.1-0.2]
High occupational degree of mother[1]	**1.6** * [1.1-2.3]	**1.5** * [1.0-2.2]	**1.6** * [1.1-2.4]	**1.6** * [1.1-2.3]
Parents are affected by allergies	/	**1.6** * [1.1-2.4]	/	**1.7** ** [1.1-2.5]
Intense restoration during pregnancy	/	/	**1.7** * [1.1-2.6]	**1.6** * [1.0-2.5]
p	*p<0.05*	*p<0.01*	*p<0.01*	*P<0.001*

(*) p≤0,1; * p<0,05; ** p<0,01; *** p<0,001

[1] technical college-, advanced technical college-, or university-degree

Hence, occupational degree of the mother was the only indicator of social status to be included into the initial model (see table 6). Children from mothers with highly qualified occupational degrees are 1,6 times more likely to be affected by atopic dermatitis, when compared with children of mothers with rather manual occupational degrees (table 6, model *I*).

Into a second model we added the variable ‘allergic affection of the parents’ (see table 3), in order to examine whether the prevalence of atopic dermatitis in children according to the occupational degrees of their parents could be explained by differences in the prevalence of parents’ allergic affection according to SES (as shown in table 4). But since in this case the

SES should have been the significant social status variable and *not* the occupational degree of the mother in model *I,* the odds ratio of the latter one did not change considerably after adjustment for parents' allergies. Thus, the occupational degree of the mother had an independent effect on the development of atopic dermatitis, irrespective of parent's allergic affection (see table 6, model *II*).

In model *III* only the effects of environmental factors were to be compared – these were the intensive renovation of the dwelling during pregnancy, and a high occupational degree. We did not expect the intensive renovation to reduce the effect of occupational degree, since was not associated with SES at all (see table 4). As expected, both of them remained significant after adjustment and had a stable, though modest impact on atopic dermatitis in children in the first two years of life (see table 6, model *III*).

Finally, all significant variables were put together into the last model. It indicates that the genetic aspect is indeed the strongest predicting variable, but environmental factors have almost the same relevance on the manifestation of atopic dermatitis (table 6, model *IV*). Comparing these results with wheezing, there were fewer significant influences, albeit at least all of them remained stable in the multivariate analysis.

4 Conclusion

Altogether, it is not recommended to compare the prevalence rates shown in this work with other results regarding allergy prevalence in Germany or even throughout the world. First, it is well proven that allergies for a long time have been more frequent in Western than in Eastern Germany (Mutius et al. 1994, Nowak et al. 1996, Mutius, 1999, Hermann-Kunz, 1999), although the rates have been adjusting in the past years. Second, the LISA-study is representative for neither the Eastern nor Western German standard population. But, since the objective of the study was to examine risk factors and to observe changing patterns during the lifetime, relative frequencies and proportions were to be focused on, and representativeness of data was not compulsory.

However, the presented analysis was carried out to question the association between SES and the prevalence of allergies by means of longitudinal data of an East German urban birth cohort. We found results therein which distinguish our analysis from numerous other empirical studies with a focus on social influences on the development of allergic diseases.

This particularly applies to the fact that the prevalence of *atopic dermatitis* was not related to SES – at least not in children within their first two years of living. Moreover, even influences of household-net-income have not been detected. We hence assume that atopic dermatitis is related to social differences in lifestyles and habits rather than to economic conditions, as is the case for many other diseases. In fact, it is characterized through certain living conditions that perhaps might be related to social status, but may not necessarily be considered as

vertical inequalities in terms of 'class' or SES either. Moreover, regarding atopic dermatitis it might even be reasonable to completely leave the paradigm of vertical social stratification behind, and rather focus on horizontal social differences, better characterized as 'living circumstances' (in German: *'Lebenslage'*). The occupational degree of the mother could point to some extent to these factors in terms of constraints that are subject to the actual occupational state of parents. This conclusion is also supported by the finding that atopic dermatitis in children is more closely related to the occupational degree of the mother than to her educational degree. Although we could not examine the actual occupational situation, we therefore argue that with respect to the development of allergies in childhood *present* and *changeable* conditions of family life (as the occupational state is) are of greater relevance than *early* acquired and mainly *non-changeable* educational degrees of the parents.

Generally, although atopic dermatitis is a type of allergy that often occurs more frequently in the upper social strata, any simple classification of atopic dermatitis according to either social top or bottom is not recommended. The only risk factor which was acquired with respect to atopic dermatitis – aside from a high occupational degree and the allergic affection of the parents – was that the dwelling had been intensely renovated during pregnancy, which was not associated with SES at all. Surprisingly, aspects of renovation truly depend on social characteristics (Elvers et al. 2004). Families with a newborn child are more likely to move and therefore do basic things like renewing carpets or hanging and painting wallpaper. Among those, mainly economically privileged families with somewhat older parents and at least one child are more likely to buy new furniture. Following these differing priorities, the quantity and quality of possibly emitted chemicals may vary. Hence, the risk for the child to acquire a specific type of allergy may vary too, according to the type of renovation carried out.

Unlike atopic dermatitis, the prevalence of *wheezing* is characterized by patterns of typical diseases of the disadvantaged. With one exception, all risk factors were characteristic for the living situation of families with lower SES. It has been well proven that exposure to environmental health hazards is higher and more frequent among the disadvantaged than among the better off. In the U.S. these results have partly been referred to as the 'environmental injustice' discourse for a couple of years now (Szasz 1993, Bullard 1993, 2000, Maschewsky 2001, Pellow 2002). The early day care of children at a nursery is the only exception of this pattern, as it is practiced especially by highly educated mothers. The fact that a day care at a nursery has had *stronger* effects on wheezing than the SES seems also to contradict the results of a higher wheezing prevalence among the disadvantaged. Indeed, the SES is an indicator, whereas the first one is nearly a causal factor. Given this background, the strong impact of day care at a nursery has to be seen as evidence for the higher relevance of the immediate context of living, compared to the parents' SES for children's health related development.

It might be argued that the high influence of a regular day care at nursery on wheezing could indicate a lower risk of allergies in later life due to early infections, referring to the so called 'hygiene hypothesis'. But reading the hygiene hypothesis right, rather *gastrointestinal* instead of *respiratory* infections should suppress allergy manifestations in later life (Strachan 1989, 2000). Anyway, the children with wheezing are in fact to be considered as *children under risk* of getting affected by asthma in their later life, since wheezing is regarded an asthmatic symptom rather than a respiratory infect.

Altogether, these results make clear that social influences on the development of allergic diseases are no longer to be tackled with the SES-paradigm only, but rather require more detailed sociological research. Both atopic dermatitis and wheezing are diseases which refer to different significant environmental factors in early childhood, be it the physical or social environment. With respect to these diseases our work has provided evidence for both vertical and horizontal social inequalities playing an important role in the pathogenesis. However, as these results are derived from a German population they are not to be generalized to other nations. They reflect the lifestyles of a rather wealthy, highly developed country, where income inequality is below the global average. Hence, in the first instance this analysis might serve as a methodological assistance in order to successful uncover the interactions between medical and social risk factors of environmental diseases.

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