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Incidence of Episodes of Wheezy Bronchitis in Children living near the Iron and Steel Factory from Cãlãrasi

by

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Abstract

Background: *During daily clinical work as a GP in Cãlãrasi, Rumania, a large number of wheezing cases was observed in children living in the vicinity of a large Iron, Steel and Coke factory. In children under 10 years old who are living in this area with heavy industrial pollution, incidence of episodes of wheezing was found to be much higher compared to other regions in Romania.*

Objective: *To investigate the incidence of episodes of wheezing in children. To assess the relation of occurrence of episodes of wheezing with the distance to the factory, smoking habits of the parents, a family history of allergy and the presence of mouldiness in the houses.*

Methods: *Retrospective cohort study including 1500 children under ten years old living in this area. The area was stratified in three zones, according to the distance from the factory gate, each zone having a length of about 1 kilometre. All children were followed during a period of 5 years (1993-1997).*

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Results: *The percentage of children with at least one episode of wheezing was 41.3%, in zone I (nearest to the factory), 47.3% in zone II, and 42.1% in zone III (at the largest distance). From 656 children with wheezing, 13% in zone I, 18.8% in zone II, and 15% in zone III had more than two attacks in this period.*

Of 1461 children the other risk factors were studied as well. The relative risk of wheezing in children with smoking parents was 1.52 (95%CI = 1.35-1.70), with mouldiness in the houses 1.41 (95%CI = 1.25-1.60) and with a family history of allergy 1.08 (95%CI = 0.86-1.35).

Conclusions: *The high incidence of episodes of wheezing in children does not drop within a distance of three kilometres (1.875 miles) from the factory, that is a known main source of pollution. Smoking parents and mouldiness in the houses were additional risk factors.*

Introduction

In Romania the health system in primary care is organised in territories with one dispensary in each of them.

In 1985 one of us (A.C.) started working in Cãlãrasi in a dispensary caring for people living near the local Iron, Steel and Coke Factory. The neighbourhood begins at the gate of the factory without any protection area. The main emitted pollutants of ferrous metallurgy are SO_2, CO, NO_2, and suspended particles. In coke production the main polluants are: ammonia, phenol, hydrogen sulphide and suspended particles. According to a recent PHARE report, the average concentration in 24 hours often exceeded permissible values in twenty Romanian cities and Calarasi is on the tenth place among them (1). Monthly levels of the air concentrations of SO_2, phenol and H_2S have been published for 10 months (not in July and August) in 1995 and for all months in 1996 and 1997. They averaged 0.865, 0.381 and 0.364 mg/m^3 respectively. The highest monthly levels during this period were 4.2, 0.68 and 2.28 mg/m^3. The climate in Cãlãrasi is harsher than in other parts of the country with big differences of temperatures (from +40°C in summer to –20°C in winter) and strong winds all the year, mostly directed from the factory towards the town.

Over the years a high incidence of wheezing was observed in children living in this area, requiring long and expensive treatment. So, we examined if the distance between the house and the factory is related to the incidence of episodes of wheezing in children in this area.

Therefore a retrospective cohort study over a period of five years (1993-1997) was designed including all children born since 1987, stratified in three groups according to the distance between their houses and the factory.

We also included other risk factors: smoking habits of the parents, mouldiness and a family history of allergy. These risk factors are known to be related to respiratory symptoms. The incidence of asthma and wheezy bronchitis is strongly associated with the presence of atopic diseases (2). The excess incidence of wheezing in smoking households appears to be non-atopic wheezy bronchitis with a relatively benign prognosis, but among children with established asthma, parental smoking is associated with more severe disease (3). Because of the effect of mould cell wall component, exposure to mould during childhood may be a significant etiologic factor in allergic respiratory diseases in general (4).

Methods

Design

A retrospective cohort study over a period of five years (1993-1997) was designed including all children born between 1 January 1987 and 1 January 1997, stratified in three groups according to the distance between the house where they lived and the factory. The incidence of wheezing was related to this distance, used as a proxy for the factory-related air pollution, also taking into account other risk factors: smoking habits of parents, the presence of mouldiness in the houses, and the presence of a family history of allergy.

Patients

Exactly 1500 children were born between 1987 and 1997 and live in the Cãlãrasi region. The area was stratified in three zones having a radius of 1 kilometre (0.625 miles) each. Within the first zone and part of the second, there are small sized houses with little gardens and some trees. They are heated by fires, made by wood and coal. In the remaining part of the second and the whole of the third zone, there are new blocks of flats with some young trees, but no gardens. They have district heating and electric radiators. For cooking all inhabitants use gas stoves. Traffic density is low and similar throughout the research area and therefore cannot influence any differences between the zones. During the registration period, there were no major outbreaks of influenza. There were other regions within the country, however, where this was the case.

Disease definition

We studied the incidence of wheezing as seen in cases of wheezy bronchitis, asthma and broncheolitis. Wheezing as a symptom and the presence of sibilants were the criteria to select patients. Only those who

were seen with wheezing by a doctor were selected, we did not use data from history taking.

Data collection basic

In Romania every consultation is registered in a book-file and in the patient's file. Those data were used for this study. For all children each episode of wheezing, parent smoking habits and family history of allergy were copied from the family doctor's files. The presence of mouldiness in the house was registered using a questionnaire.

Statistical Analysis

For each territorial zone, the proportion of children with at least one episode of wheezing was identified. Separately, in each group also the percentages of children with at least two episodes of wheezing were calculated. The statistical significance of differences between the groups were tested using chi^2-tests. The relation between each of the other risk factors that were examined and the incidence of episodes of wheezing was examined by calculating relative risks (R.R.). For all measures 95% confidence intervals (95%CI) were calculated. Epi-info 6.04 was used for the statistical analyses.

The independent relation between the territorial zones and the incidence of at least one or two attacks of wheezing was multivariably examined by using logistic regression analysis. Co-variables that ware included in the model were smoking of the parents, a family history of allergy and the presence of mould on the walls. SPSS was used for the analyses.

Results

Data with respect to the addresses and number of episodes of wheezing were available for all 1500 children. Data with respect to the

TABLE 1:
Occurrence of episodes of wheezing in children according to the distance from the factory (N = 1500)

Zone	Total N of children	At least of one episode of wheezing		
		Number	Percentage (95% CI)	Adj. OR* (95% CI)
I (0-1 km)	407	168	41.3% (36.5-46.2)	0.94 (0.72-1.22)
II (1-2 km)	523	248	47.4% (43.0-51.8)	1.22 (0.96-1.56)
III (2-3 km)	570	240	42.1% (38.0-46.3)	1.0

* Adjusted for smoking of the parents, mouldiness in the house and a family history of allergy.

other risk factors that were examined were collected from 1463 (98%) children.

Crude data analysis:

In zone I, out of 407 children 41.3% had at least one episode of wheezing in a five-year period, in zone II, 47.4% out of 523 children and in zone III, 42.1% out of 570 children (Table 1). The relative risks of episodes of wheezing for living in zone II or III compared to living in zone I were 1.15 (95% C.I. = 0.99-1.33) and 1.02 (95%C.I. = 0.88-1.19) respectively.

In zone I, 25% of the children with wheezing had two or more attacks, in zone II 34% and in zone III 33% (Table 2).

The relative risk for having at least one episode of wheezing for children with smoking habits of parents, compared to children with non-smoking parents is 1.52 (95%CI = 1.35-1.71). For children exposed to mouldiness the relative risk of having wheezing, compared with the children living in houses without mouldiness is 1.41 (95% CI = 1.25-1.60), and for a family history of allergy compared to those without the relative risk for wheezing is 1.08 (95% BI = 0.86-1.35). Wheezing was more frequent in summer than in winter.

TABLE 2:
Occurrence of at least two episodes within a five-year period in children with wheezing according to the distance from the factory (N=656)

Zone	Total N of children	N of children with two and more attacks	Adj. OR* (95% CI)
I	407	48	0.71 (0.48±1.05)
II	523	89	1.22 (0.87±1.71)
III	570	80	1.0

* Adjusted for smoking of the parents, mouldiness in the house and a family history of allergy.

Multivariate analysis:

There was no significant independent relation between the territorial zone and the presence of at least one or at least two attacks of wheezing (table 2 + 3). The odds ratios of at least one attack of wheezing, adjusted for smoking of the parents, mould in the house and a family history of allergy, were 0.63 and 0.11 for zone I and II compared to zone III. For at least 2 attacks these odds ratios were 0.71 and 1.22.

Discussion

In this study a five-year incidence rate of 43.7% of at least one episode of wheezing was found in children under ten years old. This is a very high rate. In a similar study in 1994-1998 in a rural village (Roseti) in the same region of Romania, but far from all air pollution, a two-year incidence of 1.9% of at least one attack of wheezing was found in children during the first two years of their life. For the whole of Romania the all-age yearly incidence of bronchitis is 1.4% (5). Asthma affects 10% of all children in the USA. The prevalence of asthma increased by 29% from 1980-1987 (6). The presence of wheezing in early childhood asks for special attention. All wheezy children should be carefully examined to exclude 'false asthma' and identify 'true asthma' (7). The prevalence of allergic disease tends to be higher in industrialised countries than in rural areas (8). In Israel an increase of asthma has been reported in polluted areas compared with non-polluted areas. Sulpha dioxide (SO_2) has been identified to cause broncho-constriction and asthma-like symptoms even at low levels of chemical exposure (9). In a population of children respiratory morbidity, especially bronchitis, was correlated with high levels of SO_2 pollution (10). An increase of small particle-pollution has been shown to be associated with an increased number of people hospitalised for asthma and bronchitis (11). Chronic exposure to an increased level of respirable particles, SO_2, NO_2 is associated with an increase in non-specific respiratory symptoms such as chronic cough but not with asthma (12). Exposure to suspended particles and SO_2 resulted in a significant increase of hospital admissions (13) and GPs' consultations (14, 15). Our children are exposed to SO_2, H_2S, phenol and small particles of industrial dust. Average concentrations of SO_2, H_2S, phenol and dust have been measured in 1995, 1996 and 1997 and were frequently found to be above the permitted limits, both according to Romanian and to WHO criteria.

Although it was not the objective of this study to examine this relation (no proper control group was available), it therefore is reasonable to expect the high level of wheezing in the region to be related to this industrial pollution.

In this group of children that are exposed to industrial pollution, risk factors such as smoking habits of parents (R.R = 1.52), the presence of mouldiness in the houses (R.R. = 1.41), and a family history of allergy (R.R. = 1.08) were all related to an increased incidence of episodes of wheezing during bivariate analysis. Smoking and mould remained significant during multivariate analysis. These findings are not new. They reflect however the completeness and accuracy of our data collection. At the other hand they could have a confounding effect on our results,

together with the effect of pollens and the use of gas stoves for cooking, although the latter are scattered all over the three regions that were studied. We therefore adjusted our analysis for all three co-variables. Our main results, however, remained robust for the adjustment.

In this study the distance between the houses where the children were living and the factory could not be related to the incidence of episodes of wheezing. This could be the result of an absence of such relation. More probably, however, no relation has been found because of the small distances that were studied. Each group covered a distance of one kilometre (0.625 miles), resulting in a maximum distance of three kilometres (1.875 miles) for those living at the longest distance. Within the latter hypothesis it can be expected that the increased incidence of wheezing would only decrease at a distance that is more than three kilometres from the factory.

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References

1. Report from PHARE Country Visit (an attachment to report from PHARE Country Visit) Romania December 08-December 11 1998
2. Anderson HR, Potter AC, Strachan DP. Asthma from birth to age 23: incidence and relation to prior and concurrent atopic diseases. Thorax 1992; 47: 537-42
3. Strachan DP, Cook DG. Health effects of passive smoking. Parental smoking and childhood asthma: longitudinal and case control studies Thorax 1998; 53: 204-12
4. Holt PG. Potential role of environmental factors in the aetiology and pathogenesis of atopi: a working model.: Envirom Health Perspect. 1999 Suppl. 3: 485-7
5. Brukner I, Internal Medicine. Medical publisher House, Bucharest 1980.
6. Smith L, Gergen PJ, Mullally DI, Evans RI. National Survey of Prevalence of Asthma Among Children In U.S. 1976-1980, Paediatrics 1988; 81:1-7
7. Dutan G. Asthme du nourisson et du jeune enfant: définition et épidémiologie. Arch-Pediatr 2002; 9 Suppl 3: 344s-9s.
8. Bjorksen B. Risk Factors in Early Childhood for the development of Atopic Disease. Allergy 1994; 49: 400-7.
9. Guidelines for Diagnostic and Management of Asthma National Heart, Blood and Lung Institute. National Asthma Education Program Expert Panel Report. J. Allergic Clinic Immunology 1991, 88: 425-534.
10. David A, Kegel E, Rudnai P, Sarkany E, Kertesz M.Correlation between air pollution and respiratory morbidity in children at Dorog. Orvosi-hetilap 1990;131(10): 513-7.

11. Weiss CB, Gergen PJ, Wagener DK. Breathing better or wheezing worse? The changing epidemiology of asthma morbidity and mortality. Ann Rev Publ Health 1993; 14: 491-513.
12. Nicolai T. Air pollution and respiratory diseases in children: what is the clinically relevant impact. Pediatr-Pulmonar- Suppl; 18: 9-13
13. Hruda F, Fabianova E, Koppova K, Vandenberg JJ. Childhood respiratory symptoms, hospital admission, and long term exposure to airborne particulate matter. J Expo Anal Environ Epidemiol 2001; 11: 33-40
14. Atkinson RW, Bremner SA, Anderson HR, Strachan DP, Bland JM, de Leon AP. Short term association between emergency hospital admission for respiratory and cardio vascular diseases and outdoor pollution in London. Arch Environ Health 1999; 54 (60): 398-411
15. Sanchez J, Romien I, Ruiz S, Pino P, Gutierrez M. Acute effect of breathing of industrial waste and sulphur dioxide on respiratory health of children living in the industrial area of Puchuncavi; Chile. Panam Salud Public 1999; 6 (6): 384-91