

Seasonal Variation of Asthma and Allergic Rhinitis

Consultation Pattern in General Practice Related to Pollen and Spore Counts and to Five Indicators of Air Pollution

POUL A. PEDERSEN and EVA RUNG WEEKE

Central Research Unit of General Practice, Danish College of General Practitioners, Institute of General Practice, University of Copenhagen, and Department of Respiratory Diseases, Copenhagen County Hospital, Denmark

The seasonal variation of consultations on account of asthma and allergic rhinitis, and the relationship with air concentrations of pollen, spores, and lead, cadmium, dust, soot and sulfur dioxide was investigated in Danish general practice during a 1-year period 1977–78. A population of about 500,000 was studied. Among about 3000 asthmatics there were less consultations during spring than the rest of the year, but the seasonal variation of consultations with symptoms was rather small. The highest rate of consultations was in week 24, which is close to the peak of the grass pollen period. No relationship was found between asthma symptoms and concentrations of pollution indicators. Among about 5000 patients with allergic rhinitis the rate of consultations with symptoms increased at the start of the tree pollen season, still more at the start of the birch pollen season, and was very high during weeks 21–26 in the grass pollen season. Two thirds of all consultations for symptomatic allergic rhinitis took place within 10 weeks (Nos. 18–27). During the grass pollen season there was a relative preponderance of young patients, while during the birch pollen season older patients dominated. No connection was seen between rhinitis symptoms and pollution indicators. The different seasonal variation of asthma and allergic rhinitis indicates that the two patient categories differ as regards symptom-provoking factors. Allergic rhinitis is mainly precipitated by grass and birch pollen. The precipitating factors of asthma were not disclosed in this study, with the exception perhaps of some influence from pollen, and – among 0–4-year-old children – respiratory infections.

Key words: allergic rhinitis; asthma; pollen; pollution; seasonal variation; spores.

Accepted for publication 16 September 1983

In asthma and allergic rhinitis, symptoms may be provoked by exposure to various physical, chemical, exertional and psychological factors, or by certain allergens.

A description of the seasonal variation of asthma and allergic rhinitis may therefore lead to knowledge about the significance of seasonally occurring provoking factors, and to an understanding of the differing impact of various factors on the diseases.

The aim of this study is to describe the

seasonal variation of asthma and allergic rhinitis in general practice, and to relate this variation with continuously measured air concentrations of pollen, spores, and five indicators of pollution: sulfur dioxide, dust, soot, lead and cadmium.

Definitions

Asthma is defined as paroxysmal bouts of dyspnoea of expiratory type, and allergic rhinitis

as paroxysmal sneezing and rhinorrhoea without signs of infection.

PATIENTS AND METHODS

During a 1-year period from June 1977 information about all patients consulting on account of asthma and/or allergic rhinitis was collected in a Danish multipractice study. The practice and patient material of this article is composed of two groups. One comprises 131 practices with a defined patient population of 450,160 persons. The other includes a supplementary 22 practices, the populations of which are not defined. Totals of some of the figures therefore cannot be directly compared. The relative nature of their contents, however, makes comparison possible. The reasons for consultation could be symptoms, desensitization, repeat prescriptions, or advice. At each consultation the following were recorded: Date, personal identification, diagnosis, symptoms present or absent, age at onset, and whether this was the first consultation with a physician because of this disease. A detailed description of the methods has been published previously (10, 11, 12).

Pollen and spore counts were performed by the Danish aerobiological group in Copenhagen, using a Burkard Recording Volumetric Spore Trap (15). Results from these counts, covering the same period as the practice survey, were reported as weekly average concentrations of pollens or spores per cubic metre air. Indicators of air pollution were routinely measured by the Copenhagen Office of Environmental Control at 13 stations located in the city and its suburbs (9). Figures from these measurements are used in this study as weekly averages of the daily averages.

RESULTS

Asthma

A total of 2390 persons from among the defined practice population consulted their general practitioner on account of asthma during 1 year, on average 5.5 times per year. Slightly

Table 1

Asthma. Number of patients and consultations in 131 general practices during 1 year

	Asthma		
	with symptoms	without symptoms	Total
Patients	1608	1322	2930
Consultations	4183	11827	16010

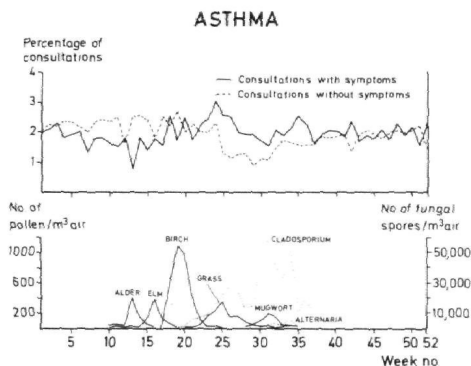


Fig. 1. Distribution of asthma consultations with ($n = 4183$) or without ($n = 11827$) symptoms during 1 year. Percentage of consultations per week in each group in 131 practices. Below: Weekly average concentrations of pollens and spores.

more than 1/4 of the consultations involved symptoms (Table 1). Fig. 1 shows the seasonal variation of asthma with symptoms present or absent. The seasonal variation was rather small. During spring, consultations involving symptoms were less frequent than during the rest of the year; the highest frequency occurred in week 24. This pattern, with the lowest relative consultation rate for symptomatic asthma during February and March, and the highest in June, was followed by all age groups with the exception of the 0–4 years age group, in which the level of consultations with symptoms was highest during the winter months (Fig. 2).

A comparison between consultation rates and concentrations of pollen, spores, and indicators of pollution can be made by referring to Figs. 1

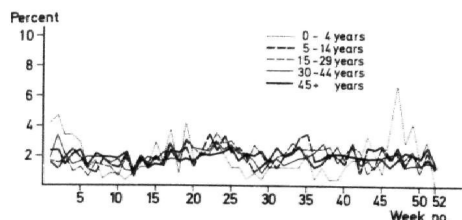


Fig. 2. Distribution of asthma consultations with symptoms in various age groups during 1 year. Percentage of consultations per week in each group in 153 practices. (Number of persons: 0-4 years: 240; 5-14 years: 904; 15-29 years: 652; 30-44 years: 872; 44+ years: 1996).

and 3. Consultations on account of symptoms reached a peak at the time of highest concentration of grass pollen. In general, the number of consultations because of symptoms increased at the start of the birch pollen pollination period. Another peak occurred around week 35. Whether there is a relationship between this peak and the concentrations of cladosporium spores and/or mugwort pollen is not clear. The concentrations of lead, cadmium, dust, soot, and sulfur dioxide co-varied to some extent, but no simple relationship was seen between these and the frequency of consultations on account of asthma symptoms.

Consultations with no symptoms were most frequent during the first part of the year, and less frequent from early summer onwards (Fig. 1).

Allergic rhinitis

A total of 4883 persons from among the defined practice population consulted for allergic rhinitis on average 4.3 times during the observation year. At about 1/4 of the consultations the patients had symptoms (Table 2). Except for the seasonal increase during spring and summer 0.5-1% of all consultations on account of symptomatic allergic rhinitis occurred weekly. This increased to about the double at week 13, which is close to the start of the tree pollen season. A sharp increase occurred at week 19, which marks the peak of the birch pollen season, and, particularly, at week 21-24, which is in the first part of the grass pollen season.

Table 2

Allergic rhinitis. Number of patients and consultations in 131 general practices during 1 year

	Allergic rhinitis with symptoms	without symptoms	Total
Patients	3173	1710	4883
Consultations	4897	16171	21068

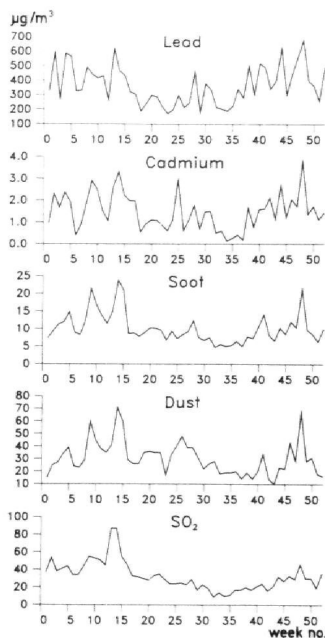


Fig. 3. Average concentrations of lead, cadmium, dust, soot, and sulfur dioxide per week during 1 year in the Copenhagen area.

During weeks 21-26 the level of consultations was very high. After the grass pollen season - from week 26 and onwards - the frequency of consultations decreased abruptly (Fig. 4). In total, 65% of all consultations for allergic rhinitis with symptoms took place within 10 weeks (weeks 18-27), and 54% of all rhinitis patients had symptoms exclusively within this period.

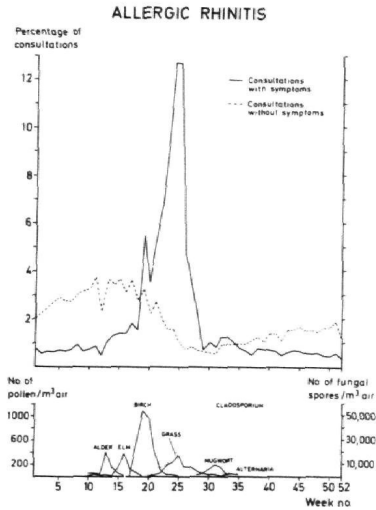


Fig. 4. Distribution of allergic rhinitis consultations with ($n = 4897$) or without ($n = 16171$) symptoms during 1 year. Percentage per week in each group in 131 practices. Below: Weekly average concentrations of pollen and spores.

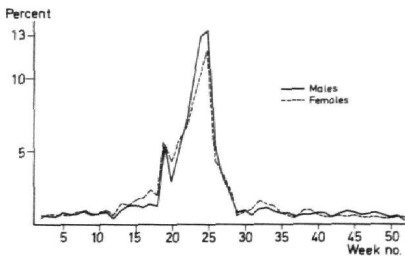


Fig. 5. Distribution of allergic rhinitis consultations with symptoms among males ($n = 2697$) and females ($n = 2186$) during 1 year. Percentage per week in each group in 131 practices.

This pattern was identical among males and females (Fig. 5).

The number of consultations on account of rhinitis symptoms in the grass pollen season was highest among the 5–14-year-old group, and fell with increasing age. During the birch pollen season the rate of consultations on account of symptoms was lowest among the 5–14-year-old group (Fig. 6).

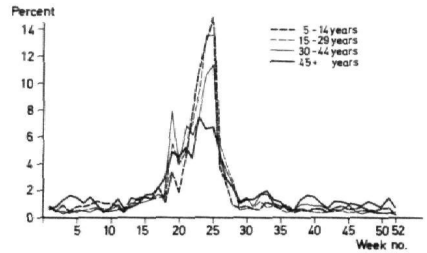


Fig. 6. Distribution of allergic rhinitis consultations with symptoms in various age groups during 1 year. Percentage of consultations per week in each group in 153 practices. (Number of persons: 5–14 years: 1367; 15–29 years: 2069; 30–44 years: 1432; 45+ years: 593).

No co-variation was found between symptoms of allergic rhinitis and concentrations of air pollution indicators (Figs. 3, 4).

The frequency of consultations without symptoms was about double as high during the first half of the year as during the latter half (Fig. 4).

DISCUSSION

One of the most significant findings of this study is the different yearly pattern of variation between allergic rhinitis and asthma. This indicates that the precipitating factors of these two syndromes are different for a large number of patients. Rhinitis patients seem considerably affected by birch and grass pollens, while asthma patients seem affected to a lesser extent even if the seasonal increase in asthma during the pollen season indicates that some asthma patients are allergic to pollen.

This agrees with present views on the pathogenesis of asthma as a disease resulting from hyperreactivity. Hyperreactivity is a condition of increased liability to bronchospasm, excessive production of mucus and mucous oedema when provoked by various factors. Pollen allergens, which are only one of these provoking factors, seemed to play a relatively small role in this study. In other studies, for instance about the New Orleans asthma, asthma was definitely related with exposure to allergens (14). The effect of respiratory infections, which are most prevalent during the winter months, was indi-

cated only in the youngest age group. The infectious origin of asthma among small children has also been seen (16). Airborne particles, certain gasses, cold air, exercise, hyperventilation and other factors which may provoke hyper-reactivity (6), were not evaluated in this study.

The major precipitating significance of pollen in allergic rhinitis is well known (6).

In rhinitis, hyperreactivity has also been demonstrated, although the degree of hyper-reactivity seems much less than in the bronchii, as judged from the histamine concentration necessary for provoking an effect. This different degree of reaction may explain at least part of the different pattern of seasonal variation in the two syndromes.

That five possible irritant factors did not influence the incidence of asthma proves little. A positive association would have indicated an etiological relationship, while a negative one might have resulted from deficient methods, too low concentrations or lack of some factors which, combined with the observed factors, might have produced an effect. The lack of evidence of air pollution as an asthma-provoking factor has been reported by others (5), but, nevertheless, these negative findings do not preclude an association under different conditions.

There are numerous airborne factors which may affect the human respiratory tract. It is essential when searching for asthma-provoking factors, to take into account that the decisive factor is not just the agent itself, but also its concentration, or its combination with other factors, e.g. climatological (4, 14, 17). It should also be taken into account that some outdoor factors, such as lead and soot, may not be relevant to asthma if the actual persons live mostly indoors, as many people do in Western countries (18).

Some previous studies of asthma and allergic rhinitis have found seasonal variation in asthma (6, 16), while others have not (3, 8). The seasonal variation of rhinitis has been noted as characteristic since the first description of the disease (2). In general practice it has also been noticed that the main season of rhinitis is short (7).

The age-dependent prevalence of allergic rhinitis in the birch and grass pollination periods indicates that sensitization to grass pollen takes a shorter time than sensitization to birch pollen, due perhaps to the heavier exposure to grass pollen than to birch pollen, or to the longer average duration of reactivity to birch pollen than to grass pollen, thus giving a higher average age among the birch pollen allergics.

Seasonal variation of consultations without symptoms among allergic rhinitis patients, and to some degree also among asthma patients, is probably due to preseasonal desensitization among allergic patients. A strategy of pre-seasonal desensitization still seems to prevail, even if a perennial procedure has long been advocated and used in most allergy outpatient clinics in Denmark.

The measurement of spores, pollens and the five pollution indicators stem from the Copenhagen area, while the disease data stem from the whole of Denmark. The counts have been reported as weekly averages of daily averages. These circumstances are a part of the difficulties involved in measuring the effect of generally recognised environmental factors.

The work load in general practice during the peak period of allergic rhinitis was high. This could be lessened by instructing known allergic rhinitis patients in advance about the value of pollen counts in the prophylactic use of topical treatment (13).

CONCLUSION

This study indicates that more cases of allergic rhinitis than asthma are provoked by known, seasonally occurring, precipitating factors. Pollen from birch and grass seem to be the major provoking agents in allergic rhinitis, while they do not dominate in asthma. The precipitating role of spores is not clear from this study. The five indicators of air pollution did not seem to affect the incidence of the two diseases, but air pollution as a provoking factor in asthma or allergic rhinitis has not been ruled out by this study.

Allergic rhinitis occurs at a high level especially during the 10 weeks from the beginning of May until the middle of July.

The work load in general practice generated by symptomatic allergic rhinitis is very high during a few months of the year. This could be suitably modified by educating patients in self-medication guided by the knowledge of a possible relationship between pollen counts and symptoms.

ACKNOWLEDGEMENTS

We thank all participating general practitioners and our statistical advisers Svend Kreiner and Søren Spelling for assistance during this study.

We also thank the Copenhagen Department of Environment for information about air quality in the Copenhagen area.

This research was supported by The Danish Medical Research Council (512-8259, 5112-9142, 512-10401, 520/2/1) and The Lundbeck Foundation.

REFERENCES

- Booth, S., DeGroot, I., Markush, R. & Horton, R.: Detection of asthma epidemics in seven cities. *Arch. Environ Health* 10, 152-155, 1965.
- Bostock, J.: Case of a periodical affection of the eyes and chest (*Med. Chir. Tr.*, London, 1819, 10: 161-165). In Major, R. N. (ed.): *Classic descriptions of disease*, 3rd ed., 7th print. Charles C. Thomas, Springfield, Ill., 1978.
- Broder, I., Barlow, P. P., Horton, R. J. M.: The epidemiology of asthma and hay fever in a total community, Tecumseh, Michigan. *J. Allergy* 33, 513-523, 1962.
- Girsh, L. S., Shubin, E., Dick, C. & Schulaner, E. A.: A study on the epidemiology of asthma in children in Philadelphia. *J. Allergy* 39, 347-357, 1967.
- Goldstein, I. F. & Dulberg, E. M.: Air pollution and asthma: search for a relationship. *J. Air Pollut. Control Assoc.* 31, 370-376, 1981.
- Hargreave, F. E.: Clinical implications of bronchial hyperreactivity. International conference on bronchial hyperreactivity, Hague, Netherlands, 1982.
- Harland, R. W.: The management of hay fever in general practice. *J. R. Coll. Gen. Pract.* 29, 265-286, 1979.
- Koivikko, A.: Childhood asthma in Finland. *Acta Allergol* 29, 30-72, 1974.
- Luftforureningen i Storkøbenhavn i vinterhalvåret oktober 1979 - marts 1980. Miljøkontrollen, Københavns kommune, København 1980.
- Pedersen, P. A. & Weeke, E. R.: Asthma in Danish general practice. *Allergy* 36, 175-181, 1981.
- Pedersen, P. A. & Weeke, E. R.: Allergic rhinitis in Danish general practice. *Allergy* 36, 375-379, 1981.
- Pedersen, P. A. & Weeke, E. R.: Methods of a Danish multipractice study 1977-78. *Scand. J. Prim. Health Care* 1, 72-80, 1983.
- Petersen, B. N. & Munch, E.: Anvendelse af aerobiologiske data. In Weeke, E. & Petersen, B. N. (eds.): *1st Symposium om pollen og svampesporers betydning ved allergiske sygdomme*. Fison A/S, Aarhus, 1981.
- Salvaggio, J., Hasselblad, V., Seabury, J. & Heiterscheit, L. T.: New Orleans asthma. II. Relationship of climatology and seasonal factors to outbreaks. *J. Allergy* 45, 257-265, 1970.
- Sandberg, I., Weeke, E. & Petersen, B. N.: Den aerobiologiske gruppes arbejde. In Weeke, E. & Petersen, B. N. (eds.): *1st Symposium om pollen og skimmelsvampesporers betydning ved allergiske sygdomme*. Fisons A/S, Aarhus, 1981.
- Selander, P.: Asthmatic symptoms in the first year of life. *Acta Paediatr. Scand.* 49, 265-269, 1960.
- Whittemore, A. S. & Korn, E. L.: Asthma and air pollution in the Los Angeles area. *Am. J. Public Health* 70, 687-696, 1980.
- Yocom, J. E.: Indoor-outdoor air quality relationship. *J. Air Pollut. Control Assoc.* 32, 500-520, 1982.

Address:

Dr. P. A. Pedersen

Central forskningsenhed for almen praksis

Juliane Mariesvej 18

DK-2100 Copenhagen Ø

Denmark

This document is a scanned copy of a printed document. No warranty is given about the accuracy of the copy. Users should refer to the original published version of the material.