

Development of respiratory illness in childhood— a longitudinal study in general practice

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SUMMARY. *The prognosis of early childhood respiratory illness has been studied by analysis of historic cohorts using data recorded since 1967 in the continuous morbidity registration project of the University of Nijmegen. The characteristics of this project are discussed, including the stability of the practice (study) population, a factor which allows longitudinal analysis to be performed.*

The development of respiratory morbidity during the first eight years of life has been analysed and a group of 710 patients characterized on the basis of their respiratory morbidity in the first two years of life. In general the highest levels of respiratory morbidity are seen in the first years of life, with a gradual decline over the years studied. Upper respiratory tract infections are largely responsible for this morbidity. An elevated level of episodes of respiratory illness in patients aged two to seven years was observed when the following characteristics of early life respiratory morbidity were present: more than three episodes of respiratory illness, lower respiratory tract infections or catarrhal conditions. However, by the age of seven years the level of morbidity of the children with these characteristics was very similar to that of children without these characteristics. Respiratory morbidity in childhood is predominantly benign and self-limiting. Only children with atopic conditions in early childhood showed a higher prevalence of asthma and chronic bronchitis at the end of the study period.

Introduction

IN general practice diseases of the respiratory tract are common^{1,2} and children, particularly young children, form an important subgroup of the patients consulting with respiratory illness. Sex, social class and season of birth influence the incidence of respiratory morbidity. The prognosis of the majority of episodes of respiratory illness is good, and a conservative therapeutic approach is therefore usually necessary. Among children the distribution of episodes of respiratory illness within each age group is uneven — some children hardly ever fall ill, whereas others seem to have one respiratory tract infection after another.

It is important to know the long-term prognosis of these frequent early childhood infections. The age-dependent incidence of the various diseases suggests a general benign course but such a transversal analysis is unsuitable for determining the development of disease. There is theoretical evidence that early childhood respiratory tract infections play a role in the development of asthma and chronic bronchitis in adults.³ The iden-

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tification of high risk children needing special care, difficult as it is, is one of the essential steps for proper management of respiratory morbidity.⁴

This paper describes a longitudinal study of the development of respiratory tract illness among children in the first eight years of life. The aim of the study was to determine the prognosis of the presented morbidity during the first two years of life for the respiratory morbidity in the following six years.

Method

The study used data from the continuous morbidity registration project of the Department of General Practice/Family Medicine at the University of Nijmegen.

Continuous morbidity registration project

The continuous morbidity registration project involves seven general practitioners in four practices in and around Nijmegen^{1,5} — two rural practices, one in a market town and one in the inner city. The project started in 1967, and from 1971 involved all four practices. The aim of the project is to collect morbidity data from general practice with special emphasis on the longitudinal aspects of disease.^{5,6}

Every episode of illness seen by the general practitioners is registered in the project and the diagnosis is classified by the general practitioners as soon as it is established. Classifications are corrected after follow-up where necessary.

All details of specialist care, which is only available through referral by the general practitioners, are recorded. All the patients who have been referred can be identified and the specialist reports back to the general practitioner. These reports include the diagnoses made by the specialists and are used to correct diagnoses which were initially wrong. At the end of a registration year the inclusion of all specialist diagnoses is checked using a list of all patients referred in that year.

Hospitals inform the patients' general practitioners when they are admitted and 'hospital admittance' is recorded in the registration system.

Population. The four practices have a patient population of approximately 12 000. The number of patients has remained stable over the years and there appears to be a balance between the number of patients leaving and entering the practices. However, stability at an individual level is essential for longitudinal studies. Table 1 shows the percentage of the various age groups in the

Table 1. Percentage of the project population who had been in the project for five years or more or 10 years or more in 1984 by age group ($n = 12\ 014$).

Age (years)	Percentage of population in project	
	Five years or more	10 years or more
5-14	84	—
15-24	69	63
25-44	60	39
45-64	91	83
65+	91	85
Total ^a	71	59

^a Patients over four years old only.

project population that have remained unchanged for more than five or 10 years. Children and those over 44 years of age are particularly stable groups.

Registration/classification. At the start of the project in 1967 the E-list⁷ (Dutch translation) was the only general practice morbidity classification available. This list has been used throughout the project to ensure continuity and longitudinality, and amendments to cover new developments have been incorporated. A combination of the E-list and the International Classification of Health Problems in Primary Care⁸ is about to be introduced. Episodes of illness are classified but follow-up contacts for episodes already classified are not included. An episode is defined as a problem or illness in a patient, over the entire period from its onset to its resolution.⁹

Diseases are classified as chronic⁵ on the basis of international agreements.⁹ For each calendar year following the initial diagnosis of a chronic disease, the classification is reconsidered by the general practitioner. When still relevant the classification is continued on a yearly basis with a prevalence code. A distinction is made between passive (condition known and still relevant; no treatment by the general practitioner) and active (condition known and still relevant; active treatment by the general practitioner) classifications.

Peer group assessment is made of the seriousness of the diagnoses: serious; moderately serious; not serious; not classifiable.

Quality of data. Consistency of classification is important, both between the participating general practitioners and by individual general practitioners over many years. The seven general practitioners involved in the project meet once a month and during these meetings classification problems are discussed and when necessary the application of the code and rubric definitions is assessed and reviewed. Individual output is regularly scrutinized for faulty, incomplete coding and this is also discussed at the

Table 2. Diagnoses used in the study and relation to International Classification of Health Problems in Primary Care.

Diagnosis	Relation to ICHPPC-2 (number)
Hay fever	Conforms (477)
Asthma	Conforms (493)
Otitis media	Conforms (3820)
Serous otitis	Conforms to non-suppurative otitis media (3811) and eustachian salpingitis (3815)
Upper respiratory tract infection	Conforms (460)
Tonsillitis	Conforms (463) excluding proven streptococcal infections
Sinusitis	Conforms (461)
Laryngitis	Conforms (464)
Pneumonia	Conforms (486)
Acute bronchitis	Conforms (466)
Chronic bronchitis	Including emphysema, excluding bronchiectasis (491; 492)
Hypertrophy and chronic infection of tonsils and adenoid	Conforms (474)
Seborrhoeic dermatitis	Conforms (690)
Eczema	Conforms (6918)
Allergic dermatitis	Conforms to urticaria (708) and all other allergic skin reactions of immediate type
Other dermatitis	Including diaper rash (692; 6910)

Table 3. Comparison of study group ($n = 710$) and children who had left the practices before eight years of age ($n = 178$).

	No. in study group	Practice leavers as % of study group
<i>Sociodemographic features</i>		
Sex:		
Male	375	26
Female	335	24
Social class:		
High	47	62
Middle	301	22
Low	362	24
<i>Early childhood morbidity (0–1 years)</i>		
Number of episodes of respiratory illness:		
0	159	24
1–2	220	27
3	331	15
Type of infection:		
None	159	24
Upper tract only	393	20
Lower tract	158	19
Number of episodes of catarrhal conditions:		
0	121	24
1–2	202	27
3	387	16
Number of episodes of atopic conditions:		
0	590	21
1	120	18

meetings. Coding of case reports is regularly compared. In this way the quality of the data is maintained and any differences in classifying and coding kept to a minimum.

Respiratory illness study

The study of the development of respiratory tract disease in childhood used the data collected in the registration project. The analysis was carried out in 1984–85, using all the data available up to 1982 (1972–82). Table 2 lists the diagnoses used in the study, and their relation to the International Classification of Health Problems in Primary Care.⁸

Study group. The morbidity data of all children who had been in the project population for at least the first eight years of life were studied. Eight years was a compromise between sufficient number of patients available and number of years of follow-up at the start of the study. Seven hundred and ten children met this criterion: 375 boys and 335 girls. In Table 3, the study group is compared with the children who left the practices before the age of eight years. There was a high proportion of practice leavers among the high social class, and among children with lower levels of respiratory illness. Therefore, there is little chance that the children studied form a group with low levels of respiratory morbidity.

Cohorts. The study group was divided into cohorts on the basis of the morbidity presented during the first two years of life: (1) The number of episodes of respiratory illness — none; one or two; three or more.

Table 4. Morbidity characteristics during follow-up period by cohort.

Cohort by registered morbidity in first two years of life	Number of patients (n = 710)	Mean annual number of episodes of respiratory tract infections (age 2-7 years)	Mean annual number of episodes of acute bronchitis and pneumonia (age 2-7 years)	Prevalence of asthma and chronic bronchitis (age 7 years)	Mean annual number of episodes of non-respiratory non-serious illness (age 2-7 years)
<i>Number of episodes of respiratory infection:</i>					
0	159	0.55	0.05	19	44
1-2	220	0.89	0.07	9	75
3	331	1.44	0.16	21	92
<i>Type of respiratory infection:</i>					
None	159	0.55	0.05	19	44
Upper tract only	393	1.19	0.09	15	84
Upper and lower tract	158	1.40	0.20	19	90
<i>Number of episodes of catarrhal conditions:</i>					
None	121	0.66	0.05	25	42
1-2	202	0.93	0.06	0	69
3 or more	387	1.64	0.10	23	91
<i>Number of episodes of atopic conditions:</i>					
None	590	1.15	0.10	10	74
1 or more	120	1.36	0.16	50	89

(2) The number of episodes of lower respiratory tract infections (pneumonia, acute bronchitis, chronic bronchitis); atopic conditions (hay fever, asthma, eczema, allergic dermatitis); and catarrhal conditions (conjunctivitis, otitis media, tubular catarrh, upper respiratory tract infection; tonsillitis, sinusitis, laryngitis, acute bronchitis, hypertrophic tonsils/adenoids, eczema, seborrhoeic eczema and other dermatitis).

For each cohort the annual recorded morbidity during the six years of follow up (when the children were aged between two and seven years) was determined. These cohorts cover various aspects of the prognosis of respiratory morbidity.

Results

Table 4 shows the mean annual number of episodes of respiratory tract infections, acute bronchitis and pneumonia, and non-respiratory non-serious illness over the six-year follow-up period and the prevalence of asthma and chronic bronchitis in the final year, for all cohorts. Figures 1-4 show the follow-up patterns in more detail. No differences could be demonstrated between boys and girls and so only aggregated data are presented here.

All respiratory infections

The children presenting with the most episodes of respiratory infection in the first two years of life continued to do so in the following six years (Table 4). The number of episodes of acute bronchitis and pneumonia was the highest in this cohort, as were the number of referrals. There was, however, a clear downward and convergent trend in episodes of respiratory illness for all three cohorts (Figure 1). At the end of the study period there was no significant difference in the number of children with a chronic obstructive pulmonary disease (asthma and chronic bronchitis) (Table 4).

Lower respiratory tract infections

Children with at least one lower tract infection in early childhood presented the most episodes of respiratory tract infections in the following six years (Table 4). The number of episodes of lower respiratory tract infection (acute bronchitis and pneumonia) was the highest for this cohort during the follow-up period. The referral rate was also higher. Again there was the same downward convergent trend in episodes of respiratory illness for the three

cohorts (Figure 2). For the cohort suffering lower respiratory tract infections in early childhood the majority of respiratory illnesses throughout the follow-up period were upper respiratory tract infections, and they remained at a high level until the children reached the age of four or five years. The incidence of lower respiratory tract infections was much lower and decreased further over the follow-up period.

At the end of the study period the number of children with

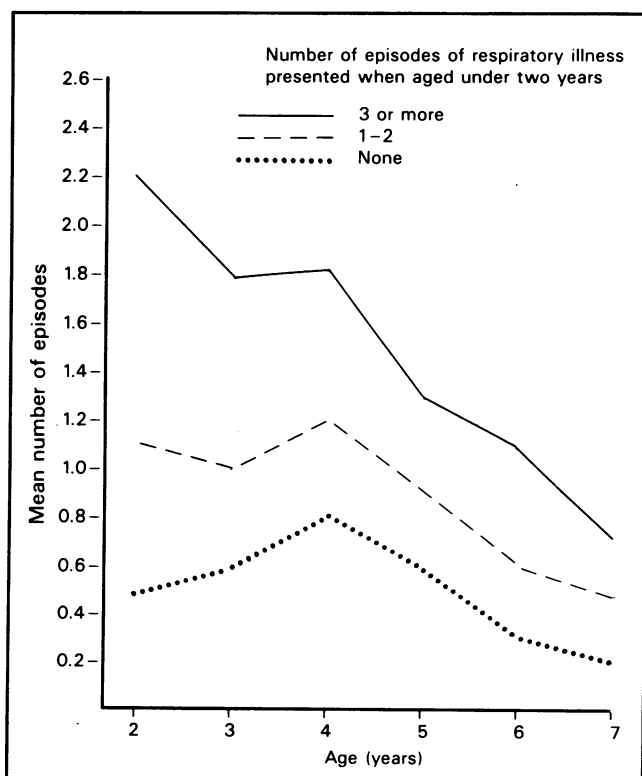


Figure 1. Number of episodes of respiratory morbidity presented annually when children aged two to seven years by number of episodes presented when aged under two years (n = 710).

a chronic pulmonary condition (asthma and chronic bronchitis) in the three cohorts was comparable (Table 4).

Catarrhal conditions

The cohort with three or more episodes of catarrhal conditions in the first two years of life had the highest number of episodes of respiratory illness in the following years (Table 4). The downward converging trend in episodes of respiratory illness started after the children reached the age of four years (Figure 3). A reduction in the number of catarrhal conditions and upper respiratory tract infections was largely responsible for this downward trend. The incidence of lower respiratory tract infections and atopic conditions was low and decreased further over the years.

Atopic conditions

There was only a small difference in the number of episodes of respiratory illness between the cohorts with and without atopic conditions in the first two years of life (Table 4); with a parallel difference over the follow-up period (Figure 4). The atopic children presented more lower respiratory tract infections in the first years, but this difference then disappeared.

There was a higher prevalence of asthma and chronic bronchitis at the end of the study period for the children with atopic conditions in early childhood than for those without (Table 4).

Non-serious disease

The number of episodes of non-respiratory non-serious conditions is shown on Table 4. The cohort with the highest number of episodes of respiratory illness and related morbidity in the first two years of life showed the highest level of non-respiratory non-serious conditions.

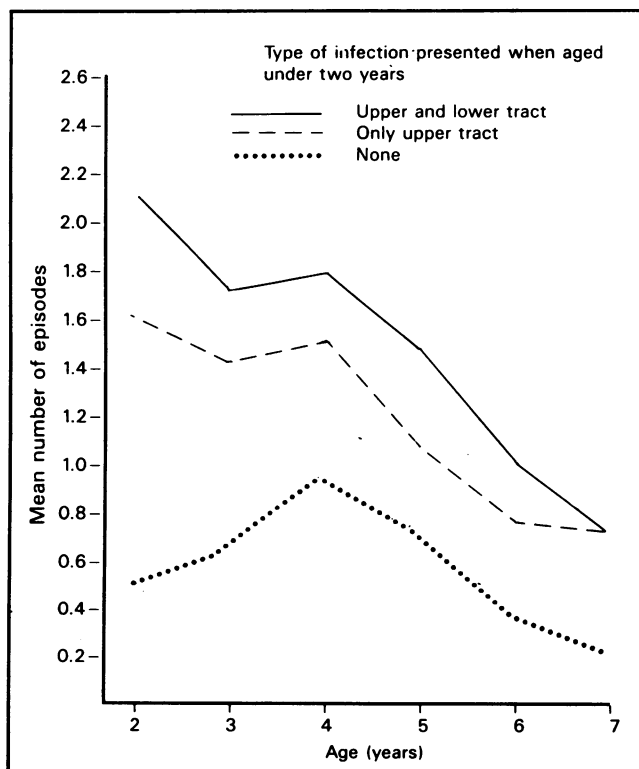


Figure 2. Number of episodes of respiratory morbidity presented annually when children aged two to seven years by type of respiratory infection presented when aged under two years ($n = 710$).

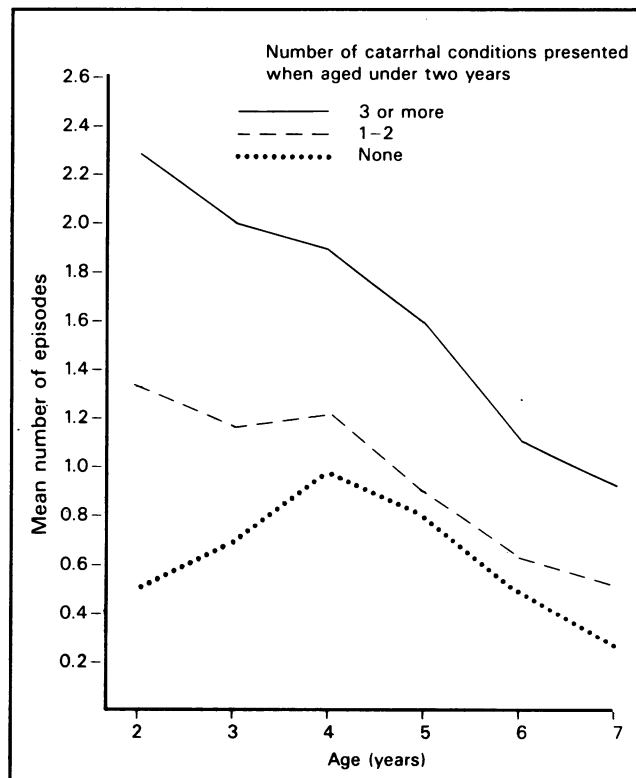


Figure 3. Number of episodes of respiratory morbidity presented annually when children aged two to seven years by the number of episodes of catarrhal conditions presented when aged under two years ($n = 710$).

Discussion

The continuous morbidity registration project allows longitudinal research to be performed. There are limitations, however: only episodes that have been presented to the general practitioner can be considered and it is known from other studies of the same population, that only 9% of respiratory illness experienced by adults is presented to the general practitioner.¹⁰ In other words, the patterns demonstrated result from use of services as well as from levels of morbidity.

Among children aged two to seven years the highest number of episodes of respiratory illness, including acute bronchitis and pneumonia, and the highest referral rates were found for those children with the highest number of episodes of respiratory illness and related morbidity in the first two years of life. Upper respiratory tract infections and catarrhal conditions accounted for the majority of the episodes in the later years; lower respiratory tract infections and atopic conditions were less frequently recorded.

By the age of five years there was a decrease in the number of episodes of respiratory illness with a clear convergence for all the cohorts studied. This decrease was greatest for the cohorts with the highest level of episodes initially, but was demonstrated in all the groups studied. The influence of use of services on the results is demonstrated by the finding that the cohorts with the highest number of episodes of respiratory illness also have the highest incidence of non-respiratory non-serious illness.

It therefore appears that early childhood respiratory illness predicts the level of morbidity in the following six years of life and especially in the following three years. There is, however, no evidence from this study that the level of respiratory illness in the first two years of life can be used to predict an increased level of lasting, serious, impairing respiratory morbidity. The

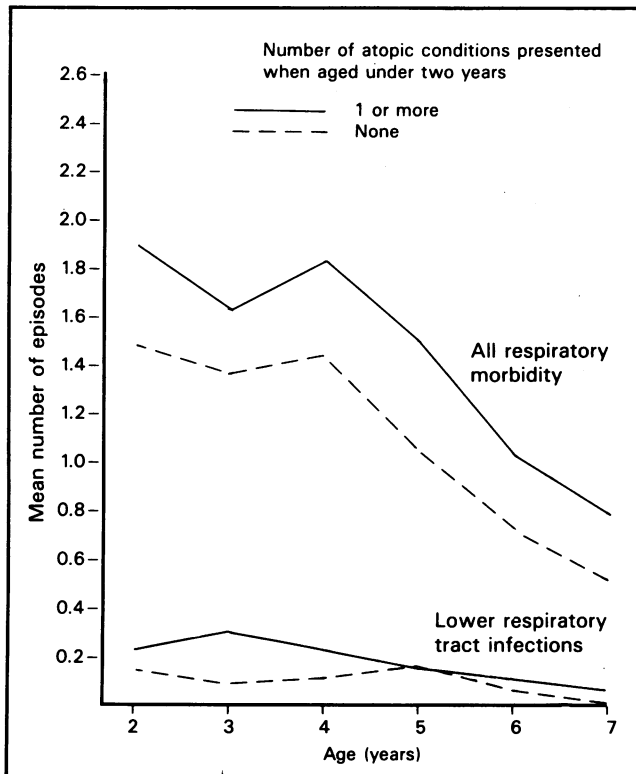


Figure 4. Number of episodes of respiratory morbidity and number of episodes of lower tract infection presented annually when children aged two to seven years by number of episodes of atopic conditions presented when aged under two years ($n = 710$).

number of children with an established chronic obstructive condition at the end of the study period was comparable for all cohorts studied. The exception was those children with an atopic condition in early childhood — 42% were known to suffer from asthma or chronic bronchitis at the age of seven years.

There is substantial evidence^{3,11} for the influence of early childhood respiratory infection on the development of respiratory illness in later life. Population surveys point to the existence of undiagnosed, potentially hazardous symptoms.¹² It has been demonstrated¹³ that the higher number of early childhood respiratory episodes in symptomatic patients compared with healthy ones is at least partly due to systematic underestimation of early childhood medical history by healthy people. No such bias has influenced this study. On the other hand, the period of eight years might be too short to substantiate the long term development of chronic respiratory conditions.

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