

## Mortality and morbidity from respiratory diseases in childhood in the Netherlands, 1980-1987

J. Wever-Hess, A.M.J. Wever, J.L. Yntema

*Mortality and morbidity from respiratory diseases in childhood in the Netherlands, 1980-1987. J. Wever-Hess, A.M.J. Wever, J.L. Yntema.*

**ABSTRACT:** National mortality and hospitalization data from the Netherlands were analysed for asthma (International Classification of Diseases (ICD 493), acute bronchi(ol)itis (ICD 466), pneumonia and influenza (ICD 480-487), and other chronic obstructive pulmonary diseases (ICD 490+491+492+496) in children aged 0-14 yrs for 1980-1987. No trends were seen in the mortality in age groups 0-4 yrs and 5-14 yrs, which actually concerned small numbers. In general a tendency towards increasing hospital admission rates for respiratory diseases was observed in both sexes in age groups 0-4 yrs and 5-9 yrs but not in age group 10-14 yrs, and significant increases were found for asthma in males and females aged 0-4 yrs and in males aged 5-9 yrs, and for acute bronchitis in females aged 5-9 yrs. Hospital admission rates in the Netherlands for asthma appeared to be low compared to other countries. The average length of stay, however, for both asthma and the other respiratory diseases was substantial though declining. Clinical information is required on possible causal factors of the apparent need for hospitalization for reactive airway disorders in young children, and on the management of asthma in particular.  
*Eur Respir J*, 1991, 4, 429-433.

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Keywords: Asthma; childhood; epidemiology; hospital admissions; morbidity; mortality; respiratory diseases.

Received: November 1989; accepted after revision June 7, 1990.

Literature on trends in asthma mortality [1-3] and morbidity [4, 5] in different parts of the world prompted us to analyse national data on asthma and other chronic obstructive pulmonary diseases in the Netherlands in the period 1980-1986, dividing the total population into four major age groups. In the age group 0-4 yrs a significant increase was found in the morbidity from asthma (as measured by the number of hospital admissions) which gave reason to analyse the data for age groups 5-9 and 10-14 yrs also. As a clear definition of asthma is lacking it was thought essential to extend the analysis to other reactive airway disorders which play a role in childhood. Furthermore, data on length of stay in hospital were analysed as this might give an indication about the severity threshold for hospital admission within the management of childhood asthma [6]. The present study aims to elucidate the perspective of reactive airway disorders in childhood in the Netherlands and may also give an epidemiological contribution to the international discussion on the subject.

### Material and methods

Annual national crude mortality data according to sex, age, and primary cause of death, based on the 9th Revision of the International Classification of Diseases

Table 1. - Age-specific death rates per million population for asthma (ICD 493), acute bronchi(ol)itis (ICD 466), pneumonia and influenza (ICD 480-487), and for other chronic obstructive pulmonary diseases (ICD 490+491+492+496) in males and females, 1980-1987

ICD code	493	466	480-487	490+1+2+6
<b>0-4 yrs</b>				
1980	4.5	16.9	26.0	2.3
1981	2.3	11.3	36.0	1.1
1982	0	6.8	31.6	0
1983	2.3	2.3	18.2	1.1
1984	2.3	9.1	27.4	1.1
1985	1.1	8.0	35.5	3.4
1986	2.3	4.6	44.5	5.7
1987	2.3	5.6	41.7	3.4
<b>5-14 yrs</b>				
1980	0.4	0	1.8	0.4
1981	1.4	0.5	3.2	0
1982	0.5	0	2.3	0.9
1983	0.5	1.0	4.3	1.0
1984	1.5	0.5	2.0	1.0
1985	0.5	0	2.1	0.5
1986	0	0	1.6	0.5
1987	0.5	0	1.1	0.5

ICD: International Classification of Diseases.

Table 2. – Age-specific hospital admission rates per million population for asthma (ICD 493), acute bronchi(ol)itis (ICD 466), pneumonia and influenza (ICD 480–487), and for other chronic obstructive pulmonary disease (ICD 490+491+492+496) according to sex, 1980–1987

Age group yrs	Males				Females			
	0–4	5–9	10–14	Total	0–4	5–9	10–14	Total
<b>ICD 493</b>								
1980	1298	657	465	762	723	418	259	442
1981	1235	701	409	739	750	378	312	458
1982	1672	772	452	908	965	410	284	522
1983	1668	768	436	904	858	396	257	478
1984	1829	837	380	960	1190	485	261	612
1985	1894	740	371	959	1128	470	302	611
1986	1897	759	309	957	1294	402	207	614
1987	1967	929	439	1095	1270	480	290	671
<i>slope</i>	+105.0	+25.8	-11.7	+43.2	+87.7	+9.8	-3.0	+33.1
<i>SE</i>	18	9.0	7.2	7.5	13.4	5.7	5.4	5.0
<i>p-value</i>	0.001	0.028	0.157	0.001	0.001	0.138	0.601	0.001
<b>ICD 466</b>								
1980	598	28	13	182	500	33	5	153
1981	733	53	18	234	496	41	17	162
1982	777	60	31	257	522	28	20	169
1983	847	109	37	299	511	65	19	179
1984	953	83	7	317	538	53	15	185
1985	901	57	19	304	508	60	8	179
1986	1119	64	20	382	792	74	16	281
1987	787	125	18	303	584	71	19	220
<i>slope</i>	+44.4	+8.3	-0.25	+20.8	+24.4	+6.1	+0.6	+13.1
<i>SE</i>	18.7	4.0	1.6	5.3	13.2	1.5	0.9	4.4
<i>p-value</i>	0.055	0.085	0.880	0.008	0.114	0.006	0.499	0.024
<b>ICD 480–487</b>								
1980	3460	802	187	1309	2550	510	181	953
1981	3480	707	188	1296	2553	611	121	974
1982	3719	760	211	1405	2758	621	173	1067
1983	3797	1090	329	1592	2618	884	220	1136
1984	4092	791	241	1577	3172	663	135	1218
1985	3871	795	172	1514	2868	583	161	1133
1986	4037	619	210	1553	3132	522	188	1229
1987	3100	1010	295	1439	2266	751	232	1063
<i>slope</i>	+12.1	+9.8	+7.9	+29.8	+21.3	+10.8	+6.8	+27.7
<i>SE</i>	55.1	25.5	8.7	15.2	50.7	20.2	5.7	12.7
<i>p-value</i>	0.834	0.714	0.403	0.098	0.689	0.612	0.279	0.072
<b>ICD 490+1+2+6</b>								
1980	1600	274	133	591	963	210	85	373
1981	1514	267	128	569	865	170	89	337
1982	1533	305	143	599	956	218	129	398
1983	1472	386	150	615	900	213	103	373
1984	1440	331	150	597	806	187	86	336
1985	1589	321	119	638	852	203	91	362
1986	1673	288	131	670	986	202	92	411
1987	1448	435	152	665	805	232	90	369
<i>slope</i>	-1.6	+14.6	+0.9	+13.4	-10.8	+2.9	-1.0	+2.3
<i>SE</i>	13.7	7.6	2.0	2.6	11.0	3.0	2.4	4.3
<i>p-value</i>	0.912	0.104	0.667	0.002	0.364	0.365	0.701	0.601



Table 3. – Average length of stay in hospital in days for asthma (ICD 493), the other respiratory diseases (ORD) (ICD 466, ICD 480–487, and ICD 490+491+492+496), and for all causes according to age group, 1980–1986\*

	0–4 yrs			5–9 yrs			10–14 yrs		
	asthma	ORD	all causes	asthma	ORD	all causes	asthma	ORD	all causes
1980	13.8	16.0	9.5	17.3	15.7	7.5	12.4	15.3	10.1
1981	13.3	15.2	9.2	12.7	14.6	7.2	12.8	14.0	9.6
1982	12.1	14.7	8.9	12.4	14.3	7.1	9.5	13.0	9.1
1983	10.2	13.9	8.7	14.1	14.1	7.2	13.7	13.0	9.3
1984	9.5	13.4	8.8	9.3	12.7	7.4	10.1	12.7	9.0
1985	10.6	12.6	8.8	8.7	12.5	7.1	9.6	12.8	8.6
1986	9.1	11.3	8.7	8.4	11.2	6.9	10.1	12.9	9.0

\*: data for 1987 not available; ICD: International Classification of Diseases.

(ICD) in 1979, were obtained from the Netherlands Central Bureau of Statistics [7]. Data on the number of days of stay in hospital were also supplied [8].

Annual crude hospital morbidity data according to sex, age, and diagnosis on discharge, based on the ICD 9th Revision (Clinical Modification), were obtained from the Dutch Centre for Health Care Information, covering 94–99% of all hospital admissions in the Netherlands in the period under study and since 1980 adjusted to 100% [9]. The analysis, therefore, was carried out from 1980, particularly since the Dutch Centre for Health Care Information introduced the 9th Revision of the ICD from 1 January 1980.

The following diseases were included in the analysis: asthma (ICD 493), acute bronchitis and acute bronchiolitis (ICD 466), pneumonia and influenza (ICD 480–487), and other chronic obstructive pulmonary diseases (ICD 490+491+492+496), *i.e.* bronchitis not specified as acute or chronic (ICD 490), chronic bronchitis (ICD 491), emphysema (ICD 492) and chronic obstructive airway disease not classified elsewhere (ICD 496).

Sex-age-specific rates were calculated per 5 yr age group per million population per calendar year, using the annual mean population age-structure [10, 11]. As the mortality data were based on very small numbers, these rates were determined for the age groups 0–4 yrs and 5–14 yrs for males and females together. The population size in the period 1980–1987 was on average 0.88, 0.94, and 1.12 million children a year in the age group 0–4, 5–9 and 10–14 yrs, respectively, with a male/female ratio of 1.05.

Time trend analyses on the morbidity rates were carried out by means of least squares regression.

## Results

Table 1 shows the age-specific death rates per million population per year in children aged 0–4 yrs and 5–14 yrs for the respective ICD-codes. The mortality in both age groups fluctuated with no trends to point to.

The age-specific hospital admission rates per million population with the slope of the regression, its standard error (SE) and *p* value, are given in table 2 for

males and females. In general there is a tendency towards an increase in the hospital admission rate for the respiratory diseases in the two youngest age groups, with no discrepant trends between males and females. Significant trends were found for ICD 493 in both males and females aged 0–4 yrs and in males aged 5–9 yrs, and for ICD 466 in females aged 5–9 yrs. In the 10–14 yr age group no (significant) trends were found.

Table 3 shows the average length of stay in hospital for asthma, for the other respiratory diseases combined, and for all causes. In general these average lengths of stay declined, particularly in the 0–4 yr and 5–9 yr age groups, but for asthma and for the other respiratory diseases they are still substantial.

## Discussion

The analysis from 1980 onwards excludes the influence of the change in coding due to the Ninth Revision of the ICD in 1979. Marginal effects on the mortality statistics because of coding practices [12] were also not to be expected as the rule to code as the primary cause of death the “major disease” out of part II of the death certificate (if not stated in part I) had already been applied for some time in the Netherlands [13]. In international death certificate validation studies the Netherlands performed well, but between-country variations existed in the ways of certifying deaths and coding certificates [13, 14]. A recent reanalysis with respect to the category asthma suggested that the reported national mortality rates are affected by the way deaths are certified [15]. Thus, comparative mortality statistics should be viewed with caution and it would be preferable to view asthma statistics on both mortality and morbidity within the context of the other (chronic) obstructive airway diseases.

As for the mortality from asthma in the 0–4 yr age group no trend could be observed. The level is comparable with that in the United Kingdom [6] and the United States [16]. Misdiagnosing deaths from asthma because of confusion with bronchi(oli)titis [17] could not have obscured a rising trend in asthma mortality but rather the reverse. In the 5–14 yr age group, in which a more



accurate diagnosis can be achieved, the mortality from asthma as well as from the other respiratory diseases is insignificant, and only a few actual deaths were involved. The reported asthma mortality rate for 1979–1986 in children aged 5–14 yrs in New Zealand is 14.2 and in England and Wales 4.3 [18]. Thus, the mortality from asthma in childhood in the Netherlands is low and relatively stable over the study period. Within the respiratory diseases only the mortality from pneumonia and influenza in the very young seems to be of importance.

The significant increase in hospital admissions for asthma in the 0–4 yr age group (more than 50% in a period of seven years), and also for the male 5–9 yr age group, cannot be explained by a change in diagnostic fashion as the hospital admission rates for the other respiratory diseases also show an increase. It should be mentioned here that the admissions for ICD 466 in age group 5–9 yrs were due to acute bronchitis, and that acute bronchiolitis played a role only in the 0–4 yr age group (on average 40%). In our study no data were available to determine whether the factors readmission and self-referral play a role [19, 20]. It is noted that in the past years a policy discouraging hospital referral was in force in the Netherlands along with an actual reduction in the number of hospital beds. This may be reflected in the steady decline of the hospital admissions in children for all causes in all three age groups for both sexes combined, and the contrasting trends for the respiratory diseases in the 0–4 yr and 5–9 yr age groups are thus remarkable (fig. 1).

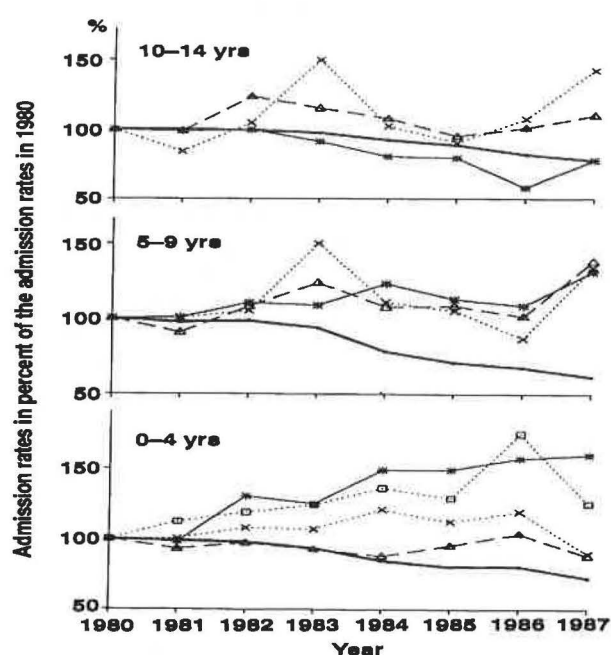


Fig. 1. – Trends in hospital admissions according to age group for all causes, asthma (ICD 493), acute bronchi(ol)itis (ICD 466) (in 0–4 yr age group only), pneumonia and influenza (ICD 480–487), and for other chronic obstructive pulmonary diseases (ICD 490+491+492+496), 1980–1987. Admission rate in 1980=100%. ICD: International Classification of Diseases. —: all causes; —●—: ICD 493; —△—: ICD 466; —□—: ICD 490+491+492+496; —×—: ICD 480–487.

In the total 0–14 yr age group the proportion of hospital admissions for all respiratory diseases under study was 3.3% in 1980 and 5.4% in 1987. For asthma these figures were 0.8 and 1.6%, respectively.

The level of the hospital admission rate for asthma in children in the Netherlands is relatively low [5, 16]. However, the lack of a clear definition of asthma is a drawback for international comparisons as different diagnostic labelling of the respiratory diseases could occur. But even when the respiratory diseases under study are taken together the total admission rate in children aged 0–14 yrs in 1980 was only 2,390 per million. Nevertheless, obstructive airway disease in children is assumed to be a common condition in the Netherlands, and from the few available data the prevalence of attacks of asthma in schoolchildren was found to be 3.3% in 1968 [21], being comparable with data from the UK [6]. Hospital admissions may also reflect asthma management practices and severity of asthma rather than prevalence [22]. A factor that leads to hospital admission can be ineffective treatment [23], the more so if lack of a good assessment of the child's condition impairs specific treatment [24, 25]. A better recognition of asthma may also lead to hospital referral for treatment at an earlier age, especially with nebulizers in the very young [26]. In the UK the average length of stay in hospital for asthma has declined in 1985 to 2.5 days for the 0–4 yr age group and 3.7 days for the 5–14 yr age group, and it has been suggested that a decline in severity along with improvements in treatment has contributed to this [6]. In a comparative study in children aged 5–14 yrs in a region in New Zealand and in the UK, the average lengths of stay did not differ (2.7 versus 2.6), although a suggestion of a greater severity of asthma was found in New Zealand [18]. In the Netherlands the average length of stay for asthma and for the other respiratory diseases proved to be considerably longer, although a decreasing trend was also found especially in the 0–4 and 5–9 yr age groups (table 3). It is tempting to conclude that the above findings point to differences in the management of childhood asthma. A possible indicative factor might be the ratio between the consultations for asthma in general practice and in out-patient clinics, being in the Netherlands two to three in children aged 0–11 yrs in 1988 (Institute of Medical Statistics, The Hague), suggesting an active participation of the specialists in the management of childhood asthma.

In conclusion, the Dutch hospital admission rates for the reactive airway disorders in childhood seem to be low, but the increase in young children, along with a still substantial average length of stay, calls for further study of its causal factors and in particular of the management of the disease labelled asthma. In the Netherlands, however, the increase in respiratory morbidity did not have any impact on the respiratory mortality.

**Acknowledgements:** The authors wish to thank Prof. Dr K.F. Kerrebijn for his comments on the manuscript.



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*Mortalité et morbidité dues à des affections respiratoires dans l'enfance au Pays-Bas, 1980-1987. J. Wever-Hess, A.M.J. Wever, J.L. Yntema.*

RÉSUMÉ: Le cadastre national de mortalité et d'hospitalisation a été étudié aux Pays-Bas pour l'asthme (ICD 493), la bronchi(ol)ite aiguë (ICD 466), la pneumonie et l'influenza (ICD 480-487), ainsi que d'autres maladies pulmonaires obstructives chroniques (ICD 490+491+492+496), chez des enfants âgés de 0 à 14 ans, pour la période 1980-1987. L'on n'a pas observé de tendance en ce qui concerne la mortalité dans les groupes d'âge 0-4 et 5-14 ans, qui ne concernent en fait que de petits nombres de sujets. En général, l'on a observé une tendance vers des taux d'admissions hospitalières croissants pour les maladies respiratoires dans les deux sexes, dans les groupes d'âge 0-4 et 5-9 ans, mais non dans le groupe 10-14 ans, ainsi que des augmentations significatives de l'asthme chez les garçons et les filles de 0-4 ans et chez les garçons de 5-9 ans, ainsi que pour la bronchite aiguë chez les filles de 5-9 ans. Les taux d'admissions hospitalières aux Pays-Bas pour l'asthme apparaissent bas par comparaison avec d'autres pays. La durée moyenne de séjour, toutefois, à la fois pour l'asthme et les autres maladies respiratoires, est substantielle, quoiqu'en voie de décroissance. Des informations cliniques sont indispensables pour établir les facteurs causaux de ce besoin apparent d'hospitalisation pour les maladies accompagnées de réactivité des voies aériennes chez les enfants, ainsi que pour l'approche de traitement de l'asthme en particulier. *Eur Respir J.*, 1991, 4, 429-433.