

## SHORT REPORT

## Bronchiolitis hospitalisations in the Netherlands from 1991 to 1999

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In order to analyse trends in the bronchiolitis hospitalisations in the Netherlands from 1991 to 1999 for children aged 0–4 years, the national number of bronchiolitis hospitalisations were compared with those of asthma and pneumonia hospitalisations of the same age group. The number of bronchiolitis hospitalisations significantly increased, whereas the number of asthma and pneumonia hospitalisations remained unchanged.

Respiratory syncytial virus (RSV) is the most important respiratory pathogen in infancy, causing lower respiratory tract infection in about 30% of cases, with bronchiolitis being the most common manifestation.<sup>1</sup> In general, about 0.5–2% of children with RSV disease need to be hospitalised for monitoring and supportive therapy.<sup>1</sup> It has been shown that from 1980 to 1989, bronchiolitis hospitalisations have increased in the Netherlands.<sup>2</sup> This descriptive analysis was performed in order to assess trends in hospitalisation for bronchiolitis from 1991 to 1999 in the Netherlands.

## METHODS

Hospital discharge data from January 1991 to December 1999 for children 0–4 years of age were obtained from the National Medical Registration (LMR Prismant, Utrecht, Netherlands), which obtains discharge data of more than 95% of hospitals in the Netherlands.

Trends in bronchiolitis admissions were compared with trends in hospital admissions of other common acute respiratory diseases in infancy and childhood in the same age group. Data with the following International Classification of Diseases, ninth revision, clinical modification (ICD-9-CM, www.cdc.gov/nchs) codes were selected: bronchiolitis (code 466.1), asthma (code 493), and bacterial pneumonia (code 481, 486, 4822, 4823, 4824, 4828, 4829).

In order to analyse whether trends in bronchiolitis hospitalisations could be related to trends in number of RSV detections, virological data were obtained from the Dutch Working Group on Clinical Virology in cooperation with the National Institute of Public Health and the Environment (RIVM). The RIVM registers weekly the positive RSV results of 17 virological laboratories, representing approximately 50% of all laboratories performing RSV tests in the Netherlands (RIVM, unpublished data).

In addition, in order to compare bronchiolitis admissions with the number of patients at risk for a severe course of RSV disease, annual hospitalisation data of patients with bronchopulmonary dysplasia (BPD, code 7707) and congenital heart disease (CHD, code 745, 746) as well as the number of premature births in the Netherlands (data obtained from the National Neonatology Registration, Prismant, Utrecht, Netherlands) were also analysed.

Finally, in order to analyse whether there has been a change in disease severity, all children admitted to the paediatric

**Table 1** Regression analysis for bronchiolitis, asthma, and pneumonia hospitalisations and RSV detections in the Netherlands during eight RSV-season-years\* from 1991–92 to 1998–99

	R square	Regression coefficient (95% CI)	p value
Bronchiolitis	0.78	234 (111 to 357)	0.003
Asthma	0.35	53 (–19 to 126)	0.13
Pneumonia	0.21	–22 (–66 to 21)	0.26
RSV detections	0.14	65 (–97 to 227)	0.36

\*RSV-season-year: July to June.

intensive care unit (PICU) of both the Emma Children's Hospital (Amsterdam) and the Wilhelmina Children's Hospital (Utrecht) with the discharge diagnosis RSV lower respiratory tract infection (RSV-LRTI) from 1991 to 1999 were counted. Both are tertiary care university hospitals with a 10–14 bed multidisciplinary PICU, each with an average of 550 admissions annually, representing 25–30% of the total number of PICU beds in the Netherlands.

## Statistics

Statistical analysis was performed with the SPSS package for Windows, version 9.0 (SPSS Inc., Chicago, IL). Trends in hospitalisation were tested with linear regression analysis. A p value less than 0.05 was considered statistically significant.

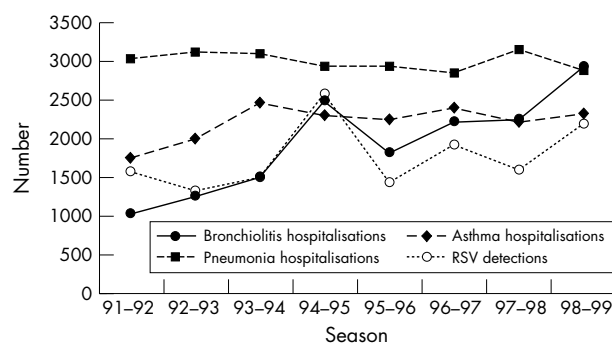
## RESULTS

To analyse trends in hospitalisations per "RSV-season-year", monthly admission data for bronchiolitis, asthma, and pneumonia were clustered from July to June the following year. During eight season-years, the number of bronchiolitis hospitalisations among children aged 0–4 years significantly increased from 1022 in season-year 1991–92 to 2918 in season-year 1998–99 (fig 1, table 1). There has been no significant change in annual number of live births during the same period (Yearbook Statistics Netherlands 1991–2000, data not shown). Neither the number of asthma nor the number of pneumonia hospitalisations changed significantly during the same period (fig 1, table 1).

Although the number of RSV detections clustered per season-year showed the same increasing pattern as the bronchiolitis hospitalisations (fig 1), this trend was statistically not significant (table 1).

There was no significant change in the number of patients hospitalised with BPD (range 97–171) or CHD (range

**Abbreviations:** BPD, bronchopulmonary dysplasia; CHD, congenital heart disease; LRTI, lower respiratory tract infection; PICU, paediatric intensive care unit; RSV, respiratory syncytial virus



**Figure 1** Total number of bronchiolitis, asthma, and pneumonia hospitalisations among children aged 0–4 years, and total number of RSV detections from 17 virological laboratories in the Netherlands during eight RSV-season-years from 1991–92 to 1998–99. RSV-season-year: July to June.

1689–2106), or in the number of premature births (range 1402–1993) during the study period.

Finally, the bronchiolitis hospitalisations were compared with the number of RSV-LRTI admissions on the two PICUs. Although the number of PICU patients with RSV-LRTI per RSV-season-year increased significantly during the study period ( $p = 0.04$  for trend), there was no significant trend in the proportion of PICU patients compared to the bronchiolitis hospitalisations per season-year.

## DISCUSSION

The number of bronchiolitis hospitalisations in the Netherlands has increased from 1991 to 1999. An increase of bronchiolitis hospitalisations has also been reported in other countries since the 1980s.<sup>3</sup> The explanation for this is probably multifactorial. Changes in admission criteria for bronchiolitis may have played a role but are difficult to quantify. Shay *et al* suggested that an increased use of pulse oximetry in emergency departments could have contributed to the observed increase of bronchiolitis admissions in the USA.<sup>3</sup> Although no data are available on the use of pulse oximetry in children with bronchiolitis seen in emergency departments in the Netherlands, it is known that nowadays over 80% of hospitalised children with RSV bronchiolitis are monitored with pulse oximetry.<sup>4</sup>

RSV bronchiolitis has many features in common with asthma, and a diagnostic shift from asthma to bronchiolitis may have occurred during the period under study. This may have been guided by the introduction of the rapid direct immunofluorescence RSV tests that were introduced in the mid-1980s in the Netherlands. Although the prevalence of asthma in developed countries has increased during the study period, the severity of asthma and the number of hospitalisations probably did not change.<sup>5</sup> Therefore, if a diagnostic shift from asthma to bronchiolitis has largely contributed to the increase in the number of bronchiolitis admissions, a concomitant decrease in asthma hospitalisations should be expected, which is not the case. However, this should be interpreted with caution as other factors, such as standardised and improved treatment for asthma, may have influenced the number of asthma hospitalisations.

RSV is the most common cause of bronchiolitis in infancy and childhood,<sup>6</sup> and an increase in the number of RSV infections among infants may have caused the increase in bronchiolitis hospitalisations. Although the number of national RSV detections showed the same pattern as the bronchiolitis hospitalisations, this trend was not significant, making this explanation less likely.

Neither the number of patients with BPD or CHD, nor the number of premature births showed a significant change during the study period, indicating that a change in number of patients at risk for severe disease has not contributed to the increase in bronchiolitis hospitalisations.

Finally, the number of patients admitted with RSV-LRTI to the two participating PICUs did not show a proportional increase compared to the total number of bronchiolitis hospitalisations, which gives an indication that disease severity did not change dramatically during the study period.

In conclusion, there was an increase in the number of bronchiolitis hospitalisations in the Netherlands from 1991 to 1999. This increase may have an important impact on health care costs, and underscores the need for further development of an effective vaccine against RSV. In addition, national guidelines for hospitalisation indications for bronchiolitis may be important in order to limit the number of bronchiolitis hospitalisations.

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