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Increase in paediatric acute otitis media diagnosed by primary care in two Finnish municipalities – 1994–5 versus 1978–9

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SUMMARY

In recent decades, several epidemiological studies have been published on acute otitis media (AOM), indicating that the occurrence of AOM is increasing. However, the comparison between the surveys is complicated and biased by several factors, e.g. variable study demography and design and dissimilar diagnostic criteria. The present study was performed with an identical set-up in 1978–9 and 1994–5 to find out potential changes in the occurrence of AOM. All the attacks of AOM among children under 10 years diagnosed by a physician during the 12-month periods 1 June, 1978 to 31 May 1979 and 1 June 1994 to 31 May 1995 were registered retrospectively in two Finnish municipalities. The incidence rate (total number of AOM attacks per 100 child years) was 19 (95% CI 18–21) in 1978–9 and 32 (95% CI 30–34) in 1994–5. The increase in the occurrence of AOM was 68% (95% CI 53–79%, $P < 0{\cdot}001$).

INTRODUCTION

Acute otitis media (AOM), the third most common illness among children [1], consumes a large amount of medical services resources. Among the child population under 5 years of age, approximately 14 million annual office visits are made in the United States due to AOM and direct and indirect costs incurred are at least $5 billion [2].

In the United States the number of office visits under the diagnosis of otitis media have been increasing during the last 15 years for unknown reasons [3, 4]. Several epidemiological studies from Europe, undertaken in different years, also suggest an increasing trend in the incidence of AOM [5–8], although some contrasting figures have also been presented [9, 10]. Along with this increase, a shift in the age distribution of AOM patients has taken place. In the 1950s the occurrence peaked in pre-school age [5, 6], but in later studies the highest incidence rates were found among children under 24 months [11–13].

Differences in study designs, diagnostic criteria and demography made direct comparisons of the data from different surveys difficult and unreliable. To eliminate this bias, we used exactly the same methods in data collection in 1978–9 [12] and in 1994–5 to find out changes in the epidemiology of AOM in 15 years.

METHODS

All episodes of AOM in children under 10 years of age diagnosed by a physician during the 12-month periods 1 June 1978 to 31 May 1979 and 1 June 1994 to 31 May 1995 in two Finnish municipalities with the total population of about 21000, were registered. Out of that population 2921 in 1978 and 2611 in 1994 were under 10 years of age. In 1978 and 1995 51% and 53% respectively were boys. The data were collected

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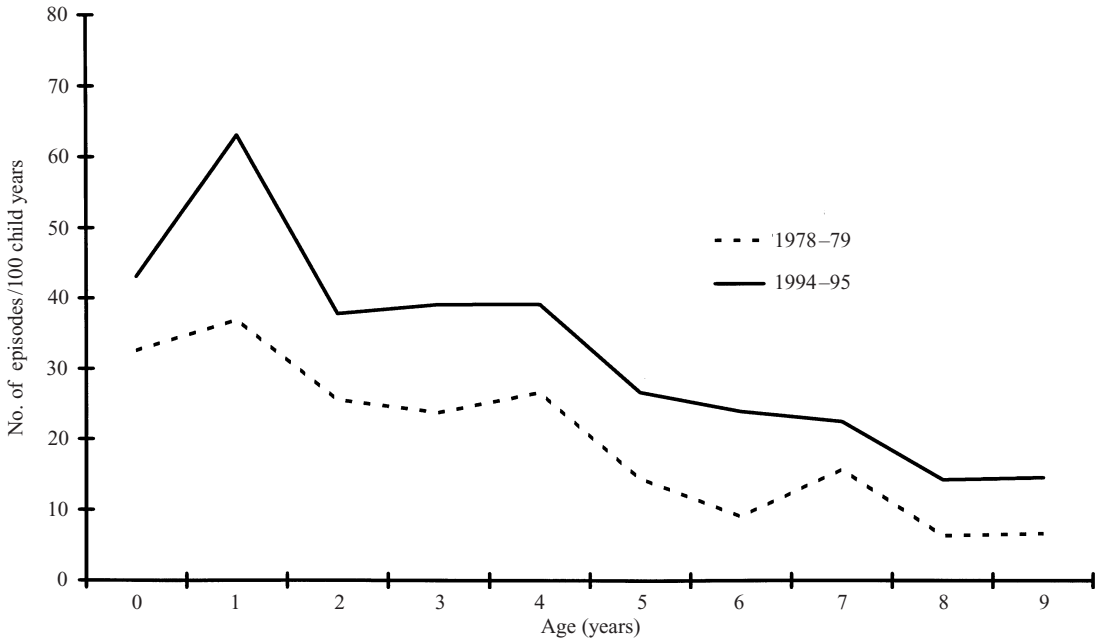

Figure 1. Occurrence of acute otitis media in 1978–9 and 1994–5.

from all available medical records in the area, Since the health care services are highly centralized in Finland, most (over 95%) AOM episodes were treated in municipal primary health care centres by general practitioners, but the registration was also compiled by relevant private medical services and local hospitals.

The primary physicians' diagnoses were checked and confirmed by one of the authors by reviewing the case reports. For a diagnosis of AOM there had to be both acute symptoms (at least one of the following: earache, ear rubbing, restless sleep, irritability, fever or other acute respiratory symptoms) and suggestive otoscopic signs (distinct redness and/or outward bulging of the tympanic membrane or, by pneumatic otoscopy, a suspicion of effusion). Acute otorrhea alone (though a spontaneously perforated tympanic membrane) also qualified for the diagnosis. The percentage of the primary physicians' AOM diagnoses which did not fulfil the criteria mentioned above was 5·2% in 1978–9 and 5·4% in 1994–5. There also had to be a minimum time period of 30 days between separate attacks, unless the patient's AOM had been judged as cured by a physician before that.

The data from 1978–9, together with the data from 1994–5, were combined to form a database, which was analysed by the SPSSWin software. Incidence figures were based on the annual census data of population in Finland [14]. Differences between the two periods were studied by cross tabulation and the χ^2-test; 95% confidence intervals (CI) were calculated for the risk differences and for the odds ratios (OR) between the two periods.

Permission for this investigation was obtained from the Ministry of Health and Social Welfare of Finland.

RESULTS

Incidence

Of the reference population under 10 years of age, 420 (14%) children in 1978–9 and 550 (12%) in 1994–5 (OR 1·6, 95% CI 1·4–1·8, $P < 0{\cdot}001$) suffered from 566 and 835 episodes of AOM respectively. The incidence rate (total number of AOM episodes per 100 child years) was 19 in 1978–9 and 32 in 1994–5 which is an increase of 68% (95% CI 53–79%, $P < 0{\cdot}001$).

Among boys, the rate was 20 in 1978–9 and 37 in 1994–5 (increase 85%, 95% CI 70–105%, $P < 0{\cdot}001$) and among girls 19 and 27 respectively (increase 42%, 95% CI 21–57%, $P < 0{\cdot}001$). The highest annual incidence of AOM was in the age group 12–24 months in 1978–9 (37, 95% CI 30–44) as well as in 1994–5 (63, 95% CI 53–73) (Fig. 1).

Recurrent attacks

In 1978–9, 26% of the children with AOM during the study year had at least one recurrent episode, the corresponding figure being 32% in 1994–5 (OR 1·4,

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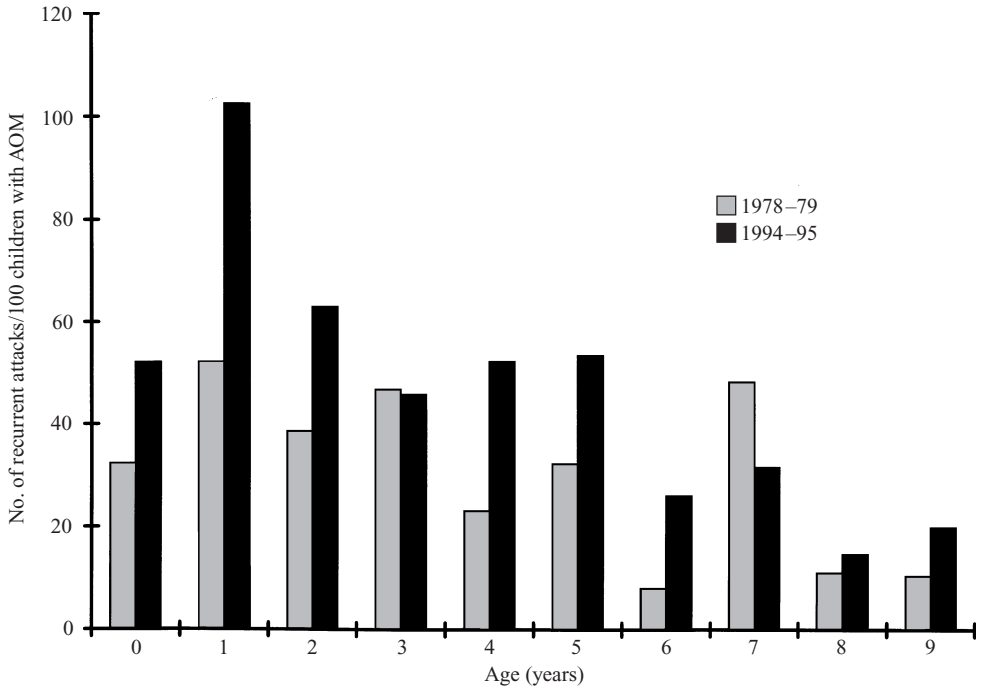

Figure 2. Recurrence of acute otitis media by age.

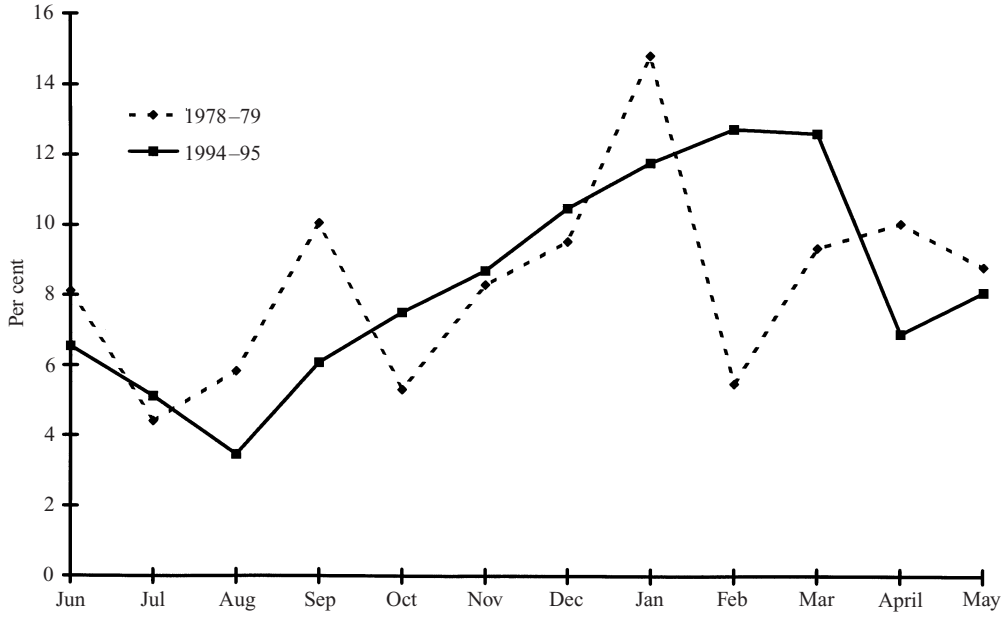

Figure 3. Seasonal variation of acute otitis media.

95% CI 1·0–1·8, $P = 0·043$). In 1978–9, 6% and in 1994–5, 13% had at least two recurrent attacks (OR 2·3, 95% CI 1·4–3·8, $P = 0·001$); 2% and 6%, respectively, experienced at least three recurrences (OR 3·7, 95% CI 1·6–8·5, $P = 0·002$). Recurrences were most common among children aged 12–24 months and increased twofold between the study periods in this age group (Fig. 2).

Seasonal variation

Most episodes of AOM occurred during the winter months in both study periods. The frequency was lowest in the middle of the summer ($P < 0·001$). There were two separate peaks in the monthly distribution of attacks in 1978–9 (September and January), while the curve of 1994–5 was more even (Fig. 3).

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DISCUSSION

Physicians as well as the public have had the feeling that the incidence of AOM is increasing. However, this has been difficult to prove because of a lack of surveys in the same populations over time. Older epidemiological studies generally tend to report lower incidence figures [5, 6, 8], but any comparison between surveys is difficult since differences in demography, diagnostic criteria and study designs influence the results. For example, cohort surveys report higher figures [7, 13, 15, 16] than cross-sectional, population-based surveys [5, 6, 9–11]. In the present study, the data collecting methods and diagnostic criteria used were identical in 1994–5 with those in 1978–9, and the geographical area was the same. We found a 68% (53–79%, $P < 0{\cdot}0001$) increase in the occurrence of AOM among children under 10 years of age (Fig. 1). The increase of recurrent attacks was especially high (Fig. 2).

The diagnosis of AOM is not always easy. In this study, most diagnoses were made by general practitioners, but the diagnostic means and tools (pneumatic otoscopy) did not change between the periods. Furthermore, medical training in Finland has been very standardized over the last decades and there is no reason to assume that the otoscopic skills of general practitioners have changed during the 15-year period. Thus the risk of systematic diagnostic bias is very low.

According to the official statistics of the study communities, the overall number of annual office visits in the study communities increased by 16·7% between the study periods. Even though the accessibility of medical emergency services in the study areas did not change between registration periods, it is possible that the children's parents consulted a physician more easily in 1994–5 than in 1978–9. Because AOM is a highly spontaneously resolved disease, controlled trials have shown that 60% of placebo treated children are free of ear pain within 24 h of presentation [17], earlier consultation can explain some, but not all, of the increase in the occurrence of AOM found in the present study. The great increase in the number of recurrent attacks is particularly surprising.

Although AOM is usually considered to be a bacterial disease, a respiratory virus infection frequently initiates acute middle ear infection and, in up to 13% of cases, a virus can be found as a single agent in middle ear fluid [18]. The changing pattern of viral diseases, particularly respiratory syncytial virus (RSV) epidemics, correlates with the occurrence of AOM [19, 20]. In the present study in 1994–5, there were no separate peaks in the monthly distribution of AOM (Fig. 3) suggesting that no major respiratory virus epidemics occurred during his period. This finding was also confirmed by the data from the Finnish national register of infectious diseases (data available from 1986–96) which reported no excessive number of RS, influenza A and influenza B virus laboratory diagnoses in the period from June 1994 to May 1995. Thus, the significant increase in the occurrence of AOM between 1978–9 and 1994–5 is not due to any incidental virus epidemic.

The most prominent worldwide changes in the bacteriology of AOM in the past 15 years have been the increasing number of β-lactamase-producing *Moraxella catarrhalis* and *Haemophilus influenzae* strains [21, 22]. Furthermore, the resistance of pneumococci is spreading [22]. In Finland, however, there has been no significant increase in the rate of β-lactamase producing *Haemophilus influenzae* isolates from middle ear fluids in children in 1978–93 [23] and resistant strains of pneumococci are rare [24]. Instead, most of the isolates of *Moraxella catarrhalis* produces β-lactamase now [23]. However, moraxella represents only about 10% of all AOM pathogens [25]. Thus, this change in resistance explains, at most, a small fraction of the change in the recurrence of AOM in the present study.

In Finland, the vaccination of infants with the conjugate polysaccharide vaccine for *Haemophilus influenzae* type b (Hib) began in 1986 and has been successful in reducing the incidence of invasive disease due to this organism [26]. Because Hib causes only about 2% of acute otitis media attacks, this vaccination cannot affect the occurrence of AOM significantly [27].

Day centre care represents the most prominent external risk factor for AOM by promoting the spread of respiratory virus infections [19, 28–30]. This risk in family day care is parallel with nursery but lower, most probably due to the smaller number of children in family day care groups [29–32]. We could not register day care attendance of individual children, but the total number of day care facilities in the study area increased from 412 in 1979 to 628 in 1995 (52% rise). Most of this increase was in family day care. At the same time, the number of children under 6 years of age decreased from 1701 to 1551. This implies that the proportion of children cared for outside the home increased even more. Over the years, the group size did not change in the day care centres but in family

care, the average number of children cared for in the same location increased from four to five. These changes obviously play the most important role in the increase of the occurrence of AOM in the present study.

Exposure to passive smoking and especially maternal smoking, increases the risk for AOM [29, 30, 33]. Although male smoking has decreased in Finland during the past two decades, smoking among women has increased [34]. According to Isohanni and colleagues (1995) smoking among pregnant women increased from 14% (1966) to 20% (1985–6) in Finland [35]. Changes in smoking habits could have affected the occurrence of AOM in the present study.

Despite a better understanding of the pathogenesis and risk factors of AOM, the occurrence of this disease seems to be increasing. Reasons for this unfortunate trend are multifactorial and can at least partly be explained by untoward development of life style and social structures. To decrease the occurrence of AOM, both medical and environmental factors, such as socio-economic legislation and health education, must be addressed.

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