Increase in hospital admissions for acute childhood asthma in Cape Town, 1978 - 1990

R. I. EHRLICH, E. G. WEINBERG

Abstract **To determine whether hospital admissions for acute childhood asthma were rising in Cape Town in line with the experience of other countries, Red Cross War Memorial Children's Hospital's records for the period 1978 - 1990 were analysed. These were compared with total admissions for non-surgical causes and lower respiratory tract illness as well as those for bronchiolitis and pneumonia. Asthma admissions showed a sharp upward trend from 1978 to 1984, a slower rise through 1987 and a levelling off since. The profile of hospital admissions for respiratory illness was also analysed. Black children were under-represented among asthma admissions compared with those for pneumonia. Asthma admissions occurred throughout the year but showed seasonal peaks in May and November. Reasons for these trends and patterns are discussed, as well as hypotheses for further research into the epidemiology of asthma in South Africa.**

S Afr Med J 1994; **84:** 263-266.

Hospitalisation rates for acute childhood asthma have been increasing in a number of developed countries in recent years.[1-6] The reasons for this trend are poorly understood. The rise may reflect a real increase in the underlying prevalence of asthma or in its severity. Alternatively, health service factors may be primarily responsible: these include better identification of the disease by doctors, changes in management practices with regard to earlier hospitalisation or readmission, increased self-referral or improved access to hospital by a larger population than previously.

Hospital-derived data are useful in assessing the demands made on health services by asthmatic children, and are an accessible source of routine information. In the absence of community-based data, examination of hospitalisation patterns may also contribute to an understanding of the epidemiology of childhood asthma.[4,7]

Red Cross War Memorial Children's Hospital is a large medical centre serving predominantly black and coloured residents of the Cape Flats, an extensive sandy plain lying to the north and east of the Cape Peninsula. The hospital functions as a tertiary (referral and teaching) centre as well as a primary medical facility for many patients who bypass local doctors and day hospitals to go straight to Red Cross.[8,9] The objective of this study was to analyse the trend in hospital admissions for acute childhood asthma during the period 1978 - 1990 inclusive, as well as the profile of admissions according to population group, sex, age and season. Admissions for acute bronchiolitis/bronchitis and pneumonia respectively were used for purposes of comparison with asthma admissions.

Departments of Community Health and Paediatrics, University of Cape Town
R. I. EHRLICH, B.BUS.SC., M.B. CH.B., D.O.H., F.F.C.H. (S.A.)
E. G. WEINBERG, M.B. CH.B., F.C.P. (S.A.)

Accepted 19 Nov 1993.

Methods

Summaries of discharge records for all lower respiratory tract (LRT) diagnoses over the period 1978 - 1990 were extracted from the hospital's computerised database. During this period the hospital used a coding system for discharges based on the 8th revision of the *International Classification of Diseases* (ICD-8); in 1988 this internal system was adjusted to accord with the ICD-9.

The records extracted were those with discharge diagnoses coded 466, 480-519 (ICD-8 and ICD-9), as well as ICD-9 code 786,09 (wheezing of uncertain cause) which was introduced as a diagnostic category in 1988. For purposes of comparison, the relevant records were further subgrouped into asthma (code 493), acute bronchitis and bronchiolitis (466) and pneumonia (480-486). Annual discharges for chronic or unspecified bronchitis (490, 491) were few and varied little from year to year, and were thus not analysed further. Preliminary analysis revealed that the diagnosis 'wheezing of uncertain cause' had an age and population group distribution closer to that of bronchiolitis than that of asthma. It was therefore excluded from further analyses of asthma admissions.

For further comparison, the annual number of non-surgical admissions to Red Cross Hospital was obtained from the hospital's annual reports. Although these totals included multiple entries for a given admission if the child moved from one unit or ward to another, they were used as a yardstick against which to evaluate changes in asthma admissions.

For the sake of uniformity, the terms *admissions* and *readmissions* are used throughout even though the records are based on discharges. For the purposes of this study, the difference is not important. A readmission is defined as a further admission in the same calendar year. Besides discharge diagnosis, the records extracted included date of admission, population group, sex and age. Population group was recorded as either coloured/Asian, black or white.

The records covered children formally admitted to both the short stay (overnight) wards and the main wards. A minority of children had more than one LRT diagnosis entered on discharge (e.g. asthma and bronchopneumonia), in which case the first diagnosis entered was used.

As the population base of the hospital, especially that of black children, was not accurately known, population rates of hospitalisation were not calculated.

Results

Fig. 1 shows the annual number of admissions for asthma, pneumonia and bronchitis/bronchiolitis over the period 1978 - 1990. The number of admissions recorded for asthma increased sharply from 1978 to 1984, more slowly through 1987, and levelled out thereafter. Asthma admissions actually fell by 24% between 1989 and 1990.

Table I examines the trend in asthma admissions as a proportion of all non-surgical admissions and LRT admissions between 1978 and 1990. During the period 1978 - 1985, asthma admissions rose faster than total non-surgical admissions; since then they have remained stable at about 10% of all non-surgical admissions.

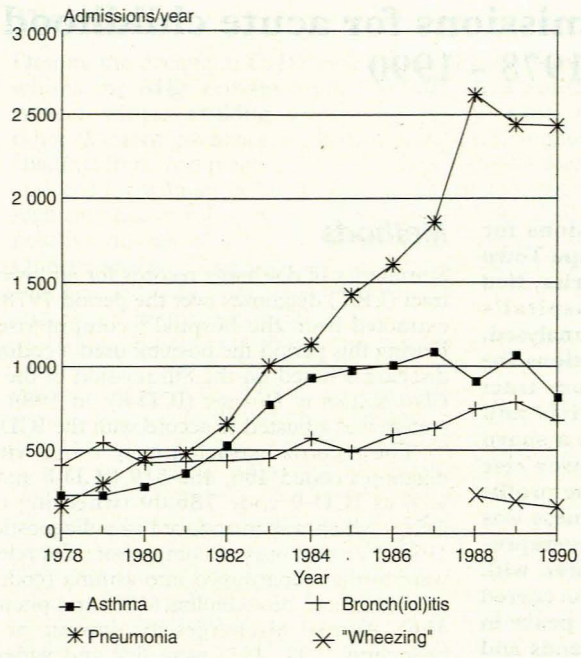

FIG. 1.
Admissions to Red Cross Hospital, 1978 - 1990: asthma and selected diagnoses.

Annual asthma admissions rose also as a proportion of LRT admissions between 1978 and 1984 (reaching a peak of 31% of the total) but declined thereafter, to about one-fifth of LRT admissions by 1990.

TABLE I.
Asthma admissions to Red Cross War Memorial Children's Hospital as a percentage of total non-surgical admissions and total admissions for lower respiratory tract illness, 1978 - 1990

	Annual asthma admissions	Percentage of all non-surgical admissions	Percentage of all LRT infection admissions
1978	238	3,8	24,3
1979	246	3,3	20,3
1980	322	4,7	23,8
1981	380	4,9	26,9
1982	508	6,7	30,3
1983	761	9,4	29,5
1984	936	10,9	31,0
1985	985	11,1	29,2
1986	1 003	10,8	27,9
1987	1 086	11,2	27,2
1988	904	8,6	19,8
1989	1 063	10,7	24,9
1990	818	8,8	19,2

LRT = lower respiratory tract.

Fig. 1 shows also that pneumonia admissions underwent a rapid increase over the same period, with a surge in 1983 and again in 1988. In contrast, bronchitis/bronchiolitis admissions have grown at a more or less steady rate, declining as a proportion of LRT admissions.

The annual admissions for asthma among coloured/Asian, white and black children were also examined. Among coloured and Asian children admissions increased from 189 in 1978 to 908 in 1989 (the peak year), a 4,8-fold increase. In contrast, while there were only 17 blacks admitted in 1978, this figure had increased to 135 by 1990, an 8-fold rise. White admissions have always been a small proportion of the total, and have been declining since 1984.

Among both asthma and pneumonia admissions, the particularly sharp increase between 1982 and 1984 (Fig. 1) suggests that a shift in data collection practice, such as a change in diagnostic or coding practice, or in the completeness of data capture, may have occurred over this period. No formal record or anecdotal evidence of such a change could be obtained. However, because of this uncertainty, admissions over the period 1984 - 1990 only were used for analyses of demographic and seasonal patterns.

Table II illustrates differences in admissions for the three LRT diagnoses by population group, sex and age. For all three diagnoses there was a male predominance, with boys comprising 55 - 60% of admissions. A marked difference by population group is also apparent. While black children made up 45% of pneumonia admissions and 33% of bronchiolitis/bronchitis admissions, they contributed only 10% on average to asthma admissions. This gap has narrowed a little over time so that by 1989/1990 black admissions made up 14% of all asthma admissions.

TABLE II.
Percentage of admissions to Red Cross Hospital for asthma, bronchiolitis,* pneumonia, and wheezing† by sex, population group and age, 1984 - 1990

	Asthma (*N* = 6 795)	Bronchiolitis (*N* = 4 517)	Pneumonia (*N* = 13 596)	Wheezing (*N* = 566)
Male	57	60	56	62
Female	43	40	44	39
Coloured/ Asian	83	61	51	65
Black	12	37	48	34
White	6	2	2	1
Under 2 yrs	20	92	75	61
2 - 4 yrs	34	6	16	27
Over 4 yrs	46	2	10	12

* Acute bronchiolitis and bronchitis.
† Wheezing of uncertain cause.

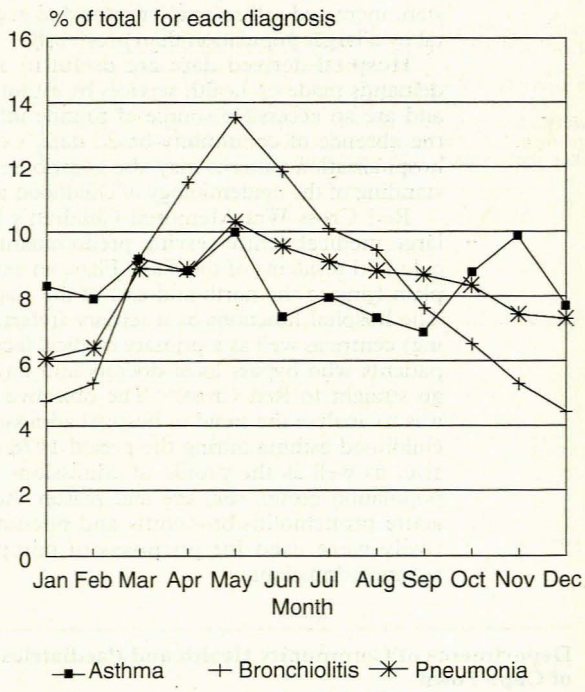

FIG. 2.
Proportion of admissions by month of admission, 1984 - 1990.

The age distribution also differed for the three diagnoses. Children admitted for asthma were older than those with other LRT disorders, with 80% over 2 years of age compared with 26% for pneumonia and 39% for bronchitis/bronchiolitis admissions.

Readmissions per calendar year were responsible for 25% of all asthma admissions in 1978, but increased considerably to about one-third of such admissions in 1984. However, since then readmissions have declined as a proportion of all asthma admissions, returning to about 25% in 1990.

The variations of proportion of admissions by month for asthma, pneumonia and bronchiolitis are compared in Fig. 2 for the period 1984 - 1990. All three diagnoses showed a peak in May (autumn), with bronchiolitis displaying the steepest rise and fall. In addition, there was a second peak in November among asthma admissions.

Discussion

While restriction of the study to a single hospital limits generalisability, the importance of Red Cross Hospital in the treatment of childhood illness in the Cape Town area makes its admission patterns useful as sentinel data, indicative at least of regional trends. However, it is questionable whether the observed increase in hospital admissions for acute asthma between 1978 and 1987 is real or merely reflects improvements in recordkeeping or changes in coding/diagnostic usage. The discharge recording system has reportedly improved in accuracy and completeness in recent years (personal communication — Dr M. Power) so that recent data are likely to be superior to earlier information. This should not, however, have affected asthma admissions selectively. The rise in asthma admissions as a proportion of all nonsurgical admissions suggests that the trend was not due to improved recording alone.

A change in the practice of hospital doctors over time may, however, have been a source of diagnostic shift from bronchiolitis and bronchitis to asthma. This might have been so, especially in the early 1980s when an education campaign directed at junior doctors was mounted in the hospital. The failure of admissions for bronchitis/bronchiolitis to rise between about 1980 and 1983, when asthma admissions increased rapidly, supports this hypothesis.

It is likely, however, that at least part of the increase in asthma admissions is real, in keeping with trends elsewhere, and it is thus necessary to examine what forces might underlie such an increase.

The most important demographic change in Cape Town over the period considered has been a rapid increase in the black population. The official census figures for Cape Town (planning region 01) shows a rise in the number of blacks from about 13% of the total population (225 000) in 1980 to 25% (about 500 000) in 1990 (personal communication — Technical Management Services, Cape Town City Council). Concomitantly, the number of black people younger than 15 years of age was estimated to have increased from about 62 000 to 140 000 between 1980 and 1990, i.e 2 - 3-fold. The increase in annual black admissions for asthma which rose from 17 (6% of total asthma admissions) in 1978 to 135 (16%) by 1990 must thus be due at least partly to the larger black population in the region.

In contrast, there was no increase in the coloured and Asian populations under 15 years of age in Cape Town between 1980 and 1990 (about 294 000 in total). The increase in coloured and Asian admissions for asthma cannot therefore be explained by population pressure.

Other than population shifts, there are a number of community influences which might have resulted in increased hospitalisation for asthma independently of an increase in prevalence or severity of the disease. These factors include improved parental education about asthma and greater ascertainment of the disease by practitioners. There is no direct evidence for or against any of these trends in Cape Town in the 1980s. An increase in self-referral may have been partly responsible for the increase noted. It is well recognised that many parents bring their children directly to Red Cross Hospital in cases of acute asthma. This reflects greater faith in Red Cross Hospital's ability to manage the problem and, concomitantly, some ambivalence about local acute paediatric care services, both during and after hours. This increase in self-referral as a factor in increased hospital admissions was also noted in England and Wales during the 1970s.[4] Better-off parents with access to general practitioners may be less likely to bring the child to Red Cross Hospital for acute asthma care during the day, but even they show a preference for Red Cross Hospital overall (M. Martin, A van Huysteen, student project, Department of Community Health, 1992).

In the second half of the 1980s there may have been an increasing tendency for children to be admitted to private medical facilities as a result of greater medical aid coverage and the growth of the private hospital sector.[10] This may account for the decrease in admissions among white and to a lesser extent coloured children during the late 1980s. Alternatively, increased use of outpatient bronchodilator nebulisers as well as short-course corticosteroids may have contributed to the decline in hospital admissions in recent years. Adverse economic pressures on hospital doctors to raise the threshold for admission may have reinforced this trend.

Given the multiplicity of factors influencing admissions, it is not possible to make inferences about changes in the community prevalence of childhood asthma from hospital data. Although increases in the prevalence of childhood asthma have been found in a number of countries,[11-13] there is at present no published evidence for such trends locally, and confirmation or otherwise must await careful population studies.

Of particular interest is whether the prevalence of asthma among black children is rising as succeeding birth cohorts spend more of their early childhood (or are born) in urban areas. Indirect evidence for this effect of urbanisation was originally suggested locally by Van Niekerk *et al.*[14] who in 1979 found a prevalence of 0,14% of bronchial hyperresponsiveness on exercise challenge among pre-teen children in the Transkei, compared with a 3% prevalence among children in Guguletu. However, a recent study of pre-teen and teenaged Transkeian children[15] using histamine challenge testing, showed a prevalence of bronchial hyperresponsiveness of 14% and a 6% prevalence of clinical asthma. This suggests that the situation has either changed over the last decade, or is complicated by the incommensurability of different techniques for measuring asthma.

Apart from changes in prevalence, a trend toward increased severity of asthma may be reflected in more frequent acute attacks or greater severity of attacks. Only indirect indicators of severity can be evaluated in our data. One of these is the ratio of readmissions to total admissions in each year. Readmissions rose from 25% of all asthma admissions in 1978 to 36% in 1984, and declined to 26% by 1990. This pattern may reflect changes in the outpatient management of asthma and the threshold for readmission, however, rather than a changing frequency of attacks.

An independent indicator of severity can be obtained by examining deaths among children in Cape Town.

Between 1983 and 1990 there were only 12 deaths from asthma among children under 14 years of age recorded on death certificates collected in the greater Cape Town area (Cape Town City Council — unpublished data). No secular trend was apparent.

Over and above secular trends, seasonality in asthma admissions may provide clues to major environmental precipitants of acute attacks or increased bronchial hyperresponsiveness.[16] In Cape Town there is an underlying perennial pattern of asthma admissions with two superimposed peaks. The first is in May which coincides with the Cape autumn. Different factors may operate here. Temperatures fall below 15°C, and calm days are more frequent with accompanying temperature inversions and peaks in air pollutants such as oxides of nitrogen.[17] The key factor may, however, be an increase in viral infections; these have been shown to be associated with acute asthmatic episodes.[18,19] The coincidence of the bronchiolitis and asthma peaks in May in Cape Town is consistent with a viral precipitant of both acute illnesses.

The second peak of asthma admissions in November requires a different explanation. Among the pollens, grass pollen counts peak in November, while of the moulds, *Epicoccum* shows a November peak.[20] However, descriptive studies of immediate hypersensitivity among asthmatic children in Cape Town have shown that responses to house dust and house-dust mite antigens predominate, with relatively smaller proportions of children showing a response to grasses and moulds.[20,21] House-dust mite counts have been shown to display some seasonality and there is preliminary evidence that these counts may peak in Cape Town in November (personal communication — P. Potter).

Finally, the predominance of male admissions is a commonly observed feature of asthma and is likely to reflect underlying prevalence. An interesting finding, however, was the strong male predominance in admissions for both pneumonia and bronchitis/bronchiolitis. Although noted in some studies, this male predominance does not seem to be an established epidemiological feature of acute respiratory infections.[22] In Cape Town at least, young girls appear less prone to develop severe acute respiratory infections or, for some reason, less likely to be admitted to hospital if they do suffer such illness.

Conclusion

In recent years there have been about 900 asthma admissions to Red Cross Hospital annually, or 2 - 3 daily on average. Recorded asthma admissions showed a sharp rise between 1978 and 1984, but since then have levelled out and may even be falling. Changes in medical practice and parental behaviour are likely to have played an important role in the increase in the early 1980s and it is therefore not possible to make inferences about changes in population prevalence or severity of asthma. Similarly, forces of a general nature affecting hospital admissions may have been responsible for the recent decline in asthma admissions.

Asthma remains, however, the most common chronic disease requiring admission to Red Cross Hospital, and sound population-based studies to determine whether the South African experience accords with that elsewhere are needed. Such research should be linked to a study of medical care utilisation patterns by asthmatic children, with a view to devising optimal strategies for education and care of such patients at the local level so as to relieve pressure on tertiary hospital services. The opportunity to study the effects on asthma of urbanisation and migration[23] should add further impetus to the carrying out of local epidemiological research.

We are grateful to the medical superintendent of Red Cross War Memorial Children's Hospital for permission to use hospital information, to Ms Vera da Silva and her colleagues at the Department of Medical Informatics for extracting the admissions data, and to Ms Diane du Toit and Dr R. Marshall for extracting totals from the annual reports. The study benefited from the work done by Tim Truluck as part of his M.A. thesis on a related topic, and from discussions with Dr M. Power on the quality of the data. Funding for this research came from Fisons Pharmaceuticals, the Coleman Bequest, the Faculty of Medicine and the Cooper Lowveld Fund, University of Cape Town.

REFERENCES

1. Khot A, Burn R, Evans N, Lenney W. Seasonal variation and time trends in childhood asthma in England and Wales. *BMJ* 1984; **289:** 235-237.
2. Halfon N, Newacheck PW. Trends in the hospitalization for acute childhood asthma, 1970-84. *Am J Public Health* 1986; **76:** 1308-1311.
3. Evans R, Mullaly DI, Wilson RW, *et al.* National trends in morbidity and mortality of asthma in the US. *Chest* 1987; **91:** suppl, 65s-74s.
4. Anderson HR. Increase in hospital admissions for childhood asthma: trends in referral, severity and readmissions from 1979 to 1985 in a health region of the United Kingdom. *Thorax* 1989; **44:** 614-619.
5. Gergen PJ, Weiss KB. Changing patterns of asthma hospitalization among children: 1979 to 1987. *JAMA* 1990; **264:** 1688-1692.
6. Wever-Hess J, Wever AMJ, Yntema JL. Mortality and morbidity from respiratory diseases in childhood in the Netherlands, 1980-1987. *Eur Respir J* 1991; **4:** 429-433.
7. Anderson HR, Balley P, West S. Trends in the hospital care of acute childhood asthma 1970-8: a regional study. *BMJ* 1980; **281:** 1191-1194.
8. Lachman PI, Stander IA. Patterns of referral to Red Cross War Memorial Children's Hospital, Cape Town. *S Afr Med J* 1990; **78:** 404-408.
9. Strebel PM, Lachman PI, Painter ML, Stander IA, Ireland J. Utilisation of outpatient services at Red Cross War Memorial Children's Hospital, Cape Town. *S Afr Med J* 1990; **78:** 408-412.
10. Broomberg J, Chetty KS, Masobe P. The role of private hospitals in South Africa. Part I. Current trends. *S Afr Med J* 1992; **82:** 329-334.
11. Shaw RA, Crane JA, O'Donnell TV, Porteous LE, Coleman ED. Increasing asthma prevalence in a rural New Zealand adolescent population: 1975-1989. *Arch Dis Child* 1990; **65:** 1319-1323.
12. Burney PGJ, Chinn S, Rona RJ. Has the prevalence of asthma increased in children? Evidence from the national study of health and growth. *BMJ* 1990; **300:** 1306-1310.
13. Robertson CF, Heycock E, Bishop J, Nolan T, Olinsky A, Phelan PD. Prevalence of asthma in Melbourne schoolchildren: changes over 26 years. *BMJ* 1991; **302:** 1116-1118.
14. Van Niekerk CH, Weinberg EG, Shore SC, Heese HDeV, Van Schalkwyk DJ. Prevalence of asthma: a comparative study of urban and rural Xhosa children. *Clin Allergy* 1979; **9:** 319-324.
15. Vermeulen J. Airway hyperresponsiveness. *Respiratory Focus* 1990; **2:** 6-8.
16. Goldstein IF, Currie B. Seasonal patterns of asthma: a clue to aetiology. *Environ Res* 1984; **33:** 201-215.
17. Truluck TF. Hospital admission patterns of childhood respiratory illness in Cape Town and their association with air pollution and meteorological factors. Unpublished M.A. thesis: Department of Environmental and Geographical Science, University of Cape Town, April 1993.
18. Pattemore PK, Johnston SL, Bardin PG. Viruses as precipitants of asthma symptoms. I. Epidemiology. *Clin Exp Allergy* 1992; **22:** 325-336.
19. Potter PC, Weinberg E, Shore SCL. Acute severe asthma. A prospective study of the precipitating factors in 40 children. *S Afr Med J* 1984; **66:** 397-402.
20. Potter PC, Berman D, Toerien A, Malherbe D, Weinberg EG. Clinical significance of aero-allergen identification in the western Cape. *S Afr Med J* 1991; **79:** 80-84.
21. Van Niekerk CH, Shore SC, Weinberg EG. The house-dust mite and childhood asthma in the Cape Peninsula. *S Afr Med J* 1977; **52:** 74-75.
22. Graham NHM. The epidemiology of acute respiratory infections in children and adults. *Epidemiol Rev* 1990; **12:** 149-178.
23. Gregg I. Epidemiological aspects. In: Clark TJH, Godfrey S, eds. *Asthma.* 2nd ed. London: Chapman & Hall, 1983.