Age and sex distribution of adult asthma admission
A study of the five-year cumulative prevalence

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ABSTRACT: Objective - to describe the age and sex distribution of adult patients (ages 15-59) in Malta, admitted because of severe acute asthma.

Design - retrospective review of all acute adult asthma admissions to determine the 5-year cumulative prevalence of acute asthma admission.

Setting - all adult medical admissions from 1989 to 1993 to St. Luke's Hospital, the only acute medical facility serving the whole of the island of Malta.

Results - in 1993, 304 patients in the 20-59 age group were admitted at least once in five years. The distribution of the age specific five year cumulative prevalence of asthma admission is a U shaped curve (p<0.001). The first peak is in the 20-24 age group 245.8 per 100,000 (95% CI:309.2-182.3) and the second peak is in the 55-59 age group 246.7 per 100,000 (95% CI:322.1-171.3). A trough is present in the 35-39 age group, 100.1 per 100,000 (95% CI:137.9-62.3). Of the whole 20-59 age group, 61.8% are female (p<0.01). This female predominance is most evident in the 30-39 and 40-49 age groups, 64.1% (p<0.05) and 73.2% (p<0.01) respectively. In the 20-59 age group, 69% of male patients were admitted only once in five years, 29.3% 2-5 times and 1.7% more than five times as compared to 66%, 29.8% and 4.2% respectively in females.

Conclusion - The female predominance in adult asthma admission rates reflects a larger number of female patients who require hospital admission rather than higher admission rates per person in females as compared to males.

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Introduction

Although acute severe asthma is one of the most common causes for hospital admission in young and middle aged adults, only a few papers have been published on the age and sex distribution of asthma hospital admission. The greatest difficulty with such epidemiological studies is determining the exact denominator population from which such admissions arise. Two papers have looked at the asthma admission rate in the whole Finnish[1] and Danish[2] populations respectively. A system of computerized personal identification numbers in these countries made these studies feasible.

Both these studies suggest that adult asthma admission rates are higher in females. A similar gender distribution was also noted in the United States[3,4]. However, in a study in Lombardy, Italy[5], there appeared to be no difference between male and female admission rates for adults.

The above studies measured admissions rather than individual patients. Skobeloff et al[6] in south eastern Pennsylvania opted to count every patient once every year and obtained similar results. The aim of the study presented here was to establish whether the higher female admission rate is due to a larger number of female patients requiring admission or due to a higher admission rate per patient in females as compared to males. For this reason every patient was counted only once every five years. To be included in the study at the end of 1993, a patient would have to have been admitted to hospital with asthma at least once in the preceding five years.

Patients and methods - the study population

The study was conducted on the island of Malta. Every individual residing permanently on the island has a personal identification number, so accurate population data for the years 1989-93 was available[7]. The population of the sister island, Gozo, was excluded from the study.

Acute asthma hospital admissions

All acute asthma patients presenting to hospital are seen by casualty medical officers. However, all admissions are reviewed by registrars or senior registrars before entry. Casualty officers personally enter the diagnosis and the main reason for admission on a special register. The admission diagnosis of asthma was based on the guidelines of the International Classification of Diseases, Ninth Revision (ICD 9)[8] code 493.0.

A team of four doctors manually reviewed the registers covering all acute medical admissions from January 1st 1989 to 31st December 1993. All admissions where acute asthma was the principal reason for admission were recorded. Cases where asthma was not the main

reason for admission, or where it was not clear whether the problem was bronchitis or acute asthma, were not included. The age, gender, identification number and date of admission were recorded for all cases.

Data for children under 14 years of age on the day of admission were not available as these children are seen in a separate paediatric department. Patients over 59 years of age in the year of admission were excluded because of the decreased reliability of the diagnosis of asthma. All foreign patients residing temporarily on the island, i.e. no personal identification number, were excluded. These data were entered into a computer database (dbaseIV 1.5) for analysis.

Five-year cumulative prevalence

Any patient admitted during the study period was counted only once irrespective of the number of admissions. The age was calculated by subtracting the birth year from 1993. The population on 31st December 1993[7] was used as denominator for age and gender stratification. In determining the cumulative prevalence of the 20-29 age group, admissions which had occurred from 1989 to 1992 when the patient would have been under 20 years of age, were taken into consideration. For each patient the number of admissions from 1989 to 1993 was determined.

Admissions per capita

The number of admissions for every patient was calculated. Patients were divided into three groups, representing one admission, two to five admissions and more than five admissions in five years. Although separation into smaller groups is, in theory, preferable, the numbers would have been too small for proper statistical analysis when comparing males with females.

Although the number of patients with more than five admissions was very small, they accounted for a large proportion of the admissions. It was decided to eliminate these patients from the analysis of patients with multiple admissions to avoid serious bias to the otherwise large group of patients with multiple admissions.

Statistics

A goodness of fit x^2 test was performed comparing the measured crude cumulative 5-year prevalence in each five year age group with random distribution. A simple paired t-test was used to compare the measured gender distribution with the expected sex distribution as based on the demographic data. A t-test was also used to compare the male and female rates for the distribution of patients by number of admissions.

Results

From 1st January 1989 to 31st December 1993 there were 696 admissions for severe acute asthma to St. Luke's Hospital in the 15-59 age group. The age specific 5-year cumulative prevalence rates for asthma admission in 5-year age groups from 20 to 59 years of age are shown in Table 1 and Figure 1. A U shaped curve is observed with the highest rates in the youngest and

Age*	(n)	Population*	Prevalence(95%CI)**
20-24	57	23,191	245.8	(309.2 -182.3)
25-29	32	22,231	143.9	(193.5 -94.3)
30-34	39	26,572	146.8	(192.8 -100.8)
35-39	27	26,960	100.1	(137.9 -62.3)
40-44	47	26,767	175.6	(225.8 -125.2)
45-49	35	28,300	123.7	(164.7 -82.7)
50-54	26	15,823	164.3	(227.4 -101.2)
55-59	41	16,618	246.7	(322.1 -171.3)

Table 1. Age distribution of 5 year cumulative prevalence of Asthma hospital admission 1989-93. (n=304)
$x^2=26.38$, df=7, p=0.001
*on 31st December 1993
**per 100,000 population

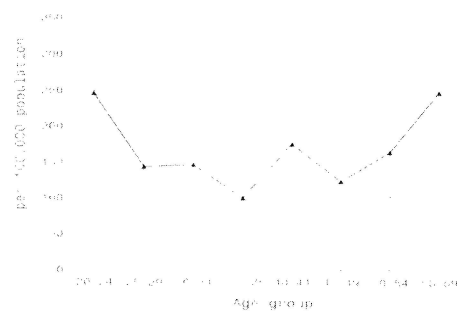oldest age groups. ($x^2 = 26.38$, at 7 degrees of freedom p<0.001).

Figure 1. Age specific 5 year cumulative prevalence of Asthma admission (1989-93).

Figure 2 shows the gender distribution by age group of the cumulative 5-year prevalence of acute asthma admissions. In Table 2, the observed sex distribution of the 5-year cumulative prevalence of acute asthma admission is compared with predicted values based on demographic data. When the whole 20-59 age group is taken into consideration, there is a statistically significant female predominance in the cumulative prevalence. This is more evident in the 30-39 and 40-49 age groups. Although a female predominance is also present in the 20-29 age group, this fails to reach statistical significance probably because the numbers are too small. In the 50-59 age group, there is no significant difference between males and females.

In Figure 3, data is presented in three groups, each group representing the number of admissions per patient in five years. There is no statistically significant difference between male and female rates. However,
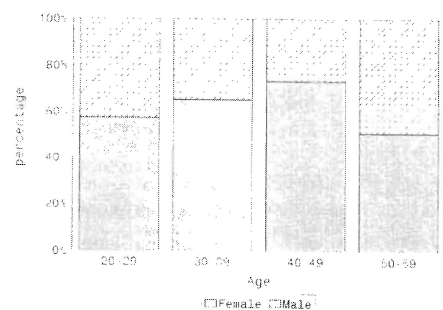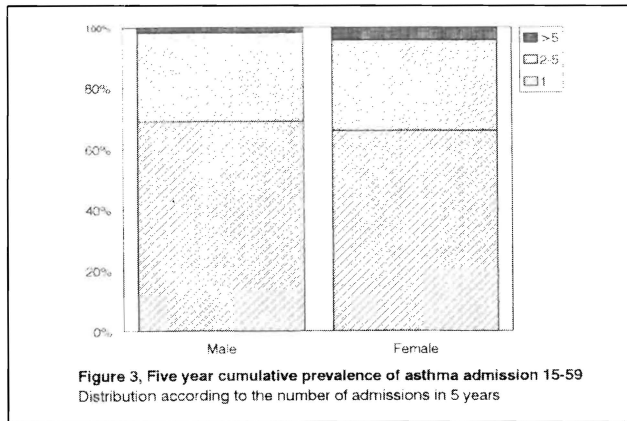

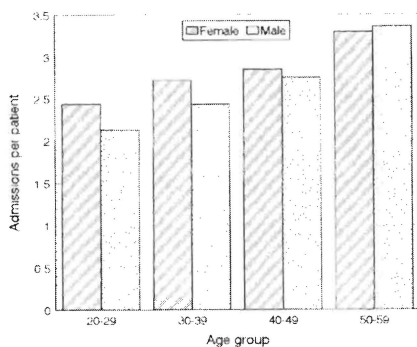Figure 2. Five year cumulative prevalence of Asthma admission. Gender distribution by age group.

Age*	Population*		Crude 5 year prevalence			Predicted values		P value
	Male	Female	Total	Male (%)	Female (%)	Male (%)	Female (%)	
20-29	23,061	22,061	89	38 (42.7)	51 (57.3)	45.8 (51.4)	43.2 (48.6)	NS**
30-39	27,473	26,059	66	23 (35.9)	43 (64.1)	33.9 (51.3)	32.1 (48.7)	p<0.05
40-49	27,588	27,479	82	22 (26.8)	60 (73.2)	41.1 (50.1)	40.9 (49.9)	p<0.01
50-59	15,521	16,920	67	33 (49.3)	34 (50.7)	32.0 (47.8)	35.0 (52.2)	NS
20-59	93,943	92,519	304	116 (38.2)	188 (61.8)	153.2 (50.4)	150.8 (49.6)	p<0.01

Table 2. Gender distribution by age group of the crude 5 year cumulative prevalence of Asthma admission (1989-93).
*as on 31st December 1993
**NS not significant

Figure 3, Five year cumulative prevalence of asthma admission 15-59
Distribution according to the number of admissions in 5 years

Figure 4 shows that there is a gradual increase in the number of admissions per capita with increasing age in both males and females in those patients admitted between two and five times in five years. However, once again, there is no significant difference between sexes in the admission rates per person in each age group.

Figure 4. Admissions per patient in five years
in patients with 2-5 admissions

Discussion

In this paper, data on asthma admission from 1989 to 1993 is presented as the 5-year cumulative prevalence. Using this method, patients rather than admissions are counted. The two Scandinavian papers[1,2] have looked only at the admission rates without determining the yearly prevalence, i.e. the number of patients per year. Furthermore, in the Maltese study, every patient is counted only once in five years, rather than once every year of admission as in the South Pennsylvania study[6].

The distribution of patients by age is U shaped. A progressive decrease in childhood onset asthma followed by a progressive increase in the prevalence of adult onset asthma would explain the two limbs of the U-shaped curve. This confirms the results of the Danish

study [2]. However, the data from the Maltese study would suggest that the higher admission rate in the older age group is more likely to be due to the larger number of patients requiring acute asthma admission rather than more frequent admissions per patient. Although there appears to be a higher admission rate per capita in the older age groups, this is too small to account for the higher prevalence in the older age groups by itself.

The distribution of admissions per patient is the same in both sexes. This suggests that the higher admission rate in females is due to a larger number of different patients requiring admission rather than a higher admission rate per capita in females as compared to males. In the 50-59 age group, males appear to catch up with females both in the 5-year cumulative prevalence and admission rate. This was observed in the Danish[2] but not in the South Pennsylvania[6] study.

The gender distribution in Malta follows a very similar pattern to that of the 5-year cumulative prevalence of patients suffering from asthma and not requiring admissions in the Tucson community[9,10]. Again, in this study males appeared to catch up with females in the 50-59 age group. A comparable age and sex distribution for the prevalence of asthma in the general population was also described in Minnesota[11].

It is not known why severe asthma is commoner in females, however hormonal differences of asthma in pregnancy have been proposed[6]. However, it is possible that males catch up with females in the older age group, because smoking related illness is commoner in the older age groups. Although no data on smoking were available in this study, it is possible that a number of patients with smoking related wheezy bronchitis could have been wrongly diagnosed as asthma. However, in the Tucson study[9,10], where patients were thoroughly evaluated, prospectively, the same pattern of increased male asthma prevalence in the older age groups was present even when smoking was excluded. This would suggest that there are other, yet undetermined factors accounting for the rise in prevalence in males in the older age groups.

Conclusion

The 5-year cumulative prevalence of acute asthma admission for adults aged 20-59 in the island of Malta has been determined from 1989 to 1993. Although this study has a different epidemiological approach to three other important studies in determining the age and sex distribution of acute asthma admission, the results are very similar.

A U shaped distribution of the age specific 5-year cumulative prevalence is present. The higher female admission rates are the result of a higher prevalence of female asthma patients requiring admission rather than to more severe asthma with more frequent exacerbations per patient in females as compared to males.

Acknowledgements

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