

THE EPIDEMIOLOGY OF ASTHMA AND HAY FEVER IN A TOTAL COMMUNITY, TECUMSEH, MICHIGAN

II. The Relationship Between Asthma and Hay Fever

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(Reporting for the Research Staff of the Tecumseh Community Health Study)*

MANY authors have stated that asthma occurs in a range of from 22 to 75 per cent (mean, 43 per cent) of persons having hay fever.¹⁻²⁴ This information is based on the clinical experience of physicians having a special interest in this type of disorder and is generally found in a context which implies that if persons having hay fever are not treated with allergenic extracts they are quite likely to develop asthma at a later time. Although it is undoubtedly true that a large proportion of persons with hay fever seen by allergists have asthma, the question can be raised as to whether or not it is valid to extend to all persons having hay fever generalizations made from such highly selected experience; as allergists may tend to see the more serious hay fever cases, this could lead to their having a distorted picture of the natural history. It, therefore, appeared desirable to examine the relationship between asthma and hay fever as found in the population of Tecumseh, Michigan. The Tecumseh Community Health Study was described in Part I of this report.

The data to be presented are somewhat in keeping with clinical experience in demonstrating that asthma and hay fever frequently occur in the same persons. However, the relationship which this study defines between the onset of these two diseases is somewhat different from that generally accepted. The data also imply that allergists may be exposed to a segment of the hay fever population in which the prevalence of asthma is disproportionately high.

RESULTS

A history of both asthma and hay fever was found in 128 persons of the more certain groups and 254 of the combined (Table I). These data demon-

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strate that asthma and hay fever occurred in the same persons considerably more often than either was separately diagnosed in the general population.

If this frequent association were on the basis of hay fever being followed at a later time by asthma, there are several relationships which the available data might be expected to show, but do not. There was no appreciable rise in the frequency of the onset of asthma following the peak for hay fever (Fig. 1).

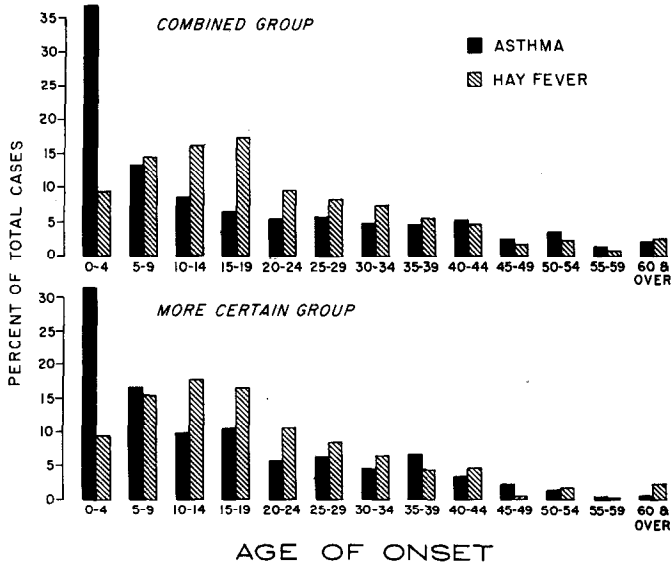


Fig. 1.—The distribution of age at onset for all persons with a history of asthma is compared with that of all persons with a history of hay fever.

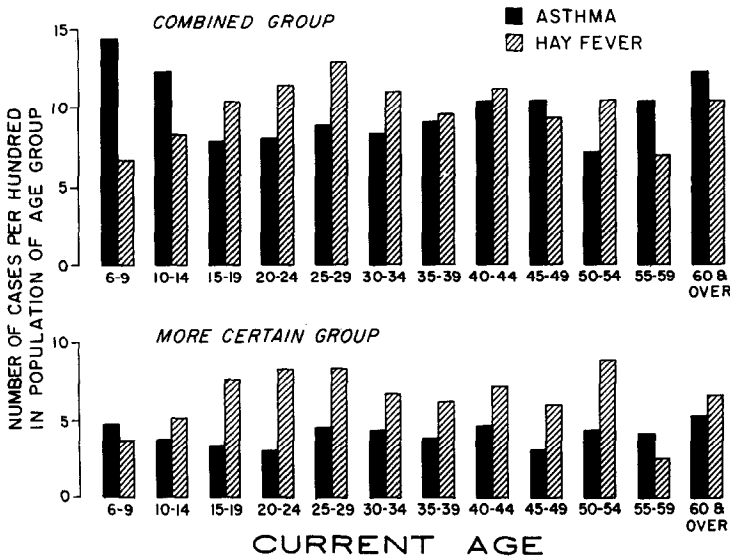


Fig. 2.—The age-specific cumulative prevalence of all persons with a history of asthma is compared with that of all persons with a history of hay fever.

TABLE I. THE NUMBER AND CUMULATIVE PREVALENCE IN THE GENERAL POPULATION OF PERSONS HAVING A HISTORY OF BOTH ASTHMA AND HAY FEVER*

	MALE	FEMALE	TOTAL
<i>More Certain Group</i>			
Number having asthma + hay fever	56	72	128
Cumulative prevalence, asthma + hay fever in general population	1.6	2.0	1.8
Cumulative prevalence, asthma in hay fever population	26.3	31.9	29.2
Cumulative prevalence, asthma in general population	4.0	4.1	4.1
Cumulative prevalence, hay fever in asthma population	40.9	48.6	44.9
Cumulative prevalence, hay fever in general population	6.3	6.3	6.3
<i>Combined Group</i>			
Number having asthma + hay fever	113	141	254
Cumulative prevalence, asthma + hay fever in general population	3.3	3.9	3.6
Cumulative prevalence, asthma in hay fever population	35.1	39.3	37.3
Cumulative prevalence, asthma in general population	10.6	9.7	10.2
Cumulative prevalence, hay fever in asthma population	31.3	40.3	35.7
Cumulative prevalence, hay fever in general population	9.5	10.0	9.7

*The cumulative prevalence of asthma in the hay fever population is compared with that of asthma in the general population; similarly, the cumulative prevalence of hay fever in the asthma population is compared with that of hay fever in the general population. The prevalence rates are expressed as number of affected persons per hundred members of the population in the respective groups.

Similarly, while there was a twofold rise in the cumulative prevalence of hay fever in the general population between the current age groups of 6 to 9 and 25 to 29 years, there was no corresponding rise in the rate of asthma (Fig. 2). Most important, there was no rise in the cumulative prevalence of asthma in the successive current age groups of the hay fever population (Table II).

TABLE II. THE CUMULATIVE PREVALENCE OF ASTHMA IN SUCCESSIVE AGE GROUPS OF THE HAY FEVER POPULATION*

	MALE		FEMALE		TOTAL	
	NO. WITH A. + H.F.	CASES PER 100 H.F.	NO. WITH A. + H.F.	CASES PER 100 H.F.	NO. WITH A. + H.F.	CASES PER 100 H.F.
<i>More Certain Group</i>						
6-14	12	29.3	13	37.1	25	32.9
15-24	8	20.0	11	26.8	19	23.5
25-34	13	32.5	17	30.4	30	31.3
35-44	9	28.1	9	19.6	18	23.1
45 and over	14	23.3	22	45.8	36	33.3
Totals	56	26.3	72	31.9	128	29.2
<i>Combined Group</i>						
6-14	28	43.1	35	53.8	63	48.5
15-24	18	34.6	22	36.7	40	35.7
25-34	23	34.3	29	33.7	52	34.0
35-44	16	30.2	21	30.9	37	30.6
45 and over	28	32.9	34	42.5	62	37.6
Totals	113	35.1	141	39.3	254	37.3

*The recorded figures represent the number and per cent of persons with a history of hay fever who also had a history of asthma.

TABLE III. THE ONSET SEQUENCE OF ASTHMA AND HAY FEVER IN PERSONS WITH A HISTORY OF BOTH DISEASES*

	MORE CERTAIN GROUP					
	MALE		FEMALE		TOTAL	
Number with asthma + hay fever	56		72		128	
Known sequence	38		49		87	
	NO.	%	NO.	%	NO.	%
Hay fever first	7	18.4	13	26.5	20	23.0
Asthma first	14	36.8	9	18.4	23	26.4
Onset in same year	17	44.7	27	55.1	44	50.6
Total	38	99.9	49	100.0	87	100.0
	COMBINED GROUP					
	MALE		FEMALE		TOTAL	
Number with asthma + hay fever	113		141		254	
Known sequence	56		68		124	
	NO.	%	NO.	%	NO.	%
Hay fever first	8	14.3	20	29.4	28	22.6
Asthma first	21	37.5	17	25.0	38	30.6
Onset in same year	27	48.2	31	45.6	58	46.8
Total	56	100.0	68	100.0	124	100.0

*These persons are divided into three sequence categories and the number in each is expressed as a per cent of the total persons in each group in whom the onset sequence was known.

These negative findings are in keeping with those obtained from examining the onset sequence of asthma and hay fever in persons having a history of both diseases (Table III). Of persons in whom the onset sequence was known, either asthma was present alone initially or the two diseases began within the same year of age in approximately 75 per cent. Table IV shows that in persons with hay fever who were at risk to develop asthma (i.e., those in whom asthma was not present beforehand or the two did not begin within the same year of age), asthma subsequently developed in only 5 to 10 per cent. Although the rates appear to be somewhat higher in females than males, they are not significantly different (chi square values have p levels greater than 0.05).

The possibility was considered that treatment which might prevent complications of hay fever may have been given to a large enough segment of this hay fever population to have obscured the anticipated relationship with asthma. In Part I it was shown that treatment information was available in 82 to 91 per cent of persons having a history of hay fever, 18 to 23 per cent of whom reported injection therapy. Table V shows further that, of the group answer-

TABLE IV. THE CUMULATIVE PREVALENCE OF ASTHMA FOLLOWING HAY FEVER IN THE HAY FEVER POPULATION AT RISK

	MORE CERTAIN GROUP			COMBINED GROUP		
	MALE	FEMALE	TOTAL	MALE	FEMALE	TOTAL
No. with asthma after hay fever	7	13	20	8	20	28
No. with hay fever at risk (onset known)	134	145	279	179	204	383
Cumulative prevalence asthma per 100 hay fever at risk	5.2	9.0	7.2	4.5	9.8	7.3

ing the question on treatment, 12 to 16 per cent reported injection therapy alone, and 4 to 9 per cent indicated injection therapy and skin tests. Although these data demonstrate that only a minority of the hay fever population received treatment which might potentially prevent asthma, this group could limit any conclusions regarding this point. However, of the total hay fever group reporting injection therapy alone, 51 to 53 per cent had a history of asthma, and of the total number reporting injection therapy and skin tests, 62 to 79 per cent had a history of asthma (Table VI). It was stated in Part I that the term "injection therapy" was not restricted to the administration of allergenic extracts. Since less than half of the persons reporting this form of therapy were in a position in which asthma could potentially be prevented, there was little opportunity for injection therapy to appreciably alter the natural frequency of complicating asthma in this hay fever population.

TABLE V. PERSONS WITH A HISTORY OF HAY FEVER WHO REPORTED INJECTION THERAPY ARE SUBDIVIDED INTO THOSE REPORTING INJECTION THERAPY ALONE AND THOSE REPORTING INJECTION THERAPY AND SKIN TESTS*

	MALE		FEMALE		TOTAL	
	NO.	%	NO.	%	NO.	%
<i>More Certain Group</i>						
Total injection therapy	41	21.5	47	22.8	88	22.2
Injection therapy alone	31	16.2	28	13.6	59	14.9
With skin tests	10	5.2	19	9.2	29	7.3
<i>Combined Group</i>						
Total injection therapy	47	17.7	56	18.9	103	18.4
Injection therapy alone	36	13.6	34	11.5	70	12.5
With skin tests	11	4.2	22	7.4	33	5.9

*The percentages are based on the total persons in the respective groups in whom treatment information was available.

TABLE VI. THE CUMULATIVE PREVALENCE OF PERSONS WITH A HISTORY OF ASTHMA IN THE HAY FEVER TREATMENT GROUPS

	MORE CERTAIN GROUP			COMBINED GROUP		
	MALE	FEMALE	TOTAL	MALE	FEMALE	TOTAL
Injection therapy alone						
Total number	31	28	59	36	34	70
Per cent with asthma	38.7	64.3	50.8	36.1	70.6	52.9
Injection therapy and skin tests						
Total number	10	19	29	11	22	33
Per cent with asthma	50.0	68.4	62.1	90.9	72.7	78.8
Neither injection therapy nor skin tests						
Total number	150	159	309	218	240	458
Per cent with asthma	23.3	22.0	22.7	28.4	29.6	29.0

An additional observation of interest may be made from these treatment data (Table VI). The cumulative prevalence of asthma in the group with hay fever reporting injection therapy and skin tests was more than twice as high as in the group not reporting injection therapy. This difference in the frequency of asthma in the two groups is highly significant statistically (chi square p value less than 0.001). Making the assumption that those persons who reported injection therapy and skin tests represent the segment of the hay fever popula-

tion seen by allergists, it is possible to speculate that these physicians may be exposed to a selected segment of the total disease group in which the prevalence of asthma is disproportionately high.

DISCUSSION

The question has been raised that the clinical experience of allergists may tend to be weighted with the more serious cases of hay fever and, therefore, could lead to a distorted picture of the natural history. These data from an epidemiological study of a total community not only suggest that this is true but also indicate that the cumulative prevalence of asthma following hay fever is considerably lower than estimates made from clinical experience.^{3, 6, 8-12, 14-22, 24} Support for these findings are available from a study of university students carried out by Maternowski and Mathews.²³

Although the data from the present study appear to provide a more valid foundation for generalizations than existing information, their interpretation may be limited by several factors. First, incomplete data, even where representing only a small per cent of the total, may favor a particular group and, therefore, introduce bias. The completeness of the data has been indicated for the analyses which are presented in this and the preceding report. The analyses based on current age (Fig. 2 and Table II) have complete data available for the entire population which was interviewed and examined and are complementary to the others which are based on less complete data. Thus, the incompleteness of the data with respect to these variables does not appear to have produced detectable bias.

A further limiting factor may be introduced by the possibility of memory error which is inherent in retrospective data, as those dealing with age at onset and onset sequence. Data of age at onset from other sources agree with those reported here.^{1, 2, 26-31} Onset sequence data for asthma and hay fever are not as readily available. We found that of a group of 41 consecutive new patients seen at the Allergy Clinic of the University of Michigan Medical Center who had both asthma and allergic rhinitis of known onset, 21 either had asthma alone initially or the two began within the same year of age.³² Urbach³³ reported that in a group of 88 patients having asthma and perennial allergic rhinitis, 57 had either asthma alone initially or an approximately simultaneous onset of the two. Although these studies are not exactly comparable to the present one, they confirm that, of persons having a history of these two diseases, a significant proportion either develop asthma first or have the onset of both relatively close in time.

It might be argued that the onset sequence group in which both asthma and hay fever began within the same year of age is an artificial one; if it were possible to examine the sequence more carefully in these persons, they could be distributed between the groups having either asthma or hay fever first. This might produce a considerable enlargement of the group in which hay fever is followed by asthma. However, in the present context, this group is an important one to maintain. It is not usual for patients having hay fever alone to present as

candidates for injection therapy during their first year of symptoms. More important, most cases of hay fever are confined to a relatively short period of a given year, particularly during the first season of symptoms. If asthma were to be associated and develop during the same year, the interval between the two would likely be so short as to make impractical any thoughts of diagnosing the first and establishing effective therapy with the aim of preventing the second.

This is an initial report from a continuing project. A repeat study of this community is currently in progress in which more detailed and prospective information is being collected. When this material has been assembled it may be possible to define more conclusively the relationship between asthma and hay fever. It is hoped that the questions raised in the present study may stimulate other population surveys which by contributing additional data will permit more valid generalizations than are currently possible.

SUMMARY

The clinical experience of allergists suggests that many persons with hay fever may develop asthma if not treated with allergenic extracts. The question has been raised that the experience of specialists may be weighted with the more serious cases of hay fever and therefore lead to a distorted picture of the natural history. While initial epidemiological data from this study of a total community are in keeping with clinical experience in indicating a frequent correlation between asthma and hay fever, they do not suggest that this relationship is dominated by hay fever leading to asthma: 75 per cent of persons having a history of both asthma and hay fever had either asthma alone initially or the two appeared within the same year of age; of all persons with hay fever who were at risk to develop asthma, this subsequently occurred in only 5 to 10 per cent. It is unlikely that injection therapy has appreciably altered the tendency for hay fever to be complicated by asthma in this population. The data also imply that allergists may be exposed to a segment of the hay fever population in which the prevalence of asthma is disproportionately high.

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