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A TENTATIVE STUDY OF THE  
GEOGRAPHICAL DISTRIBUTION OF ASTHMATIC  
PATIENTS IN THE NETHERLANDS  
DURING 1960

By

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PURPOSE OF STUDY

Despite the extensive studies made all over the world on the aethiology of asthma, very few systematic studies have been made on the geographical distribution of asthmatic patients in the same country. If such a distribution would be known for both sexes, undoubtedly many new aethiological factors would be discovered and in particular the influence of weather and climate on asthma could be studied on a more regional scale.

In view of the different definitions used by different physicians, it is fully realized that it is impossible to prepare accurate geographical maps of asthma in The Netherlands, even if all physicians in the country would cooperate. However, although the total morbidity figures may be inaccurate, the following considerations made it worthwhile to try to collect asthma morbidity data on a regional scale in The Netherlands.

1. The migration of the population in The Netherlands is still relatively small, as compared with other countries and there is no indication that the quality of the physicians is different in different parts of the country as often happens in very large countries. Physicians from the different medical schools in The Netherlands practice all over the country.

2. There is no reason to assume that general practitioners

TABLE

| Sex   | Age group      | Number of reported cases of |                |               |               |
|-------|----------------|-----------------------------|----------------|---------------|---------------|
|       |                | F*<br>(38/92)               | Gr<br>(75/152) | D<br>(41/102) | O<br>(85/223) |
| M     |                | 29                          | 65             | 28            | 81            |
| F     | 0-10           | 9                           | 21             | 5             | 34            |
| M + F |                | 38                          | 86             | 33            | 115           |
| R     |                | 3.2                         | 3.1            | 5.6           | 2.4           |
| M     |                | 27                          | 66             | 30            | 68            |
| F     | 11-20          | 11                          | 36             | 9             | 29            |
| M + F |                | 38                          | 102            | 39            | 97            |
| R     |                | 2.5                         | 1.8            | 3.3           | 2.3           |
| M     |                | 25                          | 61             | 25            | 60            |
| F     | 21-30          | 27                          | 46             | 17            | 52            |
| M + F |                | 52                          | 107            | 42            | 112           |
| R     |                | 0.9                         | 1.3            | 1.5           | 1.2           |
| M     |                | 29                          | 49             | 31            | 76            |
| F     | 31-40          | 31                          | 46             | 31            | 70            |
| M + F |                | 60                          | 95             | 62            | 146           |
| R     |                | 0.9                         | 1.1            | 1.0           | 1.1           |
| M     |                | 34                          | 79             | 46            | 59            |
| F     | 41-50          | 22                          | 75             | 31            | 52            |
| M + F |                | 56                          | 154            | 77            | 111           |
| R     |                | 1.5                         | 1.1            | 1.5           | 1.1           |
| M     |                | 38                          | 95             | 42            | 71            |
| F     | 51-60          | 27                          | 60             | 40            | 44            |
| M + F |                | 65                          | 155            | 82            | 115           |
| R     |                | 1.4                         | 1.6            | 1.1           | 1.6           |
| M     |                | 46                          | 86             | 47            | 69            |
| F     | > 60           | 34                          | 83             | 38            | 35            |
| M + F |                | 80                          | 169            | 85            | 104           |
| R     |                | 1.4                         | 1.0            | 1.2           | 2.0           |
| M     |                | 228                         | 501            | 249           | 484           |
| F     | all age groups | 161                         | 367            | 171           | 316           |
| M + F | together       | 389                         | 868            | 420           | 800           |
| R     |                | 1.4                         | 1.4            | 1.5           | 1.5           |

\* Figures between brackets under the Provinces indicate the number of general practitioners who submitted their data as compared with the total number of general practitioners in each Province.

\*\* North of the North Sea Canal connecting Amsterdam with the North Sea.

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| asthmatics in the provinces of |               |                 |               |                  | Total<br>per<br>age-group |       |
|--------------------------------|---------------|-----------------|---------------|------------------|---------------------------|-------|
| Ge<br>(167/364)                | L<br>(80/281) | NB<br>(149/456) | Z<br>(59/102) | NH**<br>(86/175) | Number                    | %     |
| 98                             | 91            | 179             | 57            | 73               | 701                       | 16.7  |
| 37                             | 38            | 75              | 21            | 26               | 266                       | 9.1   |
| 135                            | 129           | 254             | 78            | 99               | 967                       | 13.6  |
| 2.6                            | 2.4           | 2.4             | 2.7           | 2.8              | 2.6                       | —     |
| 114                            | 69            | 149             | 45            | 46               | 614                       | 14.6  |
| 67                             | 42            | 70              | 25            | 23               | 312                       | 10.7  |
| 181                            | 111           | 219             | 70            | 69               | 926                       | 13.0  |
| 1.7                            | 1.6           | 2.1             | 1.8           | 2.0              | 2.0                       | —     |
| 92                             | 62            | 135             | 22            | 51               | 533                       | 12.7  |
| 67                             | 64            | 99              | 29            | 43               | 444                       | 15.2  |
| 159                            | 126           | 234             | 51            | 94               | 977                       | 13.7  |
| 1.4                            | 1.0           | 1.4             | 0.8           | 1.2              | 1.2                       | —     |
| 109                            | 66            | 123             | 35            | 50               | 568                       | 13.5  |
| 120                            | 71            | 105             | 38            | 60               | 572                       | 19.6  |
| 229                            | 137           | 228             | 73            | 110              | 1140                      | 16.0  |
| 0.9                            | 0.9           | 1.2             | 0.9           | 0.8              | 1.0                       | —     |
| 109                            | 52            | 94              | 37            | 37               | 547                       | 13.0  |
| 96                             | 40            | 75              | 34            | 53               | 478                       | 16.4  |
| 205                            | 92            | 169             | 71            | 90               | 1025                      | 14.4  |
| 1.1                            | 1.3           | 1.3             | 1.1           | 0.7              | 1.1                       | —     |
| 118                            | 62            | 108             | 45            | 36               | 615                       | 14.6  |
| 76                             | 41            | 73              | 39            | 37               | 437                       | 15.0  |
| 194                            | 103           | 181             | 84            | 73               | 1052                      | 14.8  |
| 1.6                            | 1.5           | 1.5             | 1.2           | 1.0              | 1.4                       | —     |
| 106                            | 49            | 108             | 69            | 42               | 622                       | 14.8  |
| 62                             | 28            | 65              | 33            | 29               | 407                       | 14.0  |
| 168                            | 77            | 173             | 102           | 71               | 1029                      | 14.5  |
| 1.7                            | 1.8           | 1.7             | 2.1           | 1.4              | 1.5                       | —     |
| 746                            | 451           | 896             | 310           | 335              | 4200                      | 100.0 |
| 525                            | 324           | 562             | 219           | 271              | 2916                      | 100.0 |
| 1271                           | 775           | 1458            | 529           | 606              | 7116                      | 100.0 |
| 1.4                            | 1.4           | 1.6             | 1.4           | 1.2              | 1.4                       | —     |

M = males; F = females; R = ratio males/females;

F = Friesland; Gr = Groningen; D = Drente; O = Overijssel; Ge = Gelderland; L = Limburg; NB = Noord Brabant; Z = Zeeland; NH = Noord Holland.

TABLE 2

| Province                                                                                                             | F    | Gr   | D    | O    | Ge   | L    | NB   | Z    | NH   | Total |
|----------------------------------------------------------------------------------------------------------------------|------|------|------|------|------|------|------|------|------|-------|
| Total number of cases (M + F) of all age groups together standardized on total number of physicians of the province. | 942  | 1759 | 1045 | 2099 | 2770 | 2785 | 4496 | 915  | 1233 | 18044 |
| Same, but standardized per 1000 inh. in each province (based on population figures 31 Dec. 1960).                    | 2.0  | 3.7  | 3.3  | 2.7  | 2.2  | 3.1  | 3.0  | 3.2  | -    | -     |
| Average number of asthmatics (M + F) per physician.                                                                  | 10.2 | 11.6 | 10.2 | 9.4  | 7.6  | 9.9  | 9.9  | 9.0  | 7.0  | -     |
| Average number of inhabitants (M + F) per physician.                                                                 | 5216 | 3143 | 3083 | 3513 | 3538 | 3183 | 3318 | 2783 | -    | -     |

in certain parts of the country would treat a greater number of young subjects than older ones if the age group structure in those areas is the same. Also the sex distribution of the patients in medical practice will not differ very much in different parts of the country. In other words, although the total figures for the number of asthmatics in the different age groups and sexes will be inaccurate, there is no reason to assume that the ratio's between the morbidity incidences of different age groups and sexes will not be correct and could not be used for aetiological studies.

#### METHODS

The areas studied comprise all provinces except the provinces of Zuid Holland, Utrecht and the Southern part of the province Noord Holland (South of the North Sea Canal, connecting Amsterdam with the North Sea). The reason for eliminating these areas is the following:

On 10 April 1959 Dr. A. in 't Veld, Chief Medical Inspector of the Province of Zuid Holland requested all general practitioners in the province of Zuid Holland and neighbouring areas to collect data on the incidence of bronchial asthma.

A Medical Working Group of the province was in charge of the practical aspects of the inquiry. It was felt that the same physicians could not be asked again to cooperate in an other project in view of their many other administrative duties.

On 1 September 1961 a circular was sent by the Biometeorological Research Centre to all general practitioners in the provinces of Friesland, Groningen, Drente, Overijssel, Gelderland, Limburg, Noord-Brabant, Zeeland and the Northern part of Noord Holland (North of the North Sea Canal). It was felt that if all general practitioners in a municipality (the smallest administrative unit in The Netherlands) would cooperate the entire population would be covered. However, as this would be an utopia, the asthma incidence figures per province reported by the cooperating general-practitioners were standardized in relation to all physicians available in a province\* and these figures were standardized per 1000 inhabitants (see Table 2). Also the average number of asthmatics (of all age groups and both sexes together) per physician (cooperating in the project) per province are given in Table 2. Similar figures for larger cities are given in Table 3.

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\* Example: If 300 cases were reported by 25 physicians in a city of a total of 75 physicians, the potential asthma figure would be  $75/25 \times 300 = 900$  asthmatics.

TABLE 3

| Province      | City                     | Number of asthma patients |                      |                                |                    |                      |                                |
|---------------|--------------------------|---------------------------|----------------------|--------------------------------|--------------------|----------------------|--------------------------------|
|               |                          | Males                     |                      |                                | Females            |                      |                                |
|               |                          | Number of patients        | Number of physicians | Aver. number of pat. per phys. | Number of patients | Number of physicians | Aver. number of pat. per phys. |
| Noord-Holland | Zaandam                  | 70                        | 14                   | 5.0                            | 57                 | 14                   | 4.1                            |
|               | Alkmaar                  | 24                        | 10                   | 2.4                            | 28                 | 10                   | 2.8                            |
| Friesland     | Leeuwarden               | 78                        | 12                   | 6.5                            | 55                 | 12                   | 4.6                            |
|               | Heerenveen               | 25                        | 3                    | 8.3                            | 20                 | 3                    | 6.7                            |
| Groningen     | Groningen                | 202                       | 30                   | 6.7                            | 149                | 30                   | 5.0                            |
| Drente        | Assen                    | 40                        | 7                    | 5.7                            | 27                 | 7                    | 3.9                            |
| Overijssel    | Enschede                 | 108                       | 16                   | 6.8                            | 79                 | 16                   | 4.9                            |
|               | Almelo                   | 71                        | 6                    | 1.2                            | 43                 | 6                    | 7.2                            |
|               | Zwolle                   | 52                        | 9                    | 5.8                            | 25                 | 9                    | 2.8                            |
|               | Deventer                 | 35                        | 9                    | 3.9                            | 30                 | 9                    | 3.3                            |
|               | Hengelo                  | 31                        | 7                    | 4.4                            | 23                 | 7                    | 3.3                            |
| Gelderland    | Nijmegen                 | 117                       | 25                   | 4.7                            | 79                 | 25                   | 3.2                            |
|               | Arnhem                   | 73                        | 21                   | 3.5                            | 42                 | 21                   | 2.0                            |
|               | Apeldoorn                | 67                        | 13                   | 5.2                            | 66                 | 13                   | 5.1                            |
|               | Ede                      | 55                        | 12                   | 4.6                            | 39                 | 12                   | 3.3                            |
|               | Zutphen                  | 46                        | 7                    | 6.6                            | 20                 | 7                    | 2.9                            |
|               | Nijkerk                  | 18                        | 4                    | 4.5                            | 15                 | 4                    | 3.8                            |
| Noord-Brabant | Harderwijk               | 12                        | 3                    | 4.0                            | 11                 | 3                    | 3.7                            |
|               | Tilburg                  | 101                       | 15                   | 6.7                            | 42                 | 15                   | 2.8                            |
|               | Breda                    | 85                        | 21                   | 4.1                            | 48                 | 21                   | 2.3                            |
|               | 's-Hertogenbosch         | 39                        | 10                   | 3.9                            | 32                 | 10                   | 3.2                            |
|               | Steenbergen              | 28                        | 2                    | 14.0                           | 20                 | 2                    | 10.0                           |
|               | Roosendaal               | 27                        | 5                    | 5.4                            | 22                 | 5                    | 4.4                            |
|               | Eindhoven                | 26                        | 9                    | 2.9                            | 20                 | 9                    | 2.2                            |
|               | Oss                      | 22                        | 6                    | 3.7                            | 34                 | 6                    | 5.7                            |
| Zeeland       | Bergen op Zoom           | 20                        | 4                    | 5.0                            | 15                 | 4                    | 3.8                            |
|               | Vlissingen               | 31                        | 8                    | 3.9                            | 23                 | 8                    | 2.9                            |
|               | Oostburg<br>(Zeeuws Vl.) | 29                        | 3                    | 9.7                            | 25                 | 3                    | 8.3                            |
| Limburg       | Venlo                    | 58                        | 9                    | 6.4                            | 45                 | 9                    | 5.0                            |
|               | Roermond                 | 42                        | 3                    | 14.0                           | 28                 | 3                    | 9.3                            |
|               | Maastricht               | 40                        | 10                   | 4.0                            | 24                 | 10                   | 2.4                            |
|               | Heerlen                  | 37                        | 9                    | 4.1                            | 26                 | 9                    | 2.9                            |
|               | Sittard                  | 21                        | 2                    | 10.1                           | 25                 | 2                    | 12.5                           |
| Total         |                          | 1730                      | 324                  | 5.3                            | 1237               | 324                  | 3.8                            |

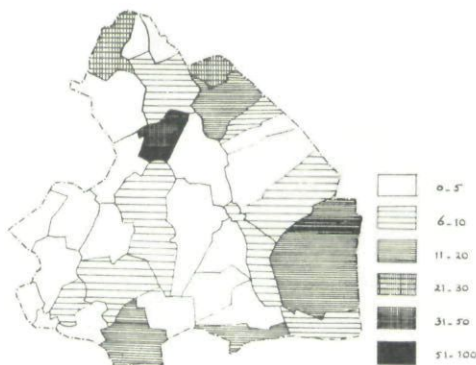


*Fig. 1a.*  
Males (Prov. of Drente).

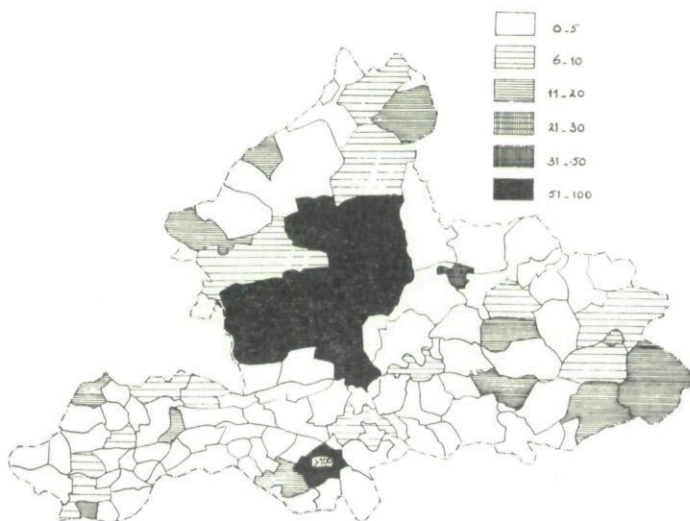


*Fig. 1b.*  
Males (Prov. of Gelderland).

The physicians were asked to reply to the following questions:

1. Total number of their asthmatic patients in 1960. Of each patient age and sex was requested.
2. In view of the lack of uniformity and the difficulty in giving the accurate diagnosis of their asthmatic patients, the physician was asked not to make a distinction between different forms of asthma, but to report simply every patient with periods of serious dyspnoea, the cause of which should be a true pulmonary

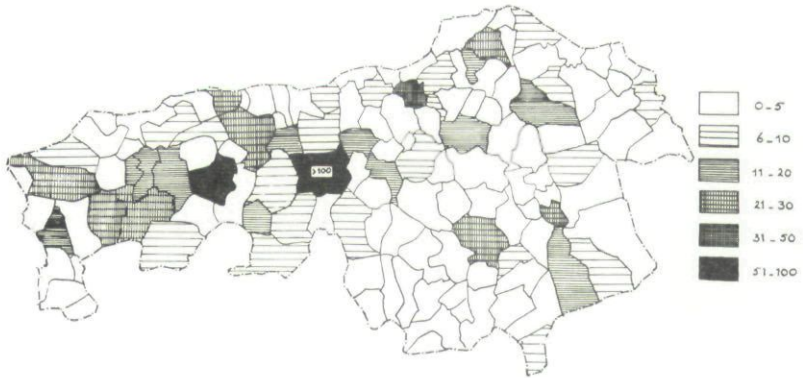


*Fig. 1c.*  
Males (Prov. of N. Brabant).



*Fig. 2a.*  
Females.

dysfunction and not primarily cardiac insufficiency. Purely bronchitic patients, without periods of serious dyspnoea were omitted in this inquiry.

The number of asthmatic patients reported by a physician does not give an accurate picture of the true number of asthmatics amongst all the patients of a physician. Many asthmatics may have been treated in the past by a physician but may not consult him in later years for asthmatic complaints. In other words, the figures given represent only the more serious cases treated by physicians during 1960.

The total number of reported asthmatics per municipality was plotted on a municipal map of The Netherlands. With special symbols the number of cases was represented in a graphic form. The following groups were distinguished:

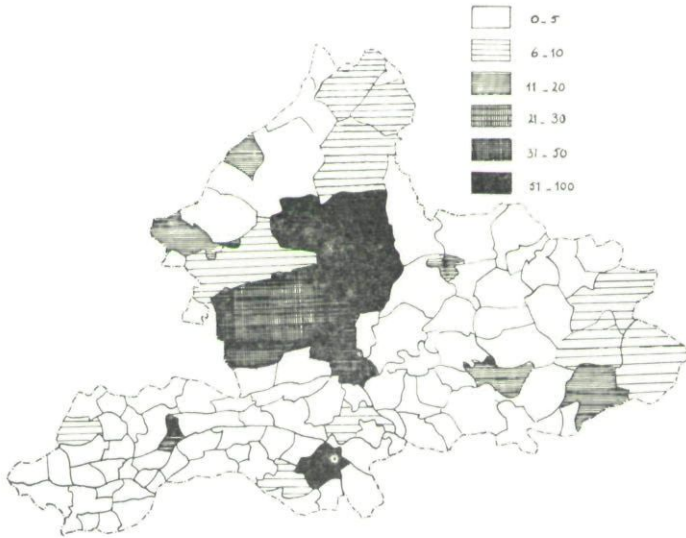


*Fig. 2b.*  
Females.

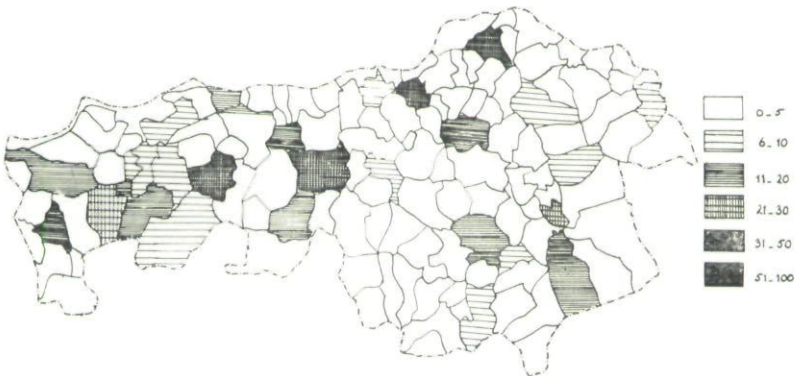


*Fig. 2c.*  
Females.

0-5, 6-10, 11-20, 21-30, 31-50, 51-100 and  $> 100$  reported cases of asthma. In Figs. 1a, b, c and 2a, b, c such geographic frequency distributions are given. Figs. 1a and 2a represent the province of Drente for males and females respectively; Figs. 1b and 2b give the same for the province of Gelderland; 1c and 2c for the province of Noord Brabant.

## RESULTS

Despite the inaccuracy of the data the following conclusions seem to be warranted.

1. *Ratio Males-Females*

- (a) With a few exceptions in all provinces and all age groups the number of reported cases of asthmatics is higher in males than in females. The ratio males/females fluctuates between 0.7 and 5.6 (Table 1).
- (b) Also in the larger cities (Table 3), with few exceptions, the number of male asthmatics surpasses that of the females. The ratios fluctuate between 0.6 and 2.4.
- (c) The ratio males/females becomes smaller above the age of 20. The highest ratio values are observed in the age group 0-10.
- (d) In the provinces of Friesland and Zeeland the average number of females exceeds the males slightly in the age group 21-40 (ratio males/females 0.9).

2. *Frequency Distribution of Reported Cases*(a) *Geographical Distribution*

(1) *Provincial distribution.* If the total number of reported cases (all age groups of males and females together) per province are standardized on the total number of available physicians (see note on p. 109) and the potential asthma figures per province are classified from high to low, the following succession is observed:

NB, L, Ge, O, Gr., NH., D., F. and Z.

However, if these potential provincial figures are standardized per 1000 of the population of each province the succession of the provinces from high to low is as follows:

Gr., D., Z., L., NB., O., Ge., F.

Also if the average number of reported cases is taken per physician per province the highest figure is found for Gro-

ningen (11.6), the second lowest value in Gelderland (7.6). Except for the province of Friesland these figures would suggest that the South Western and Northern provinces have a higher asthma incidence than the Eastern part of the country, whereas bronchitis mortality shows an opposite picture (1).

The low position of Friesland in the above sequence may be due to the relatively smaller number of physicians as compared with Groningen (92 against 152), whereas the population is about the same. The larger average number of patients per physician in Friesland (5216 against 3143 in Groningen) may be responsible for a less accurate survey of the actual number of asthmatics in Friesland. However, it may be due also to a true difference between the population of both northern provinces.

(2) *Incidence in different cities.* In Table 3, for a number of larger cities in the provinces studied, the average number of asthmatics per physician is given. Although this figure is considerably affected by the average total number of patients per physician in each city it seems unlikely that the very large differences observed between the asthma incidence in a number of towns could be explained with this factor only.

The cities in each province (in Table 3) were classified from high to low according to the number of reported asthma cases. There is no direct relationship with the number of physicians as shown in columns 2, 3 and 5, 6. For example in the province of Noord Brabant Tilburg has 101 reported cases on 15 physicians, Eindhoven 26 on 9 physicians and Bergen op Zoom 20 cases on 4 physicians. Based on 15 physicians we would expect for these three cities 101, 43 and 75.

We fully realize that many other uncertain factors may be responsible for the observed differences but the data seem to stress the importance of a more detailed incidence study, for example in the cities of Roermond and Steenberg with 14 cases per physician against for example Almelo (1.2) and Eindhoven (2.9). These differences could be (at least partly) true differences in incidence due to environmental differences, both climatic and psychological.

### (b) *Age-Group Distribution*

In *Males* most asthmatic cases are observed in the age group 0-10 (16.7 per cent). The number decreases till the age of 30 (12.7 per cent) and increases slightly again till 14.8 per cent in the age group  $> 60$ .

In *Females* the largest number was observed in the age group 31-40 (19.6 per cent), the smallest in the age group 0-10 (9.1 per cent). From the age of 40 the number of case gradually decreases till 14.0 per cent above the age of 60.

Although the total number of reported cases per age group or sex is probably incorrect there is no reason to assume that the group of physicians as a whole, in all provinces together, would have a special bias in their diagnosis which could explain this difference in number of asthmatics in different age groups and the differences between both sexes.

Despite the inaccuracy of the present study the data obtained seem to suggest a number of interesting asthma—environment relationships. The absolute figures are untrustworthy and much too small. For example, only 0.3 asthmatics per 100 inhabitants as indicated in Table 1 is far below the generally accepted figure in the Netherlands of more than 1 per 100. However, this figure represents the total number of all asthmatics, whereas the figures given in this report represent only asthmatics which require regular medical treatment.

The fact that the provinces of Zeeland, Groningen and Drente seem to have a higher incidence than the Eastern provinces could be explained by the greater atmospheric cooling conditions in these Coastal provinces. Previous studies (2, 3) have shown the importance of atmospheric cooling for the triggering of asthma attacks.

Further medical—geographical studies will be required to confirm this hypothesis.

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