Prevalence of asthma, aspirin intolerance, nasal polyposis and chronic obstructive pulmonary disease in a population-based study

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Background Remarkable overlap exists in symptoms between asthma and chronic obstructive pulmonary disease (COPD), and the symptoms of the patients with mild asthma are often falsely thought to be caused by smoking. The objective of the study was to determine the prevalence of doctor-diagnosed asthma, asthmatic symptoms and doctor-diagnosed COPD in an adult population. The prevalence and relation to asthma of aspirin intolerance, nasal polyposis, allergic rhinitis and smoking habits were also examined.

Methods Postal questionnaire survey of a population-based random sample (4300) of adult women and men aged 18–65 years served by the Päijät-Häme Central Hospital in southern Finland (a region with 208,000 inhabitants) was performed.

Results The non-response-adjusted prevalence (Drane’s linear method) of doctor-diagnosed asthma was 4.4% (95% CI: 3.3–5.5%) and of COPD 3.7% (95% CI: 2.7–4.8%). The prevalence of allergic rhinitis was 37.3% (95% CI: 33.3–41.2%), and of overall aspirin intolerance 5.7% (95% CI: 4.4–7.1%). The observed prevalence of aspirin intolerance causing shortness of breath or attacks of asthma was 1.2% and it was higher in patients with doctor-diagnosed asthma than without (8.8% versus 0.8%, relative risk [RR] = 11.4, P < 0.0001), and higher in those with allergic-like rhinitis than without (2.6% versus 0.3%, RR = 7.7, P < 0.0001). The prevalence of nasal polyposis was 4.3% (95% CI: 2.8–5.8%).

Conclusions The current prevalence of doctor-diagnosed asthma among adults is 4.4%, and allergic rhinitis, nasal polyposis and aspirin intolerance are associated with an increased risk of asthma. There is also association between aspirin-induced asthma and allergic-like rhinitis.

Keywords Asthma, COPD, epidemiology, aspirin intolerance, nasal polyposis, Finland

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The prevalence of asthma (and chronic obstructive pulmonary disease [COPD]) is increasing predominantly through an increase in the number of mild cases. The increase may, at least in part, be due to increased professional and public awareness. Many studies of the prevalence of asthma and chronic bronchitis are occupational epidemiological studies, and the selection of the study populations may have influenced the results. Previous large-scale epidemiological studies of the adult general Finnish population were published at least 30 years ago.

Today several leaders of opinion emphasize the need for countrywise programmes for obstructive lung diseases. In 1994 a comprehensive National Asthma Program in Finland covering the following 10 years was launched and quite recently the National COPD Program 1998–2007. However, to evaluate the efficacy, and further, to improve the measures used in those programmes, an updated population-based data on obstructive lung diseases is required.

There is remarkable overlap in symptoms between asthma and COPD, and the symptoms of the patients with mild asthma are often falsely thought to be caused by smoking. That is why population-based studies covering the whole range of asthmatic symptoms and diagnoses of obstructive pulmonary diseases including detailed information on smoking habits are needed.
The aim of our study was to determine the prevalence of doctor-diagnosed asthma, asthmatic symptoms and COPD in adults aged 18–65 years. Secondly, the relationship of aspirin intolerance, nasal polyposis and allergic rhinitis to asthma was investigated. Finally, smoking habits in connection with respiratory symptoms were examined.

**Subjects and Methods**

A random sample of 4300 subjects with equal numbers of men and women aged 18–65 years were drawn from the lists of the Finnish Population Register covering the district of Päijät-Häme Central Hospital in May 1996. The total population of the district is about 208 000 inhabitants including the city of Lahti, which is situated in southern Finland 100 km north of Helsinki.

The sample size calculations were based on the assumption that the prevalence of asthma in the adult population is 7% and the prevalence of intrinsic asthma 2%. We calculated that a sample size of 3500 (4300 for intrinsic asthma) would be required, so that the prevalence may be estimated to be within one percentage point (within 0.5% for intrinsic asthma) of the true value with 95% confidence. In calculations it was also assumed that the response rate would be about 70%.

The questionnaire was based on the Tuohilampi-questionnaire, which had been created by a group of Finnish researchers from the Finnish Institute of Occupational Health, the National Public Health Institute and several universities for environmental studies of asthma and respiratory disease. The Tuohilampi-questionnaire includes questions, which are based on several different questionnaires (Medical Research Council [MRC], 1960, 1966 and 1986; European Community for Coal and Steel [ECCS] 1987; American Thoracic Society, National Heart, Lung and Blood Institute, Division of Lung Diseases [ATS-DLD-78] 1978; International Union against Tuberculosis and Lung diseases [IUA TLC] 1986). Questions concerning bronchial asthma and related symptoms, atopy and smoking were included. New questions concerning aspirin intolerance and nasal polyposis were also developed. The original international questionnaires have been validated in several studies.

The questionnaires were mailed in June 1996 with a prepaid return envelope. Those subjects who did not respond within 2 weeks received one reminder letter. After one reminder the overall response rate exceeded 70%, and no further reminders were mailed.

The study was approved by the Ethics Committee of Päijät-Häme Central Hospital.

**Statistical analysis**

The results were analysed with the $\chi^2$ test for differences between proportions, and in the case of an ordered explanatory factor, the test of linear trend of proportions was applied. Relative risks (RR) based on observed prevalences were calculated to compare the patients with doctor-diagnosed asthma to subjects without asthma diagnosis. Stepwise logistic regression was used to find the risk indicators of doctor-diagnosed asthma. Analysis was done with adjustment for age. Logistic regression analyses were done with BMDP statistical package (BMDP Software Inc., Los Angeles, USA).

The prevalences of doctor-diagnosed asthma, allergic rhinitis, overall aspirin intolerance and nasal polyposis were using observed (= crude, non-adjusted) estimates, non-response-adjusted estimates and age-standardized estimates. In adjusting prevalence for non-response the method proposed by Drane was used. The relative difference between observed and adjusted prevalences were calculated using the formula:

$$\text{Bias} (\%) = \frac{100 \times (\text{observed prevalence} - \text{adjusted prevalence})}{\text{adjusted prevalence}}$$

Age-standardized prevalences were calculated by the direct method and the European Standard Population was used as the standard. To examine the relative effects of age and smoking on the prevalences of doctor-diagnosed asthma and doctor-diagnosed COPD the test for linear trend was used.

**Results**

A total of 4300 questionnaires were mailed and 3102 were returned, resulting in a response rate of 73%. Of the responders 1408 (45%) were men and 1694 (55%) were women. The mean age (SD) for men was 43.7 (12.7) years and 43.3 (13.1) years for women. Women had a higher response rate (79%) than men (66%), ($P < 0.0001$) as did older people (response rate: 80% for 50–65 years, 67% for 18–34 years, $P < 0.0001$).

**Prevalence of doctor-diagnosed asthma and COPD**

Observed and non-response-adjusted prevalences of doctor-diagnosed asthma, COPD, allergic rhinitis, aspirin intolerance and nasal polyposis and corresponding age-standardized prevalences are given in Table 1. The non-response-adjusted prevalences of doctor-diagnosed asthma and COPD in different age groups are given in Figure 1 for men and women separately.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Observed prevalence</th>
<th>Non-response-adjusted prevalence</th>
<th>Bias %</th>
<th>Age-standardized prevalence a %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asthma</td>
<td>5.3 (4.6–6.1)</td>
<td>4.4 (3.3–5.5)</td>
<td>21.4</td>
<td>5.1</td>
</tr>
<tr>
<td>COPD</td>
<td>3.6 (3.0–4.3)</td>
<td>3.7 (2.7–4.8)</td>
<td>3.7</td>
<td>3.3</td>
</tr>
<tr>
<td>Aspirin intolerance</td>
<td>5.8 (3.5–6.7)</td>
<td>5.7 (4.4–7.1)</td>
<td>1.6</td>
<td>5.7</td>
</tr>
<tr>
<td>Nasal polyposis</td>
<td>4.4 (3.6–5.1)</td>
<td>4.3 (2.8–5.8)</td>
<td>1.4</td>
<td>3.9</td>
</tr>
<tr>
<td>Allergic rhinitis</td>
<td>41.6 (39.7–43.5)</td>
<td>37.3 (33.3–41.2)</td>
<td>11.6</td>
<td>43.1</td>
</tr>
</tbody>
</table>

a European standard population.  

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**Table 1:** Prevalences of doctor-diagnosed asthma, doctor-diagnosed chronic obstructive pulmonary disease (COPD), aspirin intolerance (causing asthma, dyspnoea, urticaria or angio-oedema), nasal polyposis and allergic rhinitis. Observed prevalences (%), non-response-adjusted and age-standardised prevalences (%). Bias (%) in observed versus non-response-adjusted prevalences.
Other outcome measures

The observed prevalence of allergic rhinitis was 41.6%, and 44% of allergic rhinitis was also doctor-diagnosed. The observed prevalence of allergic rhinitis was higher in patients with doctor-diagnosed asthma than in subjects without asthma diagnosis (73.1% versus 39.6%, \(P < 0.0001\)).

The non-response-adjusted prevalence of overall aspirin intolerance was 5.7%. The observed prevalence of aspirin intolerance causing shortness of breath or attacks of asthma was 1.2% (95% CI: 0.8–1.6%). In patients with doctor-diagnosed asthma the prevalence was 8.8% (95% CI: 4.4–13.2%), and in subjects without asthma diagnosis the prevalence was 0.8% (95% CI: 0.5–1.1%). In asthmatics, aspirin intolerance causing shortness of breath or attacks of asthma was 11 times more common than in other subjects (RR = 11.4 [95% CI: 6.0–21.8], \(P < 0.0001\)). It was also higher in people with allergic rhinitis than those without (2.6% versus 0.3%, RR = 7.7 [95% CI: 3.0–19.7], \(P < 0.0001\)). The observed prevalence of aspirin intolerance causing urticaria or angio-oedema was 5.2%, and in patients with and without asthma diagnosis the prevalences were 10.7% and 4.9% (RR = 2.2 [95% CI: 1.4–3.5], \(P = 0.002\)).

The non-response-adjusted prevalence of nasal polyposis was 4.3% (95% CI: 2.8–5.8%). In patients with doctor-diagnosed asthma the observed prevalence was higher than in subjects without asthma diagnosis (16.5% versus 3.7%, RR = 4.5 [95% CI: 2.9–6.9], \(P < 0.0001\)). The prevalence of the triad nasal polyposis, aspirin-intolerance, and asthma was 4.3% in patients with doctor-diagnosed asthma (5/7 subjects with the triad had also allergic rhinitis).

The prevalence of symptoms of asthma or wheezing with shortness of breath during the last 12 months was 12.8% (95% CI: 12–14%). The prevalence of wheeze apart from colds was 13.2% (95% CI: 12–14%).

In the multivariate analysis, the occurrence of doctor-diagnosed asthma was associated with aspirin intolerance, allergic rhinitis, nasal polyposis, asthma in close relatives and age. Stepwise logistic regression showed significant effects for aspirin intolerance, allergic rhinitis, nasal polyposis, and asthma in close relatives (Table 2). The effect of age was not significant, but it was included in the model to show the increased risk in age group 50–64 years.

More men (30%) than women (18%) were regular, current smokers (Table 3), and men had smoked more than women (32% of men and 12% of women had a history of \(\geq 11\) pack-years of smoking). The prevalence of COPD increased with pack-years both in patients with and without wheeze apart from colds (test for linear trend, \(P < 0.0001\)), but the prevalence of asthma was not affected by smoking (Table 4). The prevalence of doctor-diagnosed COPD (but not asthma) increased also with pack-years both in 25–44 and 45–65 years age categories (Table 5).

Discussion

The major strength of the study is the use of a random sample of the entire population of the whole district of our hospital. Special interest was focused on markers of intrinsic asthma since although patients with the triad of nasal polyposis, aspirin
intolerance, and asthma represent the most aggressive form of asthma,15,16 the prevalence of the markers and intrinsic asthma itself are poorly recognized.

The response rate was 73% in this study, which is fairly high, but even among those responding there was a tendency for subjects with a respiratory diagnosis (or symptoms) to return the questionnaire earlier than subjects without a diagnosis (or symptoms). In the present study the non-response adjustment by Drane13 was used. The adjusted prevalence of doctor-diagnosed asthma was 4.4%, which is lower than in a study in northern Sweden17 (prevalence of 5.9% of present or past history of asthma but no adjustment for non-response was made). The adjusted prevalence of doctor-diagnosed asthma in 25–44 year age group was 3.5% (95% CI: 2.5–4.5%), which is lower than the median prevalence of diagnosed asthma (4.5%) in the European Community Respiratory Health Survey (ECRHS).18 We also introduced age-standardized prevalences in order to make it possible to compare the prevalences of asthma or other outcome measures between populations with different age distributions.14

A basic problem in questionnaire studies dealing with asthma is the absence of any gold standard for the diagnosis of asthma.19 Even when lung function studies are included, the variable nature of the disease makes it difficult to ensure the

Table 2 Results from multiple logistic regression analysis. Doctor-diagnosed asthma is explained by aspirin intolerance, allergic rhinitis, nasal polyposis, asthma in close relatives and age. The analysis is based on 2030 subjects who had relevant data for all variables included in the model.

<table>
<thead>
<tr>
<th>Explanatory factor</th>
<th>Category</th>
<th>No. of cases of asthma/all subjects</th>
<th>Multiple logistic regression analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>$\beta^a$</td>
</tr>
<tr>
<td>Aspirin intolerance</td>
<td>No</td>
<td>77/1908</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>17/122</td>
<td>0.76</td>
</tr>
<tr>
<td>Allergic rhinitis</td>
<td>No</td>
<td>24/1237</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>70/793</td>
<td>1.37</td>
</tr>
<tr>
<td>Nasal polyposis</td>
<td>No</td>
<td>78/1947</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>16/83</td>
<td>1.30</td>
</tr>
<tr>
<td>Asthma in close relatives</td>
<td>No</td>
<td>51/1574</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>43/456</td>
<td>0.91</td>
</tr>
<tr>
<td>Age (years)$^c$</td>
<td>18–34</td>
<td>27/608</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>35–49</td>
<td>26/780</td>
<td>–0.32</td>
</tr>
<tr>
<td></td>
<td>50–65</td>
<td>41/642</td>
<td>0.47</td>
</tr>
</tbody>
</table>

$^a$ Logistic regression coefficient.

$^b$ Odds ratio.

$^c$ Reference group is 18–34 years.

Table 3 Smoking history (%)

<table>
<thead>
<tr>
<th>Smoking</th>
<th>Men (n = 1408)</th>
<th>Women (n = 1694)</th>
<th>Total (n = 3102)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>39</td>
<td>57</td>
<td>49</td>
</tr>
<tr>
<td>Ex-smoker</td>
<td>24</td>
<td>15</td>
<td>19</td>
</tr>
<tr>
<td>Occasionally</td>
<td>8</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>Regularly</td>
<td>30</td>
<td>18</td>
<td>24</td>
</tr>
<tr>
<td>Pack-years</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0–5</td>
<td>59</td>
<td>81</td>
<td>71</td>
</tr>
<tr>
<td>6–10</td>
<td>10</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>11–20</td>
<td>14</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>21–</td>
<td>18</td>
<td>5</td>
<td>10</td>
</tr>
</tbody>
</table>

Table 4 Prevalence (%) of doctor-diagnosed asthma, doctor-diagnosed chronic obstructive pulmonary disease (COPD) or any respiratory diagnosis (asthma or COPD) according to symptoms and smoking history.

<table>
<thead>
<tr>
<th>Smoking (pack-years)</th>
<th>Asthma</th>
<th>COPD</th>
<th>Any respiratory diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>&lt;10</td>
<td>0.6</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>10–29</td>
<td>0.5</td>
<td>2.8</td>
</tr>
<tr>
<td></td>
<td>≥30</td>
<td>0.0</td>
<td>6.5</td>
</tr>
<tr>
<td>Yes</td>
<td>&lt;10</td>
<td>37.5</td>
<td>7.7</td>
</tr>
<tr>
<td></td>
<td>10–29</td>
<td>26.9</td>
<td>19.1</td>
</tr>
<tr>
<td></td>
<td>≥30</td>
<td>29.2</td>
<td>25.0</td>
</tr>
</tbody>
</table>

$^a$ Wheezing with shortness of breath apart from colds.

Table 5 Prevalence (%) of doctor-diagnosed asthma, doctor-diagnosed chronic obstructive pulmonary disease (COPD) or any respiratory diagnosis (asthma or COPD) according to smoking history and age category.

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Smoking (pack-years)</th>
<th>n Asthma</th>
<th>COPD</th>
<th>Any respiratory diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>18–24</td>
<td>&lt;10</td>
<td>723</td>
<td>4.4</td>
<td>1.8</td>
</tr>
<tr>
<td>10–19</td>
<td>7</td>
<td>14.3</td>
<td>0</td>
<td>14.3</td>
</tr>
<tr>
<td>25–44</td>
<td>&lt;10</td>
<td>1025</td>
<td>3.8</td>
<td>1.4</td>
</tr>
<tr>
<td>10–29</td>
<td>248</td>
<td>2.4</td>
<td>4.0</td>
<td>6.0</td>
</tr>
<tr>
<td>≥30</td>
<td>27</td>
<td>0.0</td>
<td>14.8</td>
<td>14.8</td>
</tr>
<tr>
<td>Test for linear trend</td>
<td>$P = 0.15$</td>
<td>$P &lt; 0.0001$</td>
<td>$P = 0.056$</td>
<td></td>
</tr>
<tr>
<td>45–65</td>
<td>&lt;10</td>
<td>1017</td>
<td>7.1</td>
<td>3.8</td>
</tr>
<tr>
<td>10–29</td>
<td>252</td>
<td>7.2</td>
<td>7.1</td>
<td>11.1</td>
</tr>
<tr>
<td>≥30</td>
<td>141</td>
<td>5.8</td>
<td>7.8</td>
<td>11.3</td>
</tr>
<tr>
<td>Test for linear trend</td>
<td>$P = 0.67$</td>
<td>$P = 0.007$</td>
<td>$P = 0.47$</td>
<td></td>
</tr>
</tbody>
</table>
Intrinsic asthma with the triad of nasal polyps, aspirin intolerance, and asthma has been regarded as a different entity from extrinsic asthma, which has an allergic origin. Immuneological similarities, however, predominate between intrinsic and allergic asthma, and it is not possible to rule out the possibility of local IgE production in the bronchial mucosa in non-allergic asthmatics with normal IgE serum concentrations. In our study the risk of aspirin intolerance causing shortness of breath or asthma was 8.0 times higher in people with allergic rhinitis than without. This is in concordance with the previous findings of Bocheneneck et al. who found that atopy is related to adverse drug reactions to non-steroidal anti-inflammatory drugs. Estrada et al. have also shown that children having extrinsic asthma are the most commonly affected by aspirin intolerance. The mechanism of aspirin-precipitated asthma is supposed to be linked to inhibition of cyclo-oxygenase (COX) and generation of cysteinyl leukotrienes in the respiratory tract of sensitive patients.

The aetiology of nasal polypsis is unknown. There does not, however, exist any evidence of allergic origin. Patients with asthma have been shown to have polyps in 7–15% of cases with the highest frequency in the age group above 50 years. In the present study the prevalence of nasal polypsis in asthmatic patients was 16.5%. In the study of Settipane and Chaffe it was found that the prevalence of nasal polypsis in the total population was 4.2%, which is in concordance with the result of the present study (4.3%).

The study was conducted during the peak months for seasonal allergic rhinitis, which may have some effect on the prevalence (37.3%). In ECHRMS18 the median prevalence for nasal allergies and hay fever was lower (20.9%, range 9.5–40.9%). However, our results are in concordance with a study in Finnish farmers, where one-third of the subjects were atopic. Patients with doctor-diagnosed asthma had a very high prevalence of allergic rhinitis (73.1%), which agreed with the results of a study in Finnish asthmatic schoolchildren in whom up to 81% had allergic disorders. In all epidemiological studies without allergy tests, it would, however, be better to talk about ‘allergic-like rhinitis’, since many patients with vasomotor rhinitis have more symptoms during the pollen season. That is why these patients often falsely assume themselves to be atopic. In our study about half of the symptomatic patients had a doctor-diagnosed allergic rhinitis.

The prevalence of COPD was 3.7% in our study and 4.1% in northern Sweden. Recently, in another Finnish study with an older age group (range 64–97 years) a prevalence of 12.5% for men and 3% for women has been reported. These differences reflect difficulties in making a diagnosis of COPD, since even symptomatic subjects with a history of ≥30 pack-years had only 25.0% prevalence of COPD and 41.7% prevalence of any respiratory diagnosis (Table 4). The prevalence of COPD increased with pack-years in both the age groups 25–44 years and 45–65 years (Table 5). In the age group 45–65 years the prevalence of any respiratory diagnosis (asthma or COPD) did not increase significantly with pack-years, and there is no evidence in the present study that doctors would like to call non-specific respiratory disease ‘COPD’ rather than asthma in older patients (Table 5).

The current prevalence of doctor-diagnosed asthma is 4.4% and of COPD 3.7% in the Finnish adult population. In the multivariate analysis, the occurrence of doctor-diagnosed asthma was associated with aspirin intolerance, allergic rhinitis, nasal polyposis, asthma in close relatives and age. Further studies concerning the connections between atopy and aspirin intolerance are needed in the future.

Acknowledgements
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References

Appendix

An English translation of the questions used in the study

1. Have you at any time had attacks of shortness of breath with wheezing? (Attacks here mean occasional shortness of breath, not for example normal breathlessness after exercise)
   0 no  1 yes
2. Do you have doctor-diagnosed asthma?
   0 no  1 yes
   If you have never had attacks of shortness of breath with wheezing, or doctor-diagnosed asthma, skip to question 5.
3. Have you had symptoms of asthma or attacks of shortness of breath with wheezing?
   2 only at times when you had a chest infection (for example cold or bronchitis)
   3 also during times when you did not have a chest infection
4. In the past 12 months, have you had symptoms of asthma or attacks of shortness of breath with wheezing?
   0 no  1 yes  9 don’t know (skip to question 7)
5. Have you ever had hay fever or other allergic rhinitis connected to e.g. pollen or animals?
   0 no  1 yes  9 don’t know (skip to question 9)
6. Is the allergic rhinitis mentioned in the question 5 diagnosed by a doctor?
   0 no  1 yes  9 don’t know
7. Have you had hypersensitivity to painkillers (e.g. Aspirin)?
   0 no (skip to question 9) 1 yes  9 don’t know (skip to question 9)
8. Is the hypersensitivity to painkillers manifested as (choose all the proper alternatives)
   2 shortness of breath
   3 worsening of asthma
   4 eczema
   5 other symptom, what_______________________
9. Have polyps been found in your nose?
   0 no  1 yes  9 don’t know
10. Do any of your sisters, brothers or parents have asthma now or have they had asthma before?
    0 no  1 yes  9 don’t know
11. Have you smoked?
    0 no (skip to question 16) 1 yes
12. Have you ever smoked regularly (almost every day at least one year)?
    0 no (skip to question 16) 1 yes
13. How many years have you smoked in total? (take off periods of not smoking which have lasted more than 6 months)
    No. of years _______________________
14. How much on average do you smoke now or did you smoke before you stopped?
    2 No. of cigarettes _________________
    3 No. of pipes _______________________
    4 No. of cigars _______________________
15. Do you smoke nowadays?
    0 not at all  2 yes regularly  3 yes occasionally
16. Has a doctor diagnosed any of the following diseases in you? (choose all the proper alternatives)
    2 chronic bronchitis
    3 emphysema
    4 bronchiectasis
    5 asthma
    6 none of these