CHRONIC OBSTRUCTIVE PULMONARY DISEASE

An international survey of chronic obstructive pulmonary disease in young adults according to GOLD stages

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Background: The recently published GOLD guidelines provide a new system for staging chronic obstructive pulmonary disease (COPD) from mild (stage I) to very severe (stage IV) and introduce a stage 0 (chronic cough and phlegm without airflow obstruction) that includes subjects “at risk” of developing the disease.

Methods: In order to assess the prevalence of GOLD stages of COPD in high income countries and to evaluate their association with the known risk factors for airflow obstruction, data from the European Community Respiratory Health Survey on more than 18 000 young adults (20–44 years) were analysed.

Results: The overall prevalence was 11.8% (95% CI 11.3 to 12.3) for stage 0, 2.5% (95% CI 2.2 to 2.7) for stage I, and 1.1% (95% CI 1.0 to 1.3) for stages II–III. Moderate to heavy smoking (>15 pack years) was significantly associated with both stage 0 (relative risk ratio (RRR) = 4.15; 95% CI 3.55 to 4.84) and stages I–III (RRR = 4.09; 95% CI 3.17 to 5.26), while subjects with stages I+ COPD had a higher likelihood of giving up smoking (RRR = 1.39; 95% CI 1.04 to 1.86) than those with GOLD stage 0 (RRR = 1.05; 95% CI 0.86 to 1.27). Environmental tobacco smoke had the same degree of positive association in both groups.

Conclusions: A considerable percentage of young adults already suffered from COPD. GOLD stage 0 was characterised by the presence of the same risk factors as COPD and by the same high demand for medical assistance.

The aim of the present study was to assess the prevalence of COPD severity stages, as defined in the GOLD guidelines, in high income countries and to evaluate whether subjects with stage 0 disease and those with more severe stages share a common pattern of risk factors and use of healthcare resources. Data from the European Community Respiratory Health Survey (ECRHS) were used. This study collected information about health status, lung function, and other factors known or hypothesised to be associated with COPD in more than 18 000 young adults (20–44 years) enrolled between 1991 and 1993 throughout the European Union and elsewhere. The results reported here are from 33 centres in 16 countries. The ongoing ECRHS II study will allow the follow up of these subjects over time and their transition through the GOLD stages.

METHODS

Study design and subjects

The full protocol of the ECRHS has been described elsewhere. Briefly, each participating centre selected an area of at least 150 000 inhabitants, defined by pre-existing administrative boundaries, and with an up to date sampling frame. In the first stage of the study, randomly selected samples of at least 1500 people of each sex, aged 20–44 years, were sent a screening questionnaire enquiring about respiratory symptoms, attacks of asthma, use of asthma medications, and hay fever or nasal allergies. In the second stage of the study a random sample of subjects who had completed the screening questionnaire was invited to come for a set of clinical and functional tests, including a standardised clinical interview and an assessment of lung function by spirometry.
For the purpose of the present analysis we considered all the subjects who participated in the second stage of the ECRHS (table 1).

Methods
According to the ECRHS protocol, baseline FEV₁ and forced vital capacity (FVC) were measured in all the subjects who consented. Up to five forced expiratory manoeuvres were performed and the highest FEV₁ and FVC that did not exceed the next highest one by more than 5% were considered for the present analysis. The questions on chronic symptoms and asthma used in the ECRHS were those of the 1976 version of the British Medical Research Council Questionnaire.10

Staging was defined according to the GOLD guidelines1 as follows:
- stage 0 (at risk): presence of chronic symptoms (cough and/or phlegm from the chest, usually in winter and on most days for as long as 3 months each year) at the clinical interview and FEV₁/FVC >70%;
- stage I (mild COPD): FEV₁/FVC <70% and FEV₁ >80% predicted;¹¹
- stage II (moderate COPD): FEV₁/FVC <70% and FEV₁ 50–80% predicted;
- stage III (severe COPD): FEV₁/FVC <70% and FEV₁ 30–50% predicted;
- stage IV (very severe COPD): FEV₁/FVC <70% and FEV₁ <30% predicted.

Subjects in stages I–IV could have or not have chronic symptoms. Asthma was considered present if a subject replied affirmatively to the question “Have you ever had asthma?”. All the subjects who reported asthma without chronic symptoms of cough and/or phlegm were not considered as having COPD. Subjects reporting asthma and chronic symptoms of cough and/or phlegm were considered as having COPD with coexisting asthma.

Subjects were classified according to smoking habits as current smokers, past smokers, and non-smokers. They were considered smokers (current or past) if they stated in the questionnaire that they had smoked at least 20 packs of cigarettes or 360 g of tobacco in a lifetime, or at least one cigarette per day or one cigar a week for 1 year. Current smokers were those who reported currently smoking and were divided into two subgroups according to the pack years smoked in a lifetime (light smokers <15 pack years; moderate to heavy smokers >15 pack years), while a third subgroup comprised people who were currently smoking other tobaccos (cigars, cigarillos or pipe tobacco). Subjects were considered past smokers if they had been smokers (as defined above) and had stopped smoking at least 1 month previously. All the other subjects were considered as non-smokers. Furthermore, non-smokers and past smokers were both divided into two subgroups according to exposure to environmental tobacco smoke (ETS) (exposed if they reported having been exposed for at least 4 hours per day on most days or nights in the previous 12 months; and non-exposed otherwise).

<table>
<thead>
<tr>
<th>Country</th>
<th>Centre</th>
<th>Subjects selected</th>
<th>Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spain</td>
<td>Barcelona</td>
<td>534</td>
<td>393</td>
</tr>
<tr>
<td></td>
<td>Galdakao</td>
<td>576</td>
<td>486</td>
</tr>
<tr>
<td></td>
<td>Albacete</td>
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<td></td>
<td>Oviedo</td>
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<td></td>
<td>Huelva</td>
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<tr>
<td>France</td>
<td>Bordeaux</td>
<td>2936</td>
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<td>Grenoble</td>
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<td></td>
<td>Montpellier</td>
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<td>Paris</td>
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<td>Italy</td>
<td>Pavia</td>
<td>816</td>
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<td></td>
<td>Turin</td>
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<td>Switzerland</td>
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<td>1210</td>
<td>544</td>
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<tr>
<td>Germany</td>
<td>Hamburg</td>
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</tr>
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<td></td>
<td>Erfurt</td>
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<td>Belgium</td>
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<tr>
<td></td>
<td>Antwerp City</td>
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<td>564</td>
</tr>
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<td>427</td>
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<tr>
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<td>Bergen-op-Zoom</td>
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<td></td>
<td>Geleen</td>
<td>671</td>
<td>439</td>
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<td>Denmark</td>
<td>Aarhus</td>
<td>652</td>
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<td></td>
<td>Goteborg</td>
<td>777</td>
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<td>Umea</td>
<td>611</td>
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<td>Iceland</td>
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<td>Dublin</td>
<td>599</td>
<td>454</td>
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<td>Cambridge</td>
<td>527</td>
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<td></td>
<td>Ipswich</td>
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<td></td>
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<td>655</td>
<td>473</td>
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<td>Portland</td>
<td>1604</td>
<td>734</td>
</tr>
<tr>
<td>Australia</td>
<td>Melbourne</td>
<td>1644</td>
<td>669</td>
</tr>
<tr>
<td>New Zealand</td>
<td>Wellington</td>
<td>741</td>
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<tr>
<td></td>
<td>Christchurch</td>
<td>712</td>
<td>459</td>
</tr>
<tr>
<td></td>
<td>Hawkes Bay</td>
<td>549</td>
<td>316</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>36827</td>
<td>18412</td>
</tr>
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</table>
The other risk factors considered in the analysis were self-reported serious respiratory infections before the age of 5 years, a history of occupational exposure to vapours, gas, dust or fumes, and low socioeconomic class (as indicated by having completed full time education before the age of 16 years).

The use of healthcare resources was evaluated for each subject at the clinical interview by the following questions:

- “Have you used any medicines (inhaled medicines, pills, capsules or tablets) to help your breathing at any time in the last 12 months?"
- “Have you ever been seen by a doctor because of breathing problems or because of shortness of breath?"
- “Have you ever visited a hospital casualty department or emergency room because of breathing problems?"
- “Have you ever spent a night in hospital because of breathing problems?"

Statistical analysis

A total of 14 855 subjects who answered the questions on chronic symptoms during the clinical interview and who had at least two technically satisfactory measurements of FEV1 and FVC were analysed.

Data were summarised as prevalence rates (%) with binomial exact 95% confidence intervals. Stage II (moderate COPD) and stage III (severe COPD) were combined as only eight subjects were classified in stage III. The ecological association between the prevalence rates of the GOLD stages was evaluated at the national level by the Spearman rank correlation coefficient (rs). Meta-analysis was performed using the Mantel-Haenszel method to obtain pooled odds ratios across countries for the association between sex and chronic symptoms during the clinical interview and who had at least two technically satisfactory measurements of FEV1 and FVC were analysed.

The prevalence of all the stages showed a substantial and statistically significant variation across countries: stage 0 ranged from 7.2% (95% CI 5.2 to 9.7) in Australia to 23.7% (95% CI 21.6 to 26.0) in Spain, stage I from 0.8% (95% CI 0.2 to 1.9) in Iceland to 7.4% (95% CI 5.6 to 9.5) in Switzerland, and stages II–III from 0.4% (95% CI 0.1 to 1.1) in Italy to 3.4% (95% CI 1.6 to 6.1) in Denmark.

In general, the geographical pattern of the prevalence of GOLD stages was not consistent across countries. The prevalence of chronic symptoms without obstruction (stage 0) was not significantly associated with the prevalence of COPD stage 1 (rs = 0.19, p = 0.49; fig 1A), whereas stages I and II–III were only moderately associated (rs = 0.54, p = 0.03; fig 1B).

Women had a lower prevalence of both COPD and chronic symptoms without obstruction than men: 2.4% (95% CI 2.1 to 2.8) v 4.8% (95% CI 4.3 to 5.3) and 10.9% (95% CI 10.2 to 11.7) v 12.6% (95% CI 11.9 to 13.4), respectively. This pattern was consistent within all the countries except Sweden where one centre (Uppsala) had a significantly higher prevalence of women than men in stage 0. The pooled estimate of the odds ratio for women v men was 0.85 (95% CI 0.77 to 0.94) for stage 0 and 0.49 (95% CI 0.41 to 0.59) for stages 1–3.

Among the subjects with airflow obstruction, 32.4% (95% CI 28.4 to 36.6) were symptomatic, 22.3% (95% CI 18.1 to 26.9) being in stage I and 54.5% (95% CI 46.6 to 62.2) in stages II–III. The percentage of subjects with coexisting asthma was not significantly different in stage 0 and in stages 1–3: 14.1% (95% CI 12.5 to 15.8) v 12.5% (95% CI 9.8 to 15.6), respectively.

The group of patients with COPD was significantly older and contained a higher percentage of men than did those with stage 0 disease or normal subjects (p<0.001, table 3). Compared with healthy individuals, subjects in stage 0 and in stages I–3 had a significantly greater prevalence of moderate to heavy smokers, were more exposed to vapours, gas, dust or fumes at work, reported more respiratory infections in childhood, and were in a lower socioeconomic class. The

### Table 2

<table>
<thead>
<tr>
<th>Country</th>
<th>Stage 0 (n = 1751)</th>
<th>Stage I (n = 369)</th>
<th>Stages II–III (n = 168)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spain</td>
<td>23.7 (21.6 to 25.0)</td>
<td>1.6 (1.0 to 2.4)</td>
<td>1.1 (0.6 to 1.7)</td>
</tr>
<tr>
<td>France</td>
<td>9.2 (7.9 to 10.5)</td>
<td>1.0 (0.6 to 1.6)</td>
<td>0.5 (0.3 to 1.0)</td>
</tr>
<tr>
<td>Italy</td>
<td>10.4 (8.3 to 12.8)</td>
<td>0.9 (0.4 to 1.9)</td>
<td>0.4 (0.2 to 1.1)</td>
</tr>
<tr>
<td>Switzerland</td>
<td>10.4 (8.3 to 12.8)</td>
<td>7.4 (5.6 to 9.5)</td>
<td>2.3 (1.3 to 3.6)</td>
</tr>
<tr>
<td>Germany</td>
<td>11.1 (9.6 to 12.7)</td>
<td>2.4 (1.7 to 3.2)</td>
<td>1.3 (0.8 to 2.0)</td>
</tr>
<tr>
<td>Belgium</td>
<td>11.7 (9.5 to 14.4)</td>
<td>3.4 (2.2 to 5.1)</td>
<td>2.4 (1.4 to 3.9)</td>
</tr>
<tr>
<td>The Netherlands</td>
<td>8.0 (6.6 to 9.6)</td>
<td>2.6 (1.8 to 3.6)</td>
<td>0.9 (0.4 to 1.5)</td>
</tr>
<tr>
<td>Denmark</td>
<td>12.5 (8.9 to 16.8)</td>
<td>4.4 (2.4 to 7.4)</td>
<td>3.4 (1.6 to 6.1)</td>
</tr>
<tr>
<td>Sweden</td>
<td>11.8 (10.2 to 13.5)</td>
<td>2.3 (1.6 to 3.2)</td>
<td>0.6 (0.3 to 1.1)</td>
</tr>
<tr>
<td>Norway</td>
<td>8.4 (6.7 to 10.4)</td>
<td>1.1 (0.3 to 2.1)</td>
<td>1.6 (0.9 to 2.7)</td>
</tr>
<tr>
<td>Iceland</td>
<td>11.0 (8.4 to 14.0)</td>
<td>0.8 (0.2 to 1.9)</td>
<td>1.1 (0.4 to 2.5)</td>
</tr>
<tr>
<td>Ireland</td>
<td>18.9 (14.6 to 23.8)</td>
<td>4.0 (2.1 to 7.0)</td>
<td>1.3 (0.4 to 3.4)</td>
</tr>
<tr>
<td>UK</td>
<td>9.8 (8.0 to 11.8)</td>
<td>2.3 (1.4 to 3.4)</td>
<td>1.0 (0.5 to 1.9)</td>
</tr>
<tr>
<td>USA</td>
<td>16.2 (12.6 to 20.3)</td>
<td>4.0 (2.2 to 6.5)</td>
<td>0.8 (0.2 to 2.3)</td>
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<tr>
<td>Australia</td>
<td>7.2 (5.2 to 9.7)</td>
<td>4.3 (2.8 to 6.4)</td>
<td>1.4 (0.6 to 2.8)</td>
</tr>
<tr>
<td>New Zealand</td>
<td>10.6 (8.6 to 12.9)</td>
<td>3.7 (2.5 to 5.2)</td>
<td>1.0 (0.5 to 2.0)</td>
</tr>
<tr>
<td>Total</td>
<td>11.8 (11.3 to 12.3)</td>
<td>2.5 (2.2 to 2.7)</td>
<td>1.1 (1.0 to 1.3)</td>
</tr>
</tbody>
</table>

*Eight subjects were in stage III and there were no patients in stage IV.*
excluding all the subjects with coexisting asthma classified in the GOLD stages, the pattern of associations was consistent with the main analysis (data not shown).

Compared with the group of healthy subjects, all the GOLD stages, including stage 0, were characterised by a significantly higher percentage of people who had visited a doctor (32.6% vs 18.4%, p<0.001), had taken medication (24.1% vs 14.0%, p<0.001), had attended an emergency department (ED) at least once and/or had had at least one hospital admission (10.8% vs 5.1%, p<0.001) because of respiratory problems. Subjects in stage 0 and in stages I+ had a very similar use of healthcare resources. When all the subjects with coexisting asthma classified in the GOLD stages were excluded from the analysis, the percentage of healthcare resource users decreased by about one third in all the groups, whereas the relative pattern of consumption did not change (data not shown).

**DISCUSSION**

The results of our analysis show that in young adults (1) a considerable percentage of subjects already suffered from COPD and an even higher percentage of them reported chronic symptoms (stage 0); (2) the severity of the disease was still mild to moderate, with a wide variation among and within countries; (3) stage 0 and stages I+ of the GOLD classification of COPD identify groups of subjects that shared a common pattern of the individual risk factors and had a high use of healthcare resources because of respiratory problems.

To our knowledge, this is the first international study of almost 18 000 subjects that gives an estimate of the prevalence of COPD according to the GOLD definition and that focuses on the young adult population (aged 20–44 years). Based on this definition, our results support evidence that the disease develops earlier than is usually believed. This should be taken into account when planning future widespread programmes for early detection of the disease and preventive measures.15

The mean percentage of subjects with GOLD stage 0 was 11.8%, ranging from 7.2% in Australia to 23.7% in Spain. As expected with this young age group, the percentage of subjects with stages I+ disease was much lower than that of subjects with stage 0 disease, and no subject was found in the most severe stage (stage IV). However, despite their young age, the percentage of subjects with stages I+ disease was relevant (3.6%), with some countries showing a prevalence of more than 5% (Switzerland, Belgium, Denmark, Ireland and Australia). Women had a lower prevalence of both chronic symptoms (stage 0) and COPD than men, which agrees with the findings of previous studies.16–17 The sex difference in the prevalence was consistent across and within countries (except Sweden), and the men/women ratio increased significantly in the most severe stages. While the sex difference in chronic symptoms was entirely explained by the different distribution in exposure to the considered risk factors (as shown in the multivariate analysis), the significantly higher risk of having COPD for men may be due either to the fact that they were more exposed to other hazards (occupational, lifestyle, etc) not considered in the present analysis or to their greater susceptibility than women.

COPD can coexist with asthma even if the inflammation characteristic of the disease is distinct from that of asthma.18 In our sample we found that 13.7% of the subjects classified in stages 0+ reported coexisting asthma. In these patients an overlap between asthma and COPD may have been present, but we could not exclude the possibility that chronic cough and phlegm were purely expressions of asthma. Unfortunately, because of the lack of information on diurnal...
Table 3  Main characteristics of the subjects considered in the analysis according to the GOLD severity stages, and crude relative risk ratios (RRR)* with 95% confidence intervals for the association between each risk factor and the GOLD severity stage

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>No respiratory disorders % (n = 12567)</th>
<th>Stage 0 (n = 1751)</th>
<th>Stages I+ (n = 537)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RRR (95% CI)</td>
<td>%</td>
<td>RRR (95% CI)</td>
</tr>
<tr>
<td>Active/passive smoking exposure:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-smokers and ETS—†</td>
<td>37.9</td>
<td>21.4 (1.00)</td>
<td>24.0 (1.00)</td>
</tr>
<tr>
<td>Past smokers and ETS—†</td>
<td>17.3</td>
<td>10.2 (1.05 to 1.27)</td>
<td>15.6 (1.07 to 1.89)</td>
</tr>
<tr>
<td>Past smokers and ETS+</td>
<td>7.5</td>
<td>5.4 (1.29 to 1.64)</td>
<td>5.0 (1.06 to 1.62)</td>
</tr>
<tr>
<td>Smokers (&lt;15 pack-years)</td>
<td>4.4</td>
<td>3.1 (0.91 to 1.67)</td>
<td>4.0 (0.91 to 2.33)</td>
</tr>
<tr>
<td>Smokers (&gt;15 pack-years)</td>
<td>11.5</td>
<td>30.1 (4.01 to 5.38)</td>
<td>33.5 (4.62 to 5.81)</td>
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<tr>
<td>Smokers (other tobacco)‡</td>
<td>1.5</td>
<td>1.3 (0.93 to 2.31)</td>
<td>3.5 (2.09 to 5.86)</td>
</tr>
<tr>
<td>Presence of respiratory infections before the age of 5 years</td>
<td>8.9</td>
<td>12.2 (1.26 to 1.72)</td>
<td>14.1 (1.32 to 2.20)</td>
</tr>
<tr>
<td>Presence of occupational exposure to vapours, gas, dust or fumes in a lifetime</td>
<td>41.6</td>
<td>54.4 (1.67 to 1.85)</td>
<td>52.3 (1.54 to 1.83)</td>
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<tr>
<td>Low socioeconomic class</td>
<td>19.5</td>
<td>29.0 (1.68 to 1.89)</td>
<td>28.0 (1.30 to 1.97)</td>
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<tr>
<td>Females</td>
<td>51.1</td>
<td>46.3</td>
<td>33.7</td>
</tr>
<tr>
<td>Mean (SD) age (years)</td>
<td>33.6 (7.2)</td>
<td>32.7 (7.1)</td>
<td>36.8 (6.5)</td>
</tr>
<tr>
<td>Mean (SD) FEV1 % predicted</td>
<td>106.6 (13.1)</td>
<td>103.9 (13.1)</td>
<td>86.6 (15.1)</td>
</tr>
</tbody>
</table>

*Calculated by multinomial regression models (reference population: subjects with neither chronic symptoms nor airflow obstruction).
†ETS—/+: subjects exposed/not exposed to environmental tobacco smoke.
‡Cigars, cigarillos or pipe tobacco.

On the other hand, subjects in stage 0 shared the same risk factors as patients with COPD. Active smoking was strongly associated with both stage 0 and stages I+ COPD. The overall pattern of the association between smoking exposure and the GOLD stages strongly suggests that patients with more severe disease had given up smoking or had changed type of tobacco. Respiratory infections in childhood and low social class showed the same degree of association with both stage 0 and stages I+, as did ETS exposure which was moderately and positively associated with both stage 0 and stages I+ in non- and past smokers. At variance, after adjusting for the other risk factors, occupational exposure was associated with stage 0 but not with COPD, probably because more susceptible subjects were not employed in the most dangerous jobs (healthy worker effect) or because the question we used was not properly stated.

Table 4  Mutually adjusted relative risk ratios (RRRs)* (with 95% confidence intervals) for the association between the GOLD severity stages and active/passive smoking exposure, respiratory infections before the age of 5 years, occupational exposure to vapours, gas, dust or fumes in a lifetime, socioeconomic class, and sex

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>RRR (95% CI)</th>
<th>Comparison between RRRs†</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Stage 0</td>
<td>Stages I+</td>
</tr>
<tr>
<td>Active/passive smoking exposure (v non-smoker and ETS—†)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Past smoker and ETS—†</td>
<td>1.05 (0.86 to 1.27)</td>
<td>1.39 (1.04 to 1.86)</td>
</tr>
<tr>
<td>Non-smokers and ETS—†</td>
<td>1.18 (0.92 to 1.51)</td>
<td>1.16 (0.75 to 1.80)</td>
</tr>
<tr>
<td>Past smoker and ETS—†</td>
<td>1.15 (0.84 to 1.56)</td>
<td>1.41 (0.86 to 2.29)</td>
</tr>
<tr>
<td>Past smoker and ETS+</td>
<td>2.38 (2.05 to 2.77)</td>
<td>1.22 (0.90 to 1.65)</td>
</tr>
<tr>
<td>Smokers (&lt;15 pack-years)</td>
<td>4.15 (3.55 to 4.84)</td>
<td>4.09 (3.17 to 5.26)</td>
</tr>
<tr>
<td>Respiratory infections (present v absent)</td>
<td>1.47 (1.25 to 1.74)</td>
<td>1.62 (1.24 to 2.12)</td>
</tr>
<tr>
<td>Occupational exposure (present v absent)</td>
<td>1.47 (1.31 to 1.65)</td>
<td>1.08 (0.88 to 1.31)</td>
</tr>
<tr>
<td>Socioeconomic class (low v high)</td>
<td>1.22 (1.07 to 1.40)</td>
<td>1.34 (1.05 to 1.71)</td>
</tr>
<tr>
<td>Sex (male v female)</td>
<td>1.00 (0.89 to 1.12)</td>
<td>0.55 (0.42 to 0.67)</td>
</tr>
</tbody>
</table>

*Also adjusted for the effect of the ECRHS countries (reference population: subjects with neither chronic symptoms nor airflow obstruction).
†p values obtained by the Wald test.
ETS—/+: presence/absence of exposure to environmental tobacco smoke.
‡p value for comparison between the adjusted RRRs for past smoking.
*ETT: cigarettes, cigarillos, or pipe tobacco.
††p value for comparison between the adjusted RRRs for exposure to environmental tobacco smoke.

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Subjects with stage 0 and stages 1+ disease used more healthcare resources because of respiratory problems than did healthy people. Those with stage 0 disease had the same utilisation of healthcare resources as individuals with stages 1+ disease, even when the subjects with coexisting asthma were not considered, suggesting that the presence of chronic symptoms of cough and/or phlegm was the main reason for using healthcare services by patients of this age group with mild to moderately severe COPD.

One potential problem in interpreting our results is that there was a large variation in response rates across countries. A low response rate may lead to considerable overestimation or underestimation of the actual prevalence if participation in the survey is related to the presence of symptoms. However, previous studies have shown that the effect of non-response was negligible in the second stage of ECRHS. A further limitation that should be taken into account when considering the prevalence estimates at national level is that the centres were not selected to be representative of their countries and that, in some countries, only one centre was present.

In conclusion, COPD is an important health problem even in young adults, both because of the high prevalence of the disease and the frequent use of healthcare resources. Our study shows that GOLD stage 0 identifies a particular group of subjects exposed to the same risk factors as those with COPD and characterised by requiring medical assistance for respiratory problems as frequently as do COPD patients.

The ongoing follow up of these subjects in ECRHS II will highlight the natural history of individuals in the different GOLD stages and will offer the possibility of assessing the likelihood of those in stage 0 progressing to more severe stages.

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