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Severity distribution of chronic obstructive pulmonary disease (COPD) in Dutch general practice ☆

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Summary The actual burden of chronic obstructive pulmonary disease (COPD) in terms of health care use and costs strongly depends on the distribution of disease severity. For the Netherlands, the distribution of diagnosed COPD was estimated by classifying all patients with a physician diagnosis of COPD from two different sources of general practitioners (GP)-data into mild (27%), moderate (55%), severe (15%) or very severe COPD (3%) based on their post-bronchodilator $FEV_1\%$ predicted, according to the GOLD-guidelines. This distribution will most likely shift to the less severe stages when under-reporting and under-diagnosis are reduced.

Introduction

Worldwide, chronic obstructive pulmonary disease (COPD) causes serious health problems and disability. Models that project the future morbidity, mortality and costs of COPD show that the burden of COPD will increase during the next few decades.[1,2] The actual burden in terms of costs strongly

depends on the severity distribution of COPD in the population, as there is a powerful association between use of healthcare services and disease severity.[3–5] To project the future burden of COPD by disease severity and to evaluate the impact of different smoking cessation interventions for patients with COPD on the burden of COPD in the Netherlands, we have developed a population model that simulates disease progression over time according to severity stages.[6] To classify the prevalence of diagnosed COPD in the starting year of the simulation over the stages mild, moderate, severe and very severe COPD,[7] it was necessary to know the distribution of COPD disease severity in the Dutch population of diagnosed COPD patients. Such data have not been reported in the literature before and are not routinely collected as part of any ongoing data registration. Because in the Netherlands virtually all people are registered with a general practice (GP), the prevalence of diagnosed COPD is generally derived from GP databases. This study aimed to assess the severity distribution of COPD from GP databases in the Netherlands.

Methods

Two different sources of GP data were used. The first data source contained all patients with physician-diagnosed COPD including those with co-existing asthma from five GP registrations in the Nijmegen Monitoring Project (NMP).[8] These practices are part of the academic GP network of the University Medical Centre Nijmegen. In these practices, all patients with COPD are coded using International Classification of Primary Care[9] codings (R91/R95) and all available spirometric test results are stored electronically.

The second data source was a clinical trial that contained lung function data on COPD and asthma patients from 25 GP practices in the Amsterdam area.[10] All registered patients with a diagnosis of either COPD or asthma were asked to participate in the trial. To be enrolled in the trial, participants had to meet the following inclusion criteria: age 16–75 years, capable of filling in a Dutch questionnaire, no specific pulmonary disease other than COPD or asthma and absence of any disease in a terminal phase. Known asthma patients were excluded from the dataset. All patients with physician-diagnosed COPD (including COPD with coexisting asthma) and patients for which the exact GP diagnosis for the respiratory condition was unknown entered our analysis. For the latter group, the final decision whether or not patients had COPD was based on lung function indices.

For both datasets the classification of COPD severity was based on post-bronchodilator $FEV_1\%$ predicted according to the class boundaries in the GOLD classification.[7] $FEV_1\%$ predicted was calculated using ECCS/ ERS equations.[11] Patients aged <45 years were excluded.

For all NMP patients with a FEV_1/FVC ratio <70%, the largest $FEV_1\%$ predicted value of the two most recent consecutive years with measurements in the period 1997–2002 was used for classification. When post-bronchodilator values were not available, pre-bronchodilator values were multiplied by 1.095. This factor was based on the observed difference between pre- and post-bronchodilator values from NMP patients for whom both values were available (62%). All patients from the Amsterdam data with a FEV_1/FVC ratio <70% were classified based on the baseline lung function measurements of the clinical trial performed in the period 1995–1998.

Results

Study populations

In the NMP practices 530 patients had physician-diagnosed COPD. For 307 (58%) of them sufficient spirometric data were available. Patients with and without spirometry did not differ with respect to gender, age, co-morbid conditions and number of drug prescriptions for COPD. Eighty-five patients were excluded from further analyses because their FEV_1/FVC ratio was >70%. Six additional patients were excluded because they were aged <45 years. The remaining 216 patients (70% male) with a mean age of 67.7 years were classified according to the GOLD stages mild, moderate, severe and very severe COPD. In the Amsterdam data, 1325 (65%) of the 2047 patients, who met the inclusion criteria, were willing to participate. Patients who did not enter the clinical trial were significantly younger and a higher percentage was male.[10] A total of 1308 patients had valid lung function measurements at baseline. From this group 607 patients with a diagnosis of asthma only, 400 patients with a FEV_1/FVC ratio >70% and 36 patients aged <45 years were excluded. In total, 265 COPD patients (65% male) with a mean age of 63.8 years remained for classification.

COPD severity distribution

Table 1 shows the results of the severity classification based on GOLD stages for both data sources separately as well as for both patient groups

Table 1   Distribution of disease severity among COPD patients known to the GP. Classification is based on post-bronchodilator FEV_1.

	COPD severity by GOLD criteria, $FEV_1/FVC < 70\%$, percentage (95%-confidence interval)			
	GOLD I Mild: $FEV_1\%$ predicted $\geqslant 80\%$	GOLD II Moderate: $50 \leqslant FEV_1\%$ predicted $< 80\%$	GOLD III Severe: $30 \leqslant FEV_1\%$ predicted $< 50\%$	GOLD IV Very severe: $FEV_1\%$ predicted $< 30\%$
NMP (%)	31	47	19	3
Amsterdam (%)	28	55	15	2
Total (%)	30 (26–34)	52 (47–56)	17 (13–20)	2 (1–4)

FEV_1: Forced expiratory volume in 1 s.
FVC: Forced vital capacity.

combined. Figure 1 shows the frequency distribution of $FEV_1\%$ predicted for the combined data. The bars show the empirical data, the continuous line the fitted normal distribution density function. Statistical testing demonstrated that the empirical data did not significantly deviate from a normal distribution with a mean $FEV_1\%$ predicted of 68.3 and a standard deviation of 19.9. For our simulation model we based the severity distribution on this normal distribution, truncated at 10 and 110 $FEV_1\%$ predicted: mild COPD 27%, moderate COPD 55%, severe COPD 15% and very severe COPD 3%.
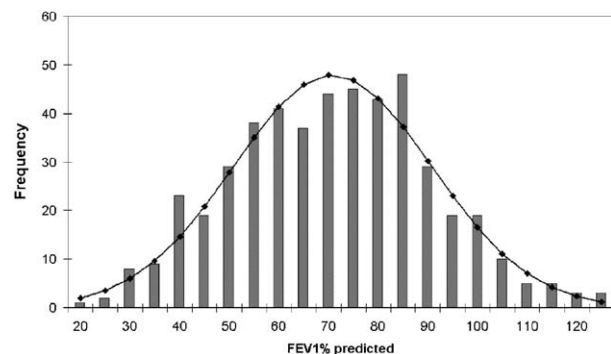
Figure 1 Frequency distribution of $FEV_1\%$ predicted of prevalent, diagnosed cases of COPD ($n = 481$), defined as $FEV_1/FVC < 70\%$, based on the combined data sources.

Discussion

This study showed that in the Netherlands, in total, 80% of the patients with a physician diagnosis of COPD had mild or moderate disease whereas almost 20% had severe or very severe COPD. As virtually all people in the Netherlands, including those treated by pulmonologists, are registered with a GP practice, these data probably represent the population of physician-diagnosed COPD patients fairly well. It does not reflect the COPD severity distribution in the entire Dutch community, as under-presentation and under-diagnosis is not accounted for.

Some of the patients also had a diagnosis of asthma. They were included. Excluding these patients has little impact; the proportion of patients with severe and very severe COPD changes from 19% to 22%.

The five NMP practices are known for keeping electronic records of spirometric test results. Nevertheless, spirometric data were absent in the electronic records for almost 40% of the patients with a physician diagnosis of COPD. Although no significant differences were found between the

groups with and without spirometry on general characteristics, the lack of lung function data may have influenced the results. In the Amsterdam database the COPD and asthma patients who participated in the clinical trial were not completely representative of the total population of COPD and asthma patients in the 25 GP practices. Patients who refused to participate were significantly younger and a higher percentage was male. Whether this has influenced our results and to what extent is difficult to determine.

An interesting finding was that 32% of the patients with a physician diagnosis of COPD did not meet the criterion of airflow limitation as it is defined in the GOLD-guidelines (i.e., FEV_1/FVC ratio $< 70\%$). This indicates that in quite a few cases physicians do not base their diagnosis on lung function, but on criteria such as a history of smoking combined with chronic cough and dyspnoea over prolonged periods of time. As the systemic effects of COPD are increasingly recognized, it is likely that in the future COPD severity will be based on a combination of variables, like the recently published BODE-index, which combines $FEV_1\%$ predicted, dyspnoea score, 6-min

walk distance and body mass index.[12] However, as this is only a recent development, no routine registrations exist that generate these data for epidemiological use yet.

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