The ‘real-life’ COPD patient in Germany: The DACCORD study

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ABSTRACT

Introduction: DACCORD is an ongoing, longitudinal, non-interventional study within the German COPD National Prospective Registry. This manuscript describes the baseline characteristics of the first 5924 participants, recruited between November 2012 and November 2013.

Methods: The main inclusion criteria are a physician diagnosis of COPD, age ≥40 years, and initiating or changing COPD maintenance medication. Data collected included: Demographic and disease characteristics; prescribed medication; symptoms; COPD Assessment Test (CAT); modified Medical Research Council dyspnoea score (mMRC); exacerbations; comorbidities; and forced expiratory volume in 1 s (FEV1).

Results: Approximately 60% of the population are male, with mean age of 65.7 years and FEV1 61.6% predicted. On entry to the study the majority of patients reported symptoms, most commonly exertional dyspnoea (85.9%) and cough (65.7%). According to GOLD 2010, 48.6% of patients were classified as GOLD II. GOLD 2011 classification was influenced by the symptoms criterion: 43.7 and 45.3% of patients were classified as GOLD B or D using CAT, compared with 26.4 and 34.0%, respectively, using mMRC. The majority of patients were receiving a LAMA-containing regimen, with 39.4% overall receiving ICS. A total of 78.3% of patients reported at least one comorbidity, most commonly cardiovascular.

Conclusion: In conclusion, DACCORD is a large, prospective, non-interventional study that provides an informative and intriguing picture of the typical COPD patient in Germany.

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1. Introduction

Chronic obstructive pulmonary disease (COPD) is one of the few chronic conditions with mortality forecast to increase over the next decade (with one projection suggesting that COPD will be the fourth leading cause of global mortality in 2030) [1], due (in Germany at least) to a demographic shift resulting from increasing life expectancy and low birth rates [2]. Given this, it is important to understand the impact of the disease, and how best to manage it.

Randomized controlled trials (RCTs) generally recruit highly selected populations, often excluding patients with significant or unstable comorbidities. Although data from RCTs can be helpful in informing treatment decisions, data that are more representative of ‘real-life’ populations are important. DACCORD, or Die ambulante Versorgung mit langwirksamen Bronchodilatatoren: COPD-Registrierung in Deutschland (English translation: Outpatient Care With Long-Acting Bronchodilators: COPD Registry in Germany) is an ongoing non-interventional study, and is, to our knowledge, the largest such study in COPD to date. The main aim of DACCORD is to generate data on the course of COPD under typical treatment conditions in the community. The study is registered in the European Network of Centres for Pharmacoepidemiology and Pharmacovigilance (http://www.encepp.eu/encepp/viewResource.htm?id=6316). This manuscript describes the baseline characteristics of the first cohort of patients recruited into DACCORD.

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2. Methods

2.1. Study design

DACCORD is an ongoing, longitudinal, prospective non-interventional study of two years duration within the newly established German COPD National Prospective Registry. The first cohort (which is described here) is of approximately 6000 participants from 349 primary and secondary care practices distributed throughout Germany (see the map in the supplementary material, and the regional breakdown of patients in Supplementary Table 1). Full details of the methods have been previously published [3]. A second cohort of another 6000 patients is currently being recruited, using similar inclusion criteria.

2.2. Participants

The main inclusion criteria are:

- a diagnosis of COPD fulfilling the German COPD Disease Management Programme (DMP) criteria (one of which is that COPD is confirmed by spirometry testing);
- age >40 years;
- initiating or changing COPD maintenance medication (given the non-interventional nature of the study, the decision to initiate or change medication was to have been made prior to inclusion in DACCORD);
- current, ex- and never-smokers.

In order to recruit as broad a population as possible, patients were excluded only if they were in the German Asthma Disease Management Programme, or if they were participating in a randomised clinical trial. All patients were to provide written informed consent prior to inclusion. Each investigator was asked to recruit five consecutive eligible patients; the aim was to recruit approximately 4000 patients whose treatment regimen included glycopyrronium bromide and 2000 patients receiving other long-acting inhaled bronchodilators for a control group.

2.3. Outcomes

Data collected on entry to the study included: Demographic and disease characteristics; smoking status; prescribed medication (both COPD and non-COPD); symptoms; COPD Assessment Test (CAT); modified Medical Research Council dyspnoea score (mMRC); exacerbations in the 6 months prior to entry (defined based on prescription of oral steroids and/or antibiotics or hospitalisation); and comorbidities (collected in an electronic case report form using prespecified headings, similar to those in the German COPD DMP e-report form). In addition, baseline forced expiratory volume in 1 s (FEV1) data were collected from spirometry conducted at the investigative sites. The majority of patients were receiving maintenance COPD treatment at baseline; given the non-interventional nature of the study there was no requirement either for their treatment to be interrupted, or for short-acting bronchodilators to be administered for lung function testing on entry to the study. However, the value of requiring the COPD DMP as an inclusion criterion is that it ensures that post-bronchodilator testing was conducted at some point previously, since the COPD DMP requires reversibility testing as part of the diagnosis and management of COPD – specifically an FEV1/FVC ratio <70%, and an increase in FEV1 of less than 15% and/or less than 200 mL 10 min after inhalation of a short-acting β2-agonist (SABA) or 30 min after inhalation of a short-acting muscarinic antagonist (SAMA). Further, it was anticipated that a subset of patients would undergo formal post-short acting bronchodilator evaluations as part of their standard care on entry to the study.

Patients are being followed for a further 2 years. Full details of the data that are being collected over this period have been described previously [3], but to summarise: data are being collected approximately every 3 months during standard clinic visits. At the 3-monthly visits, data on exacerbations and prescribed COPD medication are being collected, whilst at the 1 and 2-year visits, patients’ CAT total score and FEV1 are also being captured, together with the data collected at baseline such as comorbidities and symptoms.

2.4. Statistical methods

All baseline data are presented descriptively only, and for the overall population, either as mean and standard deviation (SD), or number and percentage. Subgroups were defined on age (<65, 65–75 and >75 years), inhaled corticosteroid use (ICS; yes/no), and baseline CAT total score (<10 vs >30). The CAT <10 cut-point was selected to match the GOLD 2011 severity classification; the >30 cut-point was selected to match the range of scores (i.e., the top 10 values).

3. Results

3.1. Demographics and disease characteristics

The first patient was recruited in November 2012, and the last in November 2013. The baseline demographics of the overall population are shown in Table 1. On entry, 87.1% of patients were already receiving COPD medication, with 12.9% newly-initiating treatment; 50.3% had received an influenza vaccination, 36.0% a pneumococcal vaccination, 7.1% had undertaken pulmonary rehabilitation, 61% were using oxygen, and 34.8% had undertaken a patient education programme.

Approximately 46% of the patients were <65 years of age. As might be anticipated, the duration since primary diagnosis increased with increasing age group, with the proportion of current smokers decreasing with increasing age. The two CAT subgroups were of a similar size, each accounting for approximately 10% of the overall population. The majority of the characteristics were similar in the two CAT subgroups; patients in the CAT >30 group tended to have worse FEV1 than those in the CAT <10 group, with more patients having a time since diagnosis >1 year. In the subgroup of 1561 patients with a post-bronchodilator spirometry assessment, the mean FEV1 was 55.5% predicted.

3.2. Symptoms and health status

As the study population was recruited by routine clinical consultations, the majority of patients reported experiencing symptoms of COPD on entry to DACCORD, with only 3.4% of the patients reporting no symptoms (Table 2). The most commonly reported symptoms were exertional dyspnoea (85.9%) and cough (65.7%); which in the majority of cases was productive (59.4% of the cough cases). Patients most commonly reported daytime as the most bothersome time for symptoms (55.9% of patients), followed by morning (33.2%) (Fig. 1). In the overall population, a similar proportion of patients reported 2, 3 and >3 symptoms (26.9, 22.0 and 33.2%), with 38.6% of patients having baseline mMRC score 0 or 1, and 61.3% a score of 2 or more.

The three age subgroups reported similar levels of symptoms, although (perhaps as would be expected) with increasing age there was a trend for increasing percentages of patients reporting dyspnoea at rest and restricted exercise tolerance. As would be
anticipated, patients with CAT >30 reported more symptoms than those with CAT <10. However, in this latter group (which would be described by GOLD as ‘less symptoms’), the majority of patients reported at least one symptom, with 10.3% reporting more symptoms than those with CAT <10.

### 3.3. Exacerbations

The proportion of patients experiencing exacerbations in the 6 months prior to entry are shown in Fig. 2. Approximately 60% of the patients were recruited over the first six months of recruitment (from November 2012 to April 2013); these accounted for 63% of the patients who reported an exacerbation history.

Although exacerbations were reported by a greater proportion of patients receiving ICS than not receiving ICS, the difference between the two groups was relatively small. Most patients received a combination of antibiotics and systemic steroids for the management of their exacerbation, followed by antibiotics alone (Fig. 2).

### 3.4. COPD severity classification

COPD severity classified according to GOLD 2010 is shown in the left panel of Fig. 3. Approximately half of the patients met the criterion of GOLD II (i.e., FEV1 between 50 and 80% predicted). To classify patients according to GOLD 2011, the 6-month exacerbations data were extrapolated to 12 months, and both CAT and mMRC were used for the symptoms criterion. Use of CAT resulted in a more equal distribution. FEV1 (either alone or in combination with exacerbations history) was the main criterion for assigning patients to the high risk categories (GOLD C or D; mMRC gave a more equal distribution).

### 3.5. COPD maintenance medication

COPD maintenance medication, overall and by GOLD 2011 group (using CAT as the symptom classification) is listed in Table 3. As would be expected from the study design, a large proportion of patients across all four GOLD categories were receiving a regimen that included a LAMA. In total, 39.4% of patients were receiving an ICS-containing regimen: 31.2, 34.3, 41.7 and 45.4% of patients in GOLD Groups A, B, C and D, respectively.

Table 1

<table>
<thead>
<tr>
<th>Baseline demographics and disease characteristics of the overall population recruited into the DACCORD study, together with the subgroups with age &lt;65, 65–75, and &gt;75 years, and baseline CAT total score &lt;10 and &gt;30.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Overall population</strong></td>
</tr>
<tr>
<td>N = 5924</td>
</tr>
<tr>
<td><strong>Sex, n (%)</strong></td>
</tr>
<tr>
<td>Male</td>
</tr>
<tr>
<td>Female</td>
</tr>
<tr>
<td><strong>Age (years), mean (SD)</strong></td>
</tr>
<tr>
<td>&lt;65 years</td>
</tr>
<tr>
<td>&gt;75 years</td>
</tr>
<tr>
<td>65–75 years</td>
</tr>
<tr>
<td><strong>Smoking status, n (%)</strong></td>
</tr>
<tr>
<td>Non-smoker</td>
</tr>
<tr>
<td>Current smoker</td>
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<tr>
<td>Ex-smoker</td>
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<tr>
<td><strong>BMI (kg/m²), mean (SD)</strong></td>
</tr>
<tr>
<td>&lt;65 years</td>
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<tr>
<td>&gt;1 year</td>
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<tr>
<td>1 year</td>
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<tr>
<td><strong>FEV1 (litres)</strong></td>
</tr>
<tr>
<td>&lt;65 years</td>
</tr>
<tr>
<td>&gt;75 years</td>
</tr>
<tr>
<td><strong>Restricted exercise tolerance</strong></td>
</tr>
<tr>
<td>&lt;65 years</td>
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<tr>
<td>&gt;75 years</td>
</tr>
<tr>
<td><strong>H. Worth et al. / Respiratory Medicine 111 (2016) 64–71</strong></td>
</tr>
</tbody>
</table>

Table 2

<table>
<thead>
<tr>
<th>Baseline symptoms and health status of patients recruited in the DACCORD study.</th>
<th>Overall population</th>
<th>Age</th>
<th>Baseline CAT score</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = 5924</td>
<td>&lt;65 years (N = 2711)</td>
<td>&gt;75 years (N = 2158)</td>
<td>CAT &lt;10 (N = 563)</td>
</tr>
<tr>
<td><strong>Symptoms of COPD, n (%)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>202 (3.4)</td>
<td>108 (4.0)</td>
<td>65 (3.0)</td>
</tr>
<tr>
<td>Exertional dyspnoea</td>
<td>5090 (85.9)</td>
<td>2303 (85.0)</td>
<td>1883 (87.1)</td>
</tr>
<tr>
<td>Dyspnoea at rest</td>
<td>1106 (18.7)</td>
<td>479 (17.7)</td>
<td>388 (18.0)</td>
</tr>
<tr>
<td>Chest tightness/chest pain</td>
<td>1427 (24.1)</td>
<td>649 (23.9)</td>
<td>499 (23.1)</td>
</tr>
<tr>
<td>Cough</td>
<td>3890 (65.7)</td>
<td>1821 (67.2)</td>
<td>1404 (65.0)</td>
</tr>
<tr>
<td>Wheezing or grunting</td>
<td>1434 (24.2)</td>
<td>696 (25.7)</td>
<td>484 (22.4)</td>
</tr>
<tr>
<td>Prolonged expiration</td>
<td>1164 (19.6)</td>
<td>520 (19.2)</td>
<td>425 (19.7)</td>
</tr>
<tr>
<td>Restricted exercise tolerance</td>
<td>3345 (56.5)</td>
<td>1476 (54.4)</td>
<td>1241 (57.4)</td>
</tr>
<tr>
<td>mMRC, mean (SD)</td>
<td>1.9 (1.1) (n = 5918)</td>
<td>1.8 (1.0) (n = 2709)</td>
<td>1.9 (1.0) (n = 2158)</td>
</tr>
<tr>
<td>CAT, mean (SD)</td>
<td>20.0 (7.7) (n = 5918)</td>
<td>20.4 (7.6) (n = 2709)</td>
<td>19.5 (7.6) (n = 2158)</td>
</tr>
</tbody>
</table>

mMRC = modified Medical Research Council dyspnoea scale; CAT = COPD Assessment Test.
3.6. Comorbidities

Comorbidity data are available for 4992 of the patients recruited into DACCORD. Of these patients, 78.3% reported at least one co-morbidity. Cardiovascular disease was reported by more than half of the overall DACCORD population, and in both of the CAT sub-groups, with a prevalence that increased with increasing age group (Table 4).
4. Discussion

Randomised clinical trials (even large, ‘landmark’, post-registration trials) typically recruit narrow, selected populations. For example, three of the largest COPD trials, TORCH (Towards a Revolution in COPD Health), UPLIFT (Understanding Potential Long-
Term Impacts on Function with Tiotropium) and POET-COPD (Prevention of Exacerbations with Tiotropium in COPD) recruited populations that were approximately 75% male, mean age 63–65 years, and predominantly GOLD II or III, and all three studies recruited current or ex-smokers with a minimum smoking history of 10 pack-years [4–6]. Recruiting narrower populations permits more accurate characterisation of the efficacy of interventions; however, the populations recruited do not necessarily represent the typical COPD patient. The DACCORD study, by using minimal inclusion and exclusion criteria, recruited a population typical of patients visiting their physician as a result of symptoms, as they were either receiving maintenance therapy for the first time, or required treatment intensification. In contrast to earlier interventional studies, patients recruited into DACCORD have less severe airflow limitation (17.6% of the population were classified as GOLD I), with a much higher proportion of female participants. Although DACCORD cannot be described as a true epidemiology study (given the requirement for treatment initiation or change, and the selection of investigators), the population recruited is very similar to that of a UK primary care database review, in which 17.5% of the population had mild airflow limitation, 37% were current smokers, and just under 50% were female [7], and DACCORD is therefore likely to reflect a typical general COPD population using maintenance medication. We therefore believe that the characteristics of patients on entry to this study are generalizable to many other Western countries.

One notable finding from this population was that approximately 20% are listed as ‘non-smokers’. COPD is described by GOLD as being characterised by an enhanced inflammatory response to ‘noxious particles or gases’ [8]. Although tobacco smoke is the most common causative factor, there is increasing awareness of the role of other factors, including air pollution, occupational exposure, and smoke from biomass fuels, and it will be interesting to follow the progress of this subset of patients over the duration of the study. However, we cannot completely exclude the possibility that these patients developed COPD as a result of secondary exposure to tobacco smoke, or that they were incorrectly diagnosed (one of the potential shortcomings of the less stringent oversight of a real-life study compared with the highly-controlled environment of a clinical trial).

For approximately 75% of patients, spirometry was conducted on a non-washout basis, and without specifying the use of SABA to generate post-bronchodilator FEV1 data. However, the non-interventional protocol did not specifically prohibit use of SABA prior to visits, so reflecting ‘real life’ practice in which treatment decisions are made on such data. It is of note that the data from the subgroup with formal post-SABA spirometry are very consistent to the overall population. In any case, physicians take more account of symptoms and exacerbations in the management of COPD, with the overall population. In any case, physicians take more account of subgroup with formal post-SABA spirometry are very consistent to decisions are made on such data. It is of note that the data from the study are reflective of a typical general COPD population using maintenance medication. In contrast to earlier interventional studies, patients recruited into DACCORD have less severe airflow limitation (17.6% of the population were classified as GOLD I), with a much higher proportion of female participants. Although DACCORD cannot be described as a true epidemiology study (given the requirement for treatment initiation or change, and the selection of investigators), the population recruited is very similar to that of a UK primary care database review, in which 17.5% of the population had mild airflow limitation, 37% were current smokers, and just under 50% were female [7], and DACCORD is therefore likely to reflect a typical general COPD population using maintenance medication. We therefore believe that the characteristics of patients on entry to this study are generalizable to many other Western countries.

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This population had a high level of symptoms, with 61.3% of patients reporting a baseline mMRC score of 2 or more. In contrast, in the UK primary care database review mentioned above (which did not require patients to use maintenance medication as an inclusion criterion, and in fact almost 15% were not using any medication), 46.6% of patients had this level of dyspnoea [7]. In particular, 85.9% of patients in DACCORD reported exertional dyspnoea, yet only 56.5% reported restricted exercise tolerance. This suggests that a proportion of patients had exertional dyspnoea yet did not have restricted exercise tolerance — perhaps an indication of adaptation (they know they have exertional dyspnoea, so don’t exercise and therefore don’t consider that they have reduced exercise tolerance — the typical sedentary COPD patient). This emphasises the importance of talking to patients about the impact of the disease on their lives, and especially the degree of any adaptation, when assessing the need for treatment modification. Indeed, other studies have shown that daily activity levels are reduced even early in the progression of the disease [9,10], whilst other studies have shown that the risk of developing COPD is higher in patients with low levels of physical activity [11,12]. One especially surprising finding, however, is the high proportion of patients in the CAT < 10 group who reported experiencing symptoms. Again, this could be a reflection of the inclusion criteria (asymptomatic patients with a CAT score < 10 are less likely to require treatment intensification), or could be due to unfamiliarity with the questionnaire. It is interesting, however, that the CAT < 10 and CAT > 30 groups have similar demographics (although there is a longer duration of COPD in the CAT > 30 group). The CAT questionnaire is not a pure disease severity tool, but is an assessment of health status. Since three out of the eight questions are related to chronic bronchitis (cough, phlegm and dyspnoea), it is possible that the >30 group included a higher proportion of patients with the chronic bronchitis phenotype.

As would be anticipated from the study design, at baseline muscarinic antagonist therapy (either alone or as a component of ‘triple’ therapy regimen) was the most commonly prescribed maintenance treatment. However, a high proportion of GOLD A or B patients were receiving ICS as part of their treatment regimen. This is consistent with data on primary care prescribing patterns in the UK, in which more than 50% of the COPD population (without a concomitant asthma diagnosis) were receiving ICS [13]. Although this cannot be described as inappropriate prescribing (since we do not know the clinical characteristics of the patients at the time the ICS was initiated), it does suggest that a proportion of these patients are receiving regimens other than recommended by guidelines or drug labels. In particular, baseline exacerbations did not appear to correlate with use of ICS. This could either be because patients were being treated unnecessarily with ICS, or that ICS was preventing exacerbations. However, these findings should be interpreted with care, as they are based on only 6 months data, and are retrospective in nature — although the recruitment of patients (and their experience of exacerbations) was relatively evenly spread over a full calendar year. The decision to use 6-month data was a practical one, and was intended to improve the accuracy of data collected, given that (especially for moderate exacerbations) these data were largely based on patient recall. It will be interesting to see the 1- and 2-year follow-up data on these patients, to see whether a change in medication impacts this overall experience of exacerbations.

Approximately one quarter of the patients recruited into DACCORD had experienced an exacerbation in the 6 months prior to entry. This could again be due to the inclusion criteria, in that patients who have experienced an exacerbation are more likely to have their COPD maintenance treatment reviewed by their physician and thus be included in the study. Overall, and in the two groups of patients according to ICS use, the most common treatment for exacerbations was antibiotics, either alone or in combination with systemic steroids. An intriguing finding from the INSPIRE (Investigating New Standards for Prophylaxis in Reducing Exacerbations) study was that when patients were treated with double-blind LAMA or LABA/ICS, physicians were more likely to use systemic steroids to manage exacerbations in patients receiving LAMA, and were more likely to use antibiotics to manage exacerbations in patients receiving LABA/ICS [14]. This finding was not replicated in the current study, with patients in the non-ICS group being more likely to receive antibiotics than systemic steroids. The reason for this difference is not clear, although this could reflect local clinical practice or formulary guidance, or perhaps these patients preferred to avoid exposure to systemic steroids. It should be noted, however, that patients in INSPIRE all had severe or very
severe airflow limitation (FEV1 <50%) and a history of exacerbations, and use of ICS was therefore ‘on label’.

GOLD 2010 classification may again reveal a recruitment effect into this study, in that approximately half of the patients were classified as GOLD II. However, GOLD 2011 classification was consistent with a number of other such studies [15–17], with patients being much more likely to be classified as high risk due to FEV1 than exacerbations. In particular, in the UK primary care database review mentioned above, approximately 50% of the high-risk C and D groups were classified as high risk according to FEV1 alone, approximately 30% due to exacerbations alone, and approximately 20% according to both FEV1 and exacerbations – exactly the same distribution as in DACCORD [7]. In DACCORD, CAT and mMRC resulted in widely varying symptoms classifications – again, consistent with other studies [18,19], including an analysis of a subgroup of patients in the HEED (Health-Related Quality of Life in COPD in Europe) study, in which, for example, 63.3% of the patients were classified as GOLD D according to CAT, but only 35.9% of patients were GOLD D according to mMRC [19].

High levels of comorbidities were observed in this population, with more than 50% of the patients reporting cardiovascular comorbidities. This is again consistent with a number of other ‘real world’ studies [20–25], and is a key difference between this type of study and a randomized clinical trial. For example, in the UK primary care database review 78.8% of the COPD population had at least one comorbidity, most commonly cardiovascular (46.1%) [7]. Furthermore, in a Canadian claims database review of more than 900,000 patients with COPD, comorbidities with the highest claim rates were psychiatric (for ambulatory care visits), diabetes (for emergency department visits) and cardiovascular (for hospitalisation), with each of these comorbidities responsible for higher claim rates than COPD [24]. Some other studies have suggested a correlation between CAT total score and comorbidities, such that patients with higher CAT scores have higher levels of comorbidities [25]; this was also observed in DACCORD, with a five-fold increase in psychiatric disorders in patients in the CAT >30 group compared with the CAT <10 group. Although CAT is a disease-specific health status assessment, many of the items that it assesses could be influenced by comorbid conditions.

In conclusion, DACCORD is a large, prospective, non-interventional study. Although it cannot be truly described as an epidemiology study (given the requirement for patients to be initiating or changing bronchodilator treatment in order to be eligible), the data reported here do provide an informative and intriguing picture of COPD patients using primary and secondary care in Germany, experiencing a high level of symptoms.

Conflict of interest statement

Dr Worth reports personal fees from AstraZeneca, Boehringer Ingelheim, Chiesi, GlaxoSmithKline, Klosterfrau, Menarini, Novartis and Takeda.

Dr Buhl reports personal fees from AstraZeneca, Chiesi, GlaxoSmithKline and Takeda, and grants and personal fees from Boehringer Ingelheim, Novartis and Roche.

Dr Criée reports personal fees from Boehringer Ingelheim, Chiesi, GSK, Novartis, Takeda and Berlin-Chemie.

Dr Kardos reports personal fees from Novartis, AstraZeneca, Boehringer Ingelheim, Chiesi, GSK, Menarini and Takeda.

Dr Mailaender is employed at Novartis Pharma GmbH, Nürnberg, the sponsor of the study.

Dr Vogelmeier reports personal fees from Almirall, AstraZeneca, Boehringer Ingelheim, Chiesi, GlaxoSmithKline, Janssen, Mundipharma, Novartis, and Takeda, and grants and personal fees from Grifols.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.rmed.2015.12.010.

References

[18] J. Han, L. Dai, N. Zhong, D. Young, Breathlessness or health status in chronic obstructive pulmonary disease: the impact of different definitions, COPD 12


