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ORIGINAL RESEARCH

Physician-Patient Concordance in Pharmacological Management of Patients with COPD

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Abstract

A retrospective analysis of a cross-sectional, multicenter survey was conducted in United States (US) medical practices to evaluate the concordance between patients with COPD and their physicians on disease-specific characteristics. Associations between patient and disease-related characteristics with monotherapy, dual therapy, or triple therapy prescribed as COPD maintenance regimens were also examined. Eligible physicians completed patient record forms (PRFs) for up to 6 consecutive patients with COPD. Patients for whom a PRF was completed were invited to complete a patient self-completion (PSC) survey consisting of questions similar to those on the PRF, as well as several validated measures to assess the impact of COPD on patients' lives. A total of 469 patients completed a PSC that was matched with the PRF completed by their physician, forming the sample for the concordance analysis. Moderate agreement (kappa (κ) = 0.41–0.60) was observed for 79% of measures, with the lowest concordance rating corresponding to hemoptysis (κ = 0.22). There were few differences in demographic or clinical characteristics between patients prescribed monotherapy and dual therapy. Triple therapy rather than monotherapy or dual therapy was more often prescribed for patients with greater frequency of symptoms, negative impact of COPD on daily life and interpersonal relationships, and respiratory impairment based on the most recent FEV_1. Diverse factors influence US physicians' perceptions of disease and treatment choices, including patient symptoms, quality of life, and disease impact. Our results highlight that concordance between physicians and patients regarding symptoms and physical function may contribute to optimal management of COPD.

Keywords: communication, disease impact, physician-patient relationship, symptoms

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Introduction

COPD is a complex disorder with wide variability in pulmonary and extrapulmonary manifestations (1–3). The respiratory, social, and emotional impacts of COPD include pain (4–6), dyspnea (4, 5, 7, 8), fatigue (5, 7, 9), anxiety (5, 7, 9, 10), depression (5, 6, 9, 10), and insomnia (11, 12). Further studies also confirm diminished overall physical functioning (6) and quality of life based on validated, disease-specific and generic assessment instruments (6, 10, 13, 14). Notably, 50.8% of adults with COPD require at least one medication to manage the symptoms of COPD, 41.5% report seeing a physician for COPD symptoms in the past year, and almost 20% require hospital or emergency department care for COPD (15).

Updated guidance from the Global Initiative for Chronic Obstructive Lung Disease (GOLD) recommends that clinical assessment of patients with

COPD should be based on the impact of symptoms, as well as assessment of FEV_1, history of exacerbations and the presence of comorbidities (16, 17). This reflects, in part, the recognition that FEV_1 alone does not provide clinicians with an accurate perception of the diversity and severity of COPD symptoms (18). There is a growing body of evidence focusing on the potential of patient-centered care (19-21) and enhanced physician-patient communication (20, 22-24) to improve the quality and efficiency of care, patient satisfaction, and clinical outcomes for diverse health conditions, including COPD (18, 25-27), heart failure (25, 27), cancer (28), diabetes (25, 27, 29), and other chronic diseases (30, 31).

Despite the growing emphasis on physician-patient communication and patient-centered care, research across diverse disease states suggests a lack of concordance between patients and their physicians. This has been reported for ratings of pain (32), severity of symptoms (33, 34), etiology of symptoms (35), and frequency and type of symptoms (36, 37). Further, few studies have evaluated concordance between the perceptions of physicians and patients regarding clinical characteristics and the impact of COPD (38).

This retrospective analysis of a cross-sectional, multicenter survey conducted in the US during 2012 assessed the degree of concordance between patients with COPD and their physicians when independently reporting patient-specific information on a variety of disease-specific attributes, including symptom type, frequency, severity, and impact on quality of life. We also sought to clarify if physician-patient concordance was associated with treatment patterns and identify patient and disease-related characteristics that were associated with prescribing monotherapy, dual therapy, or triple therapy COPD maintenance regimens.

Methods

Research design

This study used data from the Adelphi COPD Disease Specific Program (DSP), a cross-sectional survey conducted every year that collects information from physicians and their patients with COPD who are presenting for routine care. A complete description of DSP survey methods has previously been published (39). This analysis is based on the COPD DSP that was conducted in the US between September 2012 and November 2012. Physicians and patients provided data in accordance with Health Insurance Portability and Accountability Act (HIPAA) regulations for healthcare market research (40). Completion of the PSC was voluntary and patients provided consent to use their data for research purposes prior to survey completion.

Physician and patient recruitment criteria

Physicians eligible to complete the survey had completed their medical training in the past 5 to 35 years, were personally responsible for treating patients with COPD, and saw 3 or more patients with COPD per month. Eligibility criteria for patients were age ≥ 40 years, a physician-confirmed history of smoking (current or ex-smoker), and a physician-confirmed diagnosis of airflow obstruction and COPD, including emphysema and/or chronic bronchitis. Patients with a concomitant diagnosis of asthma were excluded.

Physicians were identified from publically available lists and contacted by telephone to determine if they met the eligibility criteria for the DSP. Eligible physicians completed Patient Record Forms (PRFs) for up to 6 consecutive patients with COPD, regardless of the reason for the appointment. Separately, patients for whom a PRF was completed were invited to complete a voluntary patient self-completion form (PSC), which was independently completed by consenting patients (Figure 1). Physicians and patients completed their questionnaires on the same day, which ensured their responses reflected the same 4-week recall period. Both physicians and patients were assigned unique identification numbers that allowed linkage of patient surveys with the corresponding PRF completed by their physician. Trained local fieldwork partners collected all data

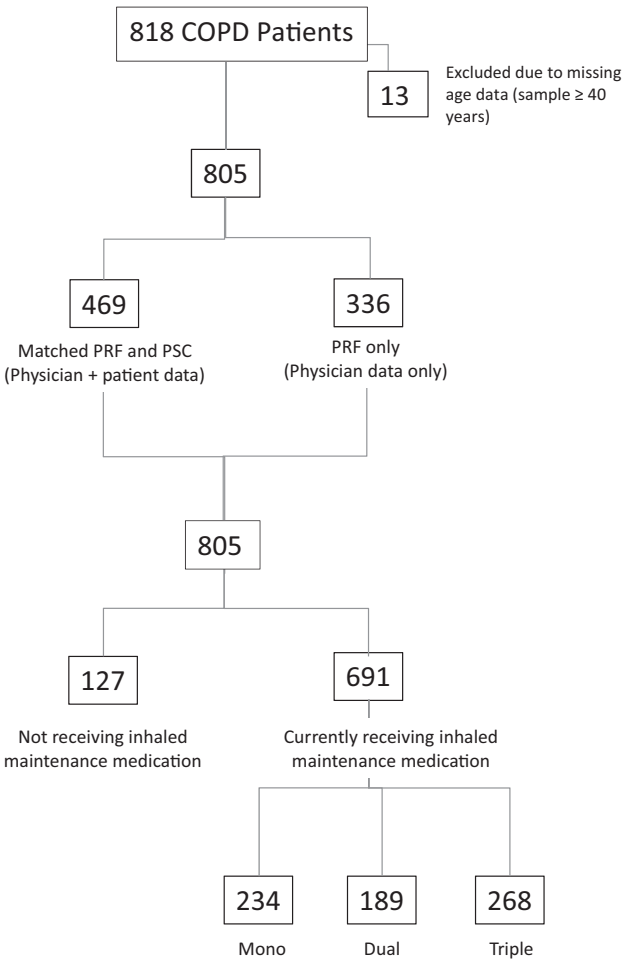

Figure 1. Patient study cohorts.

and removed all personal identifying information from completed surveys prior to analysis.

Assessments

The physician and patient surveys assessed patient demographic and clinical characteristics, including the occurrence, timing, and severity of symptoms experienced in the past 4 weeks, impact of symptoms on patients' daily life, severity of COPD, and the Medical Research Council Dyspnea Scale (MRC). Symptom assessment and frequency were recorded on ordinal scales with response options ranging from 1 to 5. A categorical scale indicating Yes or No assessed patients' experience of symptoms in the last 4 weeks and a Likert-type scale with responses ranging from 1 to 7 was used to rate the impact of symptoms.

Physicians reported the patient's most recent FEV_1% predicted, the total number of clinic visits for COPD in the preceding 12 months, overall frequency and healthcare resource utilization for exacerbations of COPD in the past 12 months, and current COPD treatment. Physicians also identified members of the medical team who were responsible for the patient's care and indicated comorbid health conditions. Completion of the PRF took approximately 15 to 20 minutes per patient and physicians were financially compensated for study participation.

The wording of questions and responses in the PRF and the PSC were either identical or equivalent, with minor wording changes in the PSC to ensure patient comprehension (eg, hemoptysis on the PRF and coughing up blood on the PSC). Patients also completed several standardized scales that have been validated for use in patients with COPD and other chronic illnesses, including the 8-item Morisky Medication Adherence Scale (MMAS-8), (41) the EuroQol-5 dimensions (EQ-5D) (42), Work Productivity and Activity Impairment Questionnaire (WPAI) (43), and the COPD Assessment Test (CAT) (44). Patients received no compensation for completion of the PSC.

Statistical analysis

Percent responses were calculated for categorical variables and means with standard deviations for continuous variables. Univariate analyses were performed for the concordance and treatment variables, including the chi-square statistic for categorical variables, the Kruskal-Wallis statistic for ordinal variables, and analysis of variance for continuous variables. The Bonferroni-adjusted *t*-test, Wilcoxon rank-sum, Fisher's exact test, and chi-square *P*-values were calculated for pairwise group combinations, where each test was applicable, with corrections for multiple comparisons.

Concordance between physician and patient ratings was calculated for 1) type of COPD symptoms experienced in the last 4 weeks, 2) time of day the patient was most often affected by COPD, 3) frequency of COPD symptoms in the last 4 weeks, 4) severity of dyspnea as assessed by the MRC, 5) impact of symptoms on life activities, and 6) severity of symptoms. A weighted kappa statistic was calculated to assess the level of agreement between physicians and their patients with results categorized as (45, 46): 1) below 0.0 (no agreement); 2) 0.00 to 0.20 (slight agreement); 3) 0.21 to 0.40 (fair agreement); 4) 0.41 to 0.60 (moderate); 5) 0.61 to 0.80 (substantial agreement); and 6) 0.81 to 1.00 (almost perfect agreement) (46). The weighted kappa statistic treated all adjacent categories as equidistant.

Treatment categories included monotherapy (long-acting β_2 agonist (LABA) alone, long-acting muscarinic antagonist (LAMA) alone, or inhaled corticosteroid (ICS) alone), dual therapy (free- and fixed-dose ICS and LABA, ICS and LAMA, or LABA and LAMA), or triple therapy (all formulations of ICS, LABA, and LAMA). Variations in treatment patterns were examined for a number of available patient and disease characteristics that might have influenced treatment decisions. These included: 1) medical specialty of the physician currently managing the patient for COPD; 2) number of routine medical appointments in the last 12 months; 3) intervention for COPD exacerbation in the preceding 12 months; 4) patient age; 5) patient gender; 6) smoking status; 7) depression based on physician assessment; and 8) MMAS-8 category. Variations in treatment regimen were also evaluated for the area(s) of impact of COPD relating to 7 activities of daily living; frequency of symptoms, time of day affected by symptoms, and type of symptoms in the preceding 4 weeks; most recent FEV_1% predicted; EQ-5D; WPAI; and CAT.

Instances of missing data for a specific variable on the matched PRFs or PSCs resulted in exclusion from analyses that included that specific variable. However, matched PRFs and PSCs were included in all analyses of variables for which data were not missing. All statistical analyses were performed with Stata/SE version 12.1 (47).

Results

Up to 6 PRFs were completed by 149 physicians, including 75 primary care physicians and 74 pulmonologists. This resulted in 805 completed PRFs, including 469 linked PSCs and PRFs, which formed the sample for inclusion in the concordance analyses (Figure 1). Clinical and demographic patient characteristics are summarized in Table 1.

Our concordance analysis revealed moderate agreement (κ = 0.41–0.60) for 79% of measures. There was moderate or substantial agreement for overall perceived severity of symptoms, disease impact, frequency of symptoms in the last 4 weeks, and time of day the patient was affected (Table 2). Notably, substantial agreement (κ = 0.61–0.80) was evident for no symptoms (κ = 0.67), shortness of breath when resting (κ = 0.63), and frequency of symptoms experienced during the daytime (κ = 0.61). The lowest concordance rating was evident

Table 1. Demographic and clinical characteristics of patients

Characteristic (N=805)	Number (%)
Age	
• <65 years	307 (38.1)
• 65 year and older	498 (61.9)
Gender	
• Female	360 (44.7)
• Male	443 (55.0)
• Missing	2 (0.3)
Smoking status	
• Current smoker	212 (26.3)
• Ex-smoker	593 (73.7)
Depression	
• Physician-confirmed diagnosis	125 (15.5)
• No physician-confirmed diagnosis	680 (84.5)
MMAS-8	
• Low	206 (25.6)
• Medium	150 (18.6)
• High	18 (2.2)
• Missing	430 (53.4)
Physician managing patient's COPD	
• Primary care	259 (32.2)
• Pulmonologist	110 (13.7)
• Primary care + pulmonologist	425 (53.1)
• Missing	11 (1.4)
Routine visits in the last 12 months	
• 1 to 2	292 (36.3)
• ≥3	498 (61.9)
• Missing	15 (1.9)
Exacerbation history	
• None or no HCP intervention required	529 (65.7)
• HCP intervention (primary care visit, emergency department visit, or hospitalization)	269 (33.0)
• Missing	7 (0.9)
Treatment	
• Monotherapy	234 (29.1)
• Dual therapy	189 (23.5)
• Triple therapy	268 (33.3)
• Missing	114 (14.2)

Abbreviations: COPD, chronic obstructive pulmonary disease; MMAS-8, Morisky Medication Adherence Scale; HCP, healthcare provider.

Table 2. Concordance between physician and patient ratings for disease characteristics

Disease Characterisitic	Number of Matched Surveys	Kappa Statistic (κ)
Time of day patient affected by COPD	400	0.47
Symptoms experienced in the last 4 weeks		
• No symptoms	398	0.67
• Shortness of breath when resting	398	0.63
• Shortness of breath when exercising	398	0.57
• Shortness of breath when exposed to trigger	398	0.49
• Bronchospasm/sudden chest tightening	398	0.41
• A tight feeling in the chest	398	0.46
• Cough	398	0.57
• Coughing up blood	398	0.22
• Excess sputum production/clearance	398	0.53
• Wheezing	398	0.53
Frequency of symptoms in the last 4 weeks		
• First thing in the morning	412	0.57
• Daytime	418	0.61
• Last thing in the evening	367	0.58
• Night time	366	0.59
• MRC dyspnea scale	401	0.59
Disease impact		
• Getting up and ready for the day	430	0.57
• Patient's normal daily activities	433	0.58
• Patient's mood	417	0.57
• Personal relationships	413	0.54
• Leisure/personal time	413	0.59
• Work	126	0.57
• Sleep	410	0.58
Perceived severity of COPD	445	0.57

Results $\kappa < 0.0$ indicate no agreement, 0.00 to 0.20 = slight agreement, 0.21 to 0.40 = fair agreement, 0.41 to 0.60 = moderate agreement, 0.61 to 0.80 = substantial agreement, and 0.81 to 1.00 = almost perfect agreement (46).
Abbreviations: COPD, chronic obstructive pulmonary disease; MRC, Modified Medical Research Council Dyspnea Scale.

for hemoptysis ($\kappa = 0.22$). Analysis of kappa scores stratified by physician characteristics revealed significantly higher concordance for primary care physicians compared with pulmonologists when rating symptoms of wheezing and getting up and ready for the day.

Significantly higher concordance was evident for hemoptysis in patients with ≥ 3 consultations compared with those who had fewer physician visits in the past 12 months. There were no other significant differences in concordance ratings attributable to physician characteristics. In addition, our evaluation of concordance ratings associated with patient demographic or clinical characteristics revealed few significant differences, with no consistent pattern in these variations. Notably, there were no systematic patterns to variations in type of treatment (monotherapy, dual therapy, or triple therapy) by concordance ratings.

Type of treatment was not significantly different based on the medical specialty of the managing physician (primary care or pulmonologist; Table 3). However, there were significant differences in the type of treatment by patient demographic and clinical characteristics (Table 3). Specifically, triple therapy was more likely to be prescribed for patients who had 3 or more routine visits in the past year (73%) compared with 56% of those prescribed monotherapy ($P < 0.001$). Significantly higher percentages of patients were prescribed monotherapy (75%) or dual therapy (70%) if they required no intervention for COPD exacerbations compared with 51% of those on a triple therapy regimen ($P < 0.001$ for both comparisons). The triple therapy group had a higher proportion of patients 65 years or older compared with the monotherapy and dual therapy groups (Table 3).

Dual therapy rather than monotherapy was more frequently prescribed for patients who experienced bronchospasm and cough in the last 4 weeks. Dual

Table 3. Type of treatment associated with demographic and clinical characteristics

Characteristic (N = 805)	Type of Therapy, %			*P*-value for Comparisons		
	Mono (n = 234)	Dual (n = 189)	Triple (n = 268)	Mono vs Dual	Mono vs Triple	Dual vs Triple
Age, years				1.000	**0.0338**	**0.038**
• <65	41.0	41.3	29.9			
• 65 or older	59.0	58.7	70.2			
• Mean (SD)	66.3 (9.9)	66.4 (10.6)	69.2 (9.4)			
Gender				1.000	1.000	1.000
• Female	42.7	45.0	46.3			
• Male	56.8	55.0	53.4			
• Missing	0.4	0.0	0.4			
Smoking status				0.695	0.321	**0.012**
• Current smoker	25.6	31.2	19.4			
• Ex-smoker	74.4	68.8	80.6			
Depression						
• Physician-confirmed diagnosis	11.1	20.6	16.8	**0.029**	0.220	0.982
MMAS-8				1.000	0.974	1.000
• High	2. 6	3.2	0.75			
• Medium	18.8	16.4	18.76			
• Low	25.2	27.5	28.0			
• Missing (no patient survey completed)	53.0	53.0	53.0			
Physician managing patient's COPD				0.113	0.132	**0.053**
• Primary care	32.5	37.6	25.8			
• Pulmonologist	56.0	45.5	57.5			
• Primary care with pulmonologist	9.4	15.9	16.0			
• Missing	2.0	1.0	1.0			
Routine visits in last 12 months				0.471	**<0.001**	0.118
• 1 to 2	42.3	34.9	26.5			
• ≥3	55. 6	61.9	72.8			
• Missing	2.0	3.0	1.0			
Exacerbation history				0.667	**<0.001**	**<0.001**
• None or no HCP intervention required	75.2	69.8	50.8			
• HCP intervention (primary care visit, emergency department visit, or hospitalization)	23.9	29.6	48.1			
• Missing	1.0	1.0	1.0			

Abbreviations: COPD, chronic obstructive pulmonary disease; HCP, healthcare provider; MMAS-8, Morisky Medication Adherence Scale; Mono, monotherapy; SD, standard deviation.

regimens were more likely to be reported than triple therapy for patients with no symptoms in the preceding 4 weeks and those who experienced wheezing. Triple therapy rates were higher compared with monotherapy for all but 2 of the reported symptoms of COPD (Table 4).

Significant variations in treatment were evident based on the time of day patients were most affected by COPD

Table 4. Variations in type of treatment associated with symptoms experienced in the last 4 weeks

Symptom (n = 691)	Type of Therapy, %*			*P*-value for Comparisons		
	Mono (n = 234)	Dual (n = 189)	Triple (n = 268)	Mono vs Dual	Mono vs Triple	Dual vs Triple
• No symptoms	24.8	16.4	5.2	0.125	**<0.001**	**<0.001**
• Shortness of breath when resting	24.4	29.1	35.8	0.807	**0.019**	0.473
• Shortness of breath when exercising	50.9	62.4	73.5	0.053	**<0.001**	0.053
• Shortness of breath when exposed to trigger	11.5	18.5	24.6	0.157	**<0.001**	0.413
• Bronchospasm/sudden chest tightening	13.7	22.8	22.0	**0.046**	0.060	1.000
• A tight feeling in the chest	19.2	25.4	34.0	0.379	**<0.001**	0.189
• Cough	54.3	67.2	73.1	**0.021**	**<0.001**	0.630
• Coughing up blood	3.4	5.3	4.5	1.000	1.000	1.000
• Excess sputum production/clearance	27.8	32.8	41.8	0.857	**0.003**	0.189
• Wheezing	18.8	27.5	41.0	0.107	**<0.001**	**0.012**
• Missing	0.0	0.5	0.0	—	—	—

*The sum of the percentages exceeds 100% because respondents could indicate more than one response. Abbreviations: Mono, monotherapy.
Significant differences ($P \leq 0.05$) shown in bold.

Table 5. Variations in type of treatment associated with time of day patient affected by COPD

Time of Day (n = 691)	Type of Therapy, %			*P*-value for Comparisons		
	Mono (n = 234)	Dual (n = 189)	Triple (n = 268)	Mono vs Dual	Mono vs Triple	Dual vs Triple
• Daytime only	21.4	19.6	13.4	0.450	**0.044**	1.000
• Primarily daytime	39.3	36.5	39.9			
• Equally day and night	29.5	31.2	39.9			
• Primarily night time	1.7	4.8	1.5			
• Night time only	0.9	2.7	0.0			
• Missing	7.3	5.3	5.2			

Abbreviations: Mono, monotherapy.
Significant differences ($P \leq 0.05$) shown in bold.

symptoms (Table 5). Differences in the proportion of patients prescribed the 3 treatment regimens were also associated with the frequency of COPD symptoms (Table 6). Triple therapy was more frequently prescribed for patients with scores indicating greater negative impact of COPD on daily activities, mood, interpersonal relationships, leisure time, work, and sleep. There were no significant differences in rates of monotherapy and dual therapy for patients based on the impact of COPD on their daily lives (Table 7).

Table 6. Variations in type of treatment by frequency of symptoms in the last 4 weeks

Frequency of Symptoms (n = 691)	Type of Therapy, %			*P*-value for Comparisons		
	Mono (n = 234)	Dual (n = 189)	Triple (n = 268)	Mono vs Dual	Mono vs Triple	Dual vs Triple
Response: First thing in the morning				1.000	**<0.001**	**<0.001**
• Not at all	35.5	28.0	15.3			
• Less than once per week	16.2	18.5	18.3			
• Once or twice per week	17.1	17.5	24.3			
• 3 to 6 times per week	18.0	20.1	17.2			
• Daily	10.7	9.0	20.9			
• Missing	2.6	6.9	4.1			
Response: Daytime				0.070	**<0.001**	**<0.001**
• Not at all	25.6	18.0	6.7			
• Less than once per week	19.2	17.5	15.7			
• Once or twice per week	23.5	21.2	23.5			
• 3 to 6 times per week	14.1	22.2	23.1			
• Daily	14.1	16.4	28.0			
• Missing	3.4	4.8	3.0			
Response: Last thing in the evening				0.065	**<0.001**	**0.004**
• Not at all	49.6	38.1	23.1			
• Less than once per week	13.7	13.8	20.2			
• Once or twice per week	14.1	20.6	26.5			
• 3 to 6 times per week	9.0	9.5	11.2			
• Daily	5.6	7.9	13.1			
• Missing	8.1	10.1	6.0			
Response: Nighttime				0.606	**<0.001**	**0.006**
• Not at all	47.4	41.8	25.0			
• Less than once per week	15.0	15.3	24.3			
• Once or twice per week	12.0	16.9	23.5			
• 3 to 6 times per week	10.3	10.6	11.9			
• Daily	6.8%	7.9%	10.8%			
• Missing	8.6%	7.4%	4.5%			

Abbreviations: Mono, monotherapy.
Significant differences ($P \leq 0.05$) shown in bold.

Table 7. Variations in type of treatment by COPD disease impact

Disease Impact, mean (n = 691)	Type of Therapy			*P*-value for Comparisons		
	Mono (n = 234)	Dual (n = 189)	Triple (n = 268)	Mono vs Dual	Mono vs Triple	Dual vs Triple
• Getting up and ready for the day	2.6	3	3.7	0.181	**<0.001**	**<0.001**
• Normal daily activities	3	3.4	4.2	0.749	**<0.001**	**<0.001**
• Mood	2.6	2.9	3.6	0.191	**<0.001**	**<0.001**
• Personal relationships	2.3	2.6	3.2	0.593	**<0.001**	**<0.001**
• Leisure/personal time	2.7	3.2	3.8	0.139	**<0.001**	**<0.001**
• Work*	2.7	2	3.5	1.000	**<0.001**	**<0.001**
• Sleep	2.4	2.7	3.2	0.411	**<0.001**	**0.002**
• Missing, %	3.9	5.3	4.9	—	—	—

*Due to the age of the sample with 498 (61.86%) of patients 65 years or older, a large percentage of patients were no longer working. These subjects were excluded from this analysis.
Abbreviations: Mono, monotherapy.
Significant differences ($P \leq 0.05$) shown in bold.

When we examined variations in treatment regimens by the impact of COPD as assessed by FEV_1, EQ-5D, WPAI, and the CAT, dual therapy was more frequently reported than monotherapy for patients with higher CAT scores. In addition, rates of triple therapy were higher compared with dual therapy regimens for patients with more severe respiratory impairment based on FEV_1 and higher CAT scores. When we compared the monotherapy and triple therapy groups, higher rates of triple therapy were evident for patients with lower FEV_1 scores, lower quality of life, and higher CAT scores, indicating greater impact of COPD on patients' lives (Table 8). Physician perceptions of the severity of symptoms were also significantly associated with the choice of treatment, with higher rates of triple therapy prescribed for patients considered to have severe COPD (Figures 2 and 3).

Discussion

Our research showed moderate agreement between patients and physicians on the majority of symptoms, with no consistent, significant differences attributable to patient demographic or clinical characteristics. The areas of highest concordance were evident for disease characteristics that were associated with mild (no symptoms) and severe disease (breathlessness at rest) as well as symptoms most likely to be present at the time of the medical appointment (daytime). It cannot be determined whether this was due to improved detection and/or dialogue, or lack thereof. The fair agreement between patient and physician ratings for hemoptysis and other dimensions with lower levels of concordance may suggest possible areas for improvement in routine discussion and management during clinical visits.

Table 8. Variations in type of treatment by lung function and health status characteristics

	Type of Therapy, %			*P*-value for Comparisons		
	Mono (n = 234)	Dual (n = 189)	Triple (n = 268)	Mono vs Dual	Mono vs Triple	Dual vs Triple
Most recent FEV_1 % predicted				0.512	**<0.001**	**0.001**
• ≥80%	9.0	6.9	2.6			
• ≤50% to <80%	38.0	32.3	37.3			
• ≤30 % to <50%	8.1	11.1	22.4			
• <30%	2.1	2.7	7.8			
• Missing, %	43.0	47.0	30.0			
EQ-5D*				0.137	**0.014**	1.000
• Mean (SD)	0.8 (0.2)	0.8 (0.2)	0. 8 (0.2)			
• Missing, %	48.3	42.3	47.0			
WPAI*				1.000	1.000	1.000
• Mean (SD)	19.8 (22.8)	22.9 (28.7)	20.7 (15.6)			
• Missing, %	76.9	85.7	89.2			
CAT*				**0.045**	**<0.001**	**0.049**
• <10	13.3	6.9	1.9			
• 10–20	18.4	21.2	16.8			
• >20	20.5	29.6	33.6			
• Mean	17.1	20.1	22.9			
• Missing, %	48.0	42.0	48.0			

*A large number of patients (n = 336) did not complete a PSC and these instruments were also not completed by these patients.
Abbreviations: CAT, COPD Assessment Test; EQ-5D, EuroQual-5 dimensions; FEV_1, forced expiratory volume in 1 second; Mono, monotherapy; WPAI, Work Productivity and Activity Impairment Questionnaire.
Significant differences ($P \leq 0.05$) shown in bold.

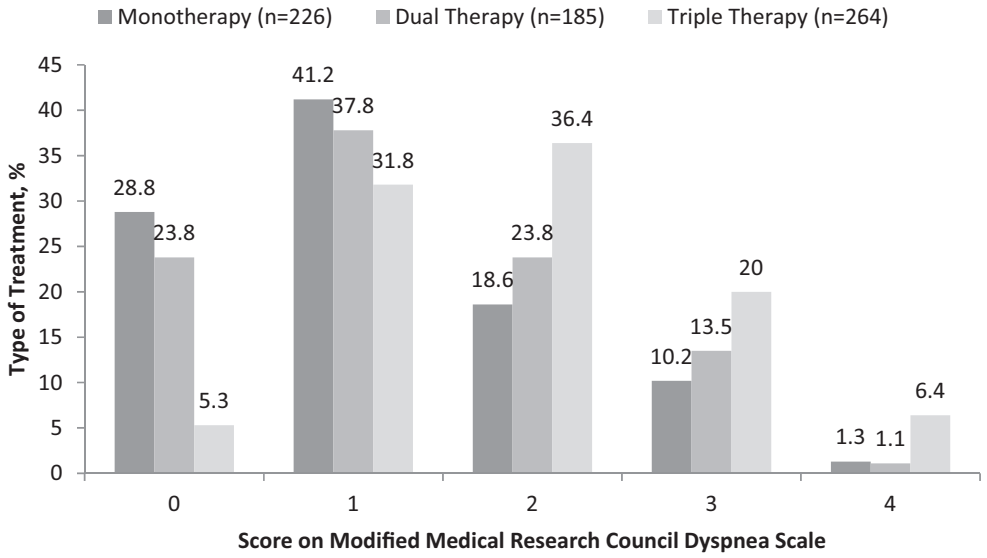

Figure 2. Variations in type of treatment by Modified Medical Research Council Dyspnea Scale.
Score: 0 = Only gets breathless after strenuous exercise; 1 = Gets breathless when hurrying on level ground or walking up a slight incline; 2 = On level ground, walks slower than people of the same age because of breathlessness, or has to stop for breath when walking at own pace; 3 = Stops for breath after walking a few meters on level ground; 4 = Is too breathless to leave the house or becomes breathless when getting dressed.

The degree of concordance measured in our research was substantially greater than the concordance reported in a previous study for patient and physician ratings of the 4 symptoms that were considered of greatest concern or impact on patients ($\kappa < 0.42$) (38). Physicians selected 4 symptoms from a list of 10 symptoms typically associated with COPD and ranked those they felt were of greatest concern or had the greatest impact on the patient. Patients ranked the 4 symptoms that most affected them and evaluated the impact of each of the 10 symptoms on a 5-point Likert-type ordinal scale (38). This was a more subjective and challenging method of concordance measurement compared with that used in our research. Consequently, it may have underestimated concordance. Our method of symptom assessment may provide a more accurate evaluation of concordance because it focuses more on the manifestation of physical symptoms and limitations, which patients and their physicians may be more likely to discuss during a routine visit.

The kappa statistic provides no information regarding the dynamics of each responder, just their alignment or lack thereof. Therefore, it is not clear how physicians or patients were contributing to concordance and discordance. It is also not clear what level of concordance in COPD is required to demonstrate a real improvement in outcomes. Exploration of these issues will require additional research and will provide insights regarding

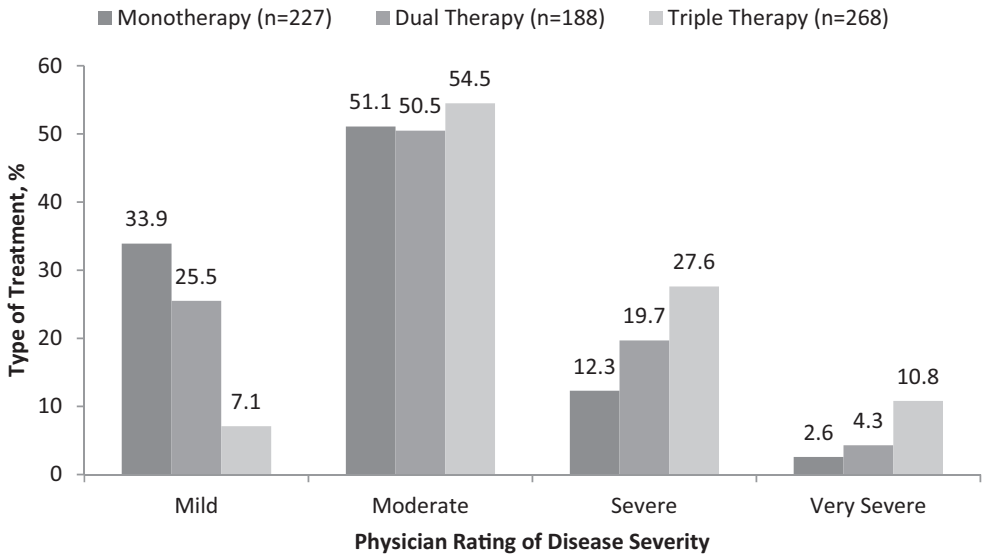

Figure 3. Variations in type of treatment by physician rating of disease severity.

contributing factors and strategies for intervention that will improve treatment decision-making and outcomes.

Our results did not identify any consistent associations between concordance and treatment regimen based on the variable included in our study and additional research is needed to clarify the impact of improving patient-physician care partnerships and concordance on choice of treatment regimens. Failure of physicians or patients to recognize and discuss symptoms could lead to treatment choices that are not consistent with patients' needs and wishes, and may negatively impact patients' health.

Physicians and patients may benefit from development of a clear, systematic, and comprehensive process to assess their disease state during appointments, which might overcome recall and communication barriers, facilitate timely exchange of information, and ensure more efficient treatment, increased patient satisfaction, and enhanced COPD management. Questionnaires such as the CAT provide patients and clinicians with a quick, easy method to assess symptoms, determine a score, and base treatment recommendations on that score (44). However, we are not aware of research indicating that the use of such standardized assessment tools improves patient-provider communication and concordance. Nor did we identify any research to indicate that the CAT is regularly used in current clinical practice in the US.

Our comparison of patients prescribed monotherapy and dual therapy revealed few differences in demographic or clinical attributes. In contrast, many differences in demographic and clinical attributes were seen between dual and triple therapy patients, and the greatest number of differences was evident between the monotherapy and triple therapy groups. For example, higher disease impact scores in the triple therapy group suggests that certain elements of physicians' perceptions of the impact of COPD on their patients' daily lives, mood, interpersonal relationships, leisure time, work, and sleep were significant factors in treatment decisions. These findings support the premise that treatment decisions, based on this US cohort, are made with a strong emphasis on patient symptoms and functioning, which is consistent with guidance provided by GOLD.

Our analysis did not reveal a consistent pattern of differences in concordance associated with physician or patient characteristics, which confirms the complexity and interrelationship of factors that influence management of patients' respiratory health. Similar findings have also been observed in studies of adherence in asthma (48). Studies designed to support an in-depth analysis of predictors of concordance between patients and physicians and assess the impact of concordance on treatment decisions will be valuable as we strive to improve the care and clinical outcomes of patients with COPD. Not unexpectedly, there was a substantial amount of missing data on FEV_1, particularly for patients prescribed monotherapy and dual therapy. Previous research by other investigators suggests that a low rate of FEV_1 testing is consistent with real-world practice (48, 49). This implies that treatment decisions may be based on physicians' assessment of patients in the absence of objective measures, such as the FEV_1. This highlights the importance of more holistic patient evaluation, including monitoring respiratory function, symptoms (type, frequency, and severity), and exacerbations, as recommended by the GOLD strategy (17).

Other limitations merit consideration when evaluating our findings. First, the COPD DSP was not based on a true random sample of physicians or patients. Participation bias of physicians and patients may have influenced these results, especially if participants were representative of a sample of patients who were more motivated, more health conscious, or more involved in their condition. We compared patients for whom only a PRF was completed due to patient refusal to participate in the survey (n = 336) and found no significant differences in type, severity, impact, or frequency of COPD symptoms, which provides indirect confirmation s that patients excluded from the concordance analysis were not dissimilar from those who completed a PSC.

Our research design included methods to ensure that physicians and staff were unaware of patient responses within the PSC. However, it was not possible to confirm that no information exchange occurred between physicians and their patients. This could have resulted in inflation of concordance estimates. Recall bias might also have affected the responses of both patients and physicians to the questionnaires, a common limitation of surveys. Additionally, several questions about symptom frequency, type, and severity were not psychometrically developed and validated. However, we also used several instruments that have been validated in patients with COPD, including the CAT, WPAI, MMAS-8, MRC, and the EQ-5D.

Although the number of patient and clinical variables included in this study was extensive, it was not an exhaustive list of all factors that might influence treatment decisions. The lack of differentiation between the monotherapy and dual therapy groups suggests the need for further research to explore and determine factors that may contribute to prescribing decisions associated with each treatment group. It may also be fruitful to identify patient and physician factors that result in escalation of therapy to dual and triple agents.

Real-world surveys such as the DSP have an important role to play in clarifying the dynamics of physician-patient communication, interactions, and disease management under conditions of actual care. Identification of areas for improvement in the management of patients with COPD is critical given the significant health burden imposed on the US population by COPD (15), with disease projections indicating that morbidity and mortality rates will continue to rise (51).

Conclusions

These findings suggest moderate to high concordance between US physician and patient perceptions of type,

frequency, and severity of COPD symptoms as well as impact of COPD on patients' daily lives. While relatively few differences in demographic or clinical characteristics were associated with rates of monotherapy and dual therapy, we identified many demographic and clinical differences between patients prescribed dual or monotherapy compared with triple therapy. Notably, triple therapy was more frequently associated with higher disease impact scores, suggesting that physicians' perception of the impact of COPD on their patients' daily lives was a significant factor in their treatment decisions. Our study suggests that US physicians may be more likely to consider patient symptoms and functioning particularly when making the decision to escalate treatment to triple therapy, which is consistent with the GOLD strategy. However, further study and identification of areas for improvement in the management of patients with COPD remains critical.

Declaration of Interests Statement

Mark Small is a fulltime employee of Adelphi Real World. Victoria Higgins is a fulltime employee of Adelphi Real World. Adam Lees is a fulltime employee of Adelphi Real World. Nicola Johns is a fulltime employee of Adelphi Real World. Anthony Mastrangelo is a fulltime employee of Novartis Pharmaceuticals Corporation. Tara Nazareth is a fulltime employee of Novartis Pharmaceuticals Corporation. Stuart Turner is a fulltime employee of Novartis Pharmaceuticals Corporation. Novartis Pharmaceuticals Corporation provided funding for the analysis of these data and medical writing support. Medical writing support was provided by Carole Alison Chrvala, PhD of Health Matters, Inc. The authors alone are responsible for the content and writing of the paper.

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