

Continuing to Confront COPD International Physician Survey: physician knowledge and application of COPD management guidelines in 12 countries

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Aim: Utilizing data from the Continuing to Confront COPD (chronic obstructive pulmonary disease) International Physician Survey, this study aimed to describe physicians' knowledge and application of the GOLD (Global initiative for chronic Obstructive Lung Disease) *Global Strategy for the Diagnosis, Management and Prevention of COPD* diagnosis and treatment recommendations and compare performance between primary care physicians (PCPs) and respiratory specialists.

Materials and methods: Physicians from 12 countries were sampled from in-country professional databases; 1,307 physicians (PCP to respiratory specialist ratio three to one) who regularly consult with COPD, emphysema, or chronic bronchitis patients were interviewed online, by telephone or face to face. Physicians were questioned about COPD risk factors, prognosis, diagnosis, and treatment, including knowledge and application of the GOLD global strategy using patient scenarios.

Results: Physicians reported using spirometry routinely (PCPs 82%, respiratory specialists 100%; $P < 0.001$) to diagnose COPD and frequently included validated patient-reported outcome measures (PCPs 67%, respiratory specialists 81%; $P < 0.001$). Respiratory specialists were more likely than PCPs to report awareness of the GOLD global strategy (93% versus 58%, $P < 0.001$); however, when presented with patient scenarios, they did not always perform better than PCPs with regard to recommending GOLD-concordant treatment options. The proportion of PCPs and respiratory specialists providing first- or second-choice treatment options concordant with GOLD strategy for a GOLD B-type patient was 38% versus 67%, respectively. For GOLD C and D-type patients, the concordant proportions for PCPs and respiratory specialists were 40% versus 38%, and 57% versus 58%, respectively.

Conclusion: This survey of physicians in 12 countries practicing in the primary care and respiratory specialty settings showed high awareness of COPD-management guidelines. Frequent use of guideline-recommended COPD diagnostic practices was reported; however, gaps in the application of COPD-treatment recommendations were observed, warranting further evaluation to understand potential barriers to adopt guideline recommendations.

Keywords: chronic obstructive pulmonary disease, physician beliefs, adherence to guidelines

Introduction

Chronic obstructive pulmonary disease (COPD) is a chronic inflammatory lung disease that is complex and progressive, but which is also considered preventable and treatable.¹ The multicomponent nature of COPD is now reflected in several regional

and international management guidelines^{2,3} and the recently released *Global Strategy for the Diagnosis, Management and Prevention of COPD* released by GOLD (Global initiative for chronic Obstructive Lung Disease).¹ The GOLD global strategy outlines preferred diagnosis methods for COPD, including evaluation of signs/symptoms, assessment of patient history and past exposure to risk factors, and post-bronchodilator spirometric confirmation. Once a COPD diagnosis is confirmed, the GOLD global strategy also recommends a new disease-classification approach that combines symptoms (modified Medical Research Council [mMRC] dyspnea grade or COPD Assessment Test) and exacerbation risk (airflow limitation and/or history of exacerbations) to categorize patients into four groups from A (low risk, fewer symptoms) to D (high risk, more symptoms). Pharmacological treatment recommendations for disease management are provided for these groups, ranging from a short-acting anticholinergic and/or short-acting β_2 -agonist for group A patients to combined therapy with an inhaled corticosteroid (ICS) and a long-acting β_2 -agonist (LABA) or long-acting

anticholinergic (long-acting muscarinic antagonist [LAMA]) for groups C and D (with the possibility of triple therapy with LAMA + ICS/LABA for group D) (Table 1).

Despite the availability of international disease-management guidelines, including those specifically aimed at primary care, COPD often remains underdiagnosed and inappropriately treated.⁴⁻⁷ A large web-based survey in 2011 of primary care physicians (PCPs) across the regions of Asia Pacific, Africa, Eastern Europe, and Latin America showed limited knowledge of COPD guidelines, including underutilization of spirometry for diagnosis of COPD and a general lack of awareness about the significance of exacerbations as an important factor in the management of COPD.⁸ Country-specific surveys largely conducted in primary care in Western Europe,^{5,6,9-11} Japan,¹² Mexico,¹³ and the USA¹⁴⁻¹⁶ have also shown that despite knowledge of guidelines, there is a lack of adherence to guideline recommendations for the treatment of COPD. In the USA, the main barriers to guideline implementation have been reported as low familiarity, low ability or confidence in interpreting recommendations,

Table 1 Initial pharmacological management of COPD*

Patient group	First choice	Second choice	Alternative choices**
A	Short-acting anticholinergic PRN or Short-acting β_2 -agonist PRN	Long-acting anticholinergic or Long-acting β_2 -agonist or Short-acting β_2 -agonist and short-acting anticholinergic	Theophylline
B	Long-acting anticholinergic or Long-acting β_2 -agonist	Long-acting anticholinergic and long-acting β_2 -agonist	Short-acting β_2 -agonist and/or Short-acting anticholinergic Theophylline
C	Inhaled corticosteroid + long-acting β_2 -agonist or Long-acting anticholinergic	Long-acting anticholinergic and long-acting β_2 -agonist	Phosphodiesterase-4 inhibitor Short-acting β_2 -agonist and/or Short-acting anticholinergic Theophylline
D	Inhaled corticosteroid + long-acting β_2 -agonist or Long-acting anticholinergic	Inhaled corticosteroid and long-acting anticholinergic or Inhaled corticosteroid + long-acting β_2 -agonist and long-acting anticholinergic or Inhaled corticosteroid + long-acting β_2 -agonist and phosphodiesterase-4 inhibitor or Long-acting anticholinergic and long-acting β_2 -agonist or Long-acting anticholinergic and phosphodiesterase-4 inhibitor	Carbocysteine Short-acting β_2 -agonist and/or Short-acting anticholinergic Theophylline

Notes: *Medications in each box are mentioned in alphabetical order, and thus not necessarily in order of preference; **medications in this column can be used alone or in combination with other options in the first and second columns. From the Global Strategy for Diagnosis, Management and Prevention of COPD 2014, © Global initiative for chronic Obstructive Lung Disease (GOLD), all rights reserved. Available from <http://www.goldcopd.org>.¹

Abbreviations: COPD, chronic obstructive pulmonary disease; PRN, pro re nata (as needed).

time constraints, and low outcome expectancy among physicians.^{15,16}

The Continuing to Confront COPD International Physician Survey aimed to describe physician beliefs and behaviors related to COPD risk factors, prognosis, diagnosis, and treatment in a broad sample of PCPs and respiratory specialists across 12 countries worldwide. The objective of this analysis was to describe physicians' knowledge and application of the GOLD global strategy (2011 version) diagnosis and treatment recommendations and compare performance between PCPs and respiratory specialists.

Materials and methods

Study design and participants

The Continuing to Confront COPD International Physician Survey was a survey of PCPs and respiratory specialists in 12 countries (Brazil, France, Germany, Italy, Japan, Mexico, the Netherlands, Russia, South Korea, Spain, the UK, and the USA) conducted between January and May 2013. Physicians were required to consult with five or more patients with COPD, emphysema, or chronic bronchitis per month, on average.

The sample of physicians was drawn from in-country databases of professional associations (eg, American Medical Association) and registries with the aim of having a national sample of PCPs and respiratory specialists at a ratio of three to one. This ratio was determined a priority in order to ensure an adequate sample size of each physician type within each country, and was not intended to represent the ratio of these physicians types practicing, or treating patients with COPD in an individual country. Each sample was proportionate to the subnational regions in each country, with the exception of Russia, where the sample was drawn to be roughly

representative of the general population of the 12 most developed and populous cities.

Data collection

A standardized questionnaire was used in all countries to assess physician knowledge of COPD-management guidelines, diagnosis and treatment practices for COPD, and beliefs about COPD risk, natural history, and treatment effectiveness. The standardized questionnaire was translated into local languages in-country and reviewed by an independent translator and a local GlaxoSmithKline clinical advisor for accuracy and cultural relevance. The surveys were conducted online, by telephone, or face to face according to cultural preferences in each country, and were approximately 20 minutes in duration. Where possible, more than one mode of survey methodology was offered to accommodate the preferences of the physicians and to minimize the rate of refusal (Table 2). Modest payments to physicians for their time completing the survey were permitted in line with country regulations. For quality-control purposes, a minimum of 10% of interviews (all sampling methods) were validated by recontact or review of recorded interviews.

The sampling and screening process identified 1,307 physicians who agreed to be interviewed, comprising 200 physicians from the USA and approximately 100 each in the remaining countries (Table 2). The response rate by country ranged from 10% (USA) to 38% (Spain). No association was observed between poor response rates and type of interview technique used (telephone/internet/face to face); countries with the lowest response rates had the highest rates of "noncontact" issues (data not shown). For the total study population, the proportion of PCPs and respiratory

Table 2 Physician response rate, physician type, and survey method in each country: Continuing to Confront COPD International Survey, 2012–2013

Country	Physician response rate (%)	Physicians interviewed (n)	PCP/RS (n)	Survey mode
USA	10	200	151/49	Telephone
Mexico	18	101	75/26	Internet/telephone
Brazil	17	101	75/26	Internet/telephone
France	37	100	74/26	Internet
Germany	35	100	75/25	Internet
Italy	21	100	74/26	Telephone
Spain	38	100	75/25	Internet/telephone
UK	31	100	75/25	Internet
Netherlands	21	101	74/27	Internet
Russia	23	100	74/26	Internet/face to face
Japan	13	101	73/28	Internet/telephone/face to face*
South Korea	14	103	76/27	Internet/telephone/face to face*
Total		1,307	971/336	

Note: *Face-to-face available only in capital cities, ie, Tokyo and Seoul.

Abbreviations: COPD, chronic obstructive pulmonary disease; PCP, primary care physician; RS, respiratory specialist.

specialists was 74% and 26%, respectively. The sample size of 1,307 physicians allowed for a sample precision of $\pm 3.1\%$ for population responses or proportions around 50%.

Outcome definitions

The primary objective of the present analysis was to describe physicians' knowledge and application of the GOLD global strategy diagnosis and treatment recommendations and compare performance in applying these guidelines between PCPs and respiratory specialists.

To evaluate physician knowledge about COPD-management guidelines, respondents were queried about whether they were aware of any local/countrywide COPD guidelines, and if so, to what degree these guidelines influenced their everyday treatment practice. Respondents were similarly queried about the GOLD global strategy recommendations and its influence on their practice.

Physician-diagnosis practices were assessed by presenting respondents with a predefined list of diagnostic tests and instructing them to indicate which test(s) they normally conduct in order to establish a diagnosis of COPD (physicians could answer "Yes", "No", or "Test not available" for each test). Respondents were also asked to name the three most important factors in a patient's history when establishing a diagnosis of COPD.

Lastly, physician concordance with prescribing a GOLD global strategy-recommended treatment for different types of COPD patients was evaluated using patient case scenarios (see Table S1 for scenario descriptions). Each patient vignette was emblematic of a typical GOLD B, C, or D patient (respondents were not told the patients' GOLD classification as part of the descriptive text). After the scenario was read to the respondents (or displayed online), they were asked to consider which medication(s) they would typically prescribe to such a patient. Respondents could pick one or more of the medication options from a prespecified list that included: 1) short-acting bronchodilator, 2) LAMA, 3) LABA, 4) ICS/LABA combination inhaler, 5) theophylline, 6) roflumilast, 7) triple therapy (LAMA + LABA/ICS fixed-dose combination in two inhaler devices), or 8) oral corticosteroids (chronic use). Respondents could also specify other medications not included in the predefined list; these were reviewed, and those that matched one of the eight prespecified classes of drugs were recoded prior to data analysis. "Concordance" with GOLD strategy for this analysis was defined as selecting a GOLD global strategy first- or second-choice treatment option for the specific type of patient, regardless of whether a medication from the alternative choice was also selected

(Tables 1 and S1). Respondents could select multiple first- (or second)-choice options and still be considered concordant. The second-choice option "LAMA and LABA" (for GOLD B, C, or D) was not evaluated, because this combination was not included in the prespecified list (no LAMA/LABA fixed-dose combination products were commercially available at the time of survey development). Given the prespecified response categories, we could not ascertain if a physician who selected both 1) LABA and 2) LAMA intended for the products to be used concomitantly or separately. For similar reasons, we did not evaluate the second-choice option of "LAMA and ICS" (for GOLD D). For the GOLD D patient scenario, if a respondent selected either LABA/ICS or LAMA and also selected roflumilast, we assumed that the physician intended to use these in combination, consistent with the indication for roflumilast for use as an add-on therapy to bronchodilator treatment.¹⁷ Respondents were considered "discordant" with GOLD strategy if they 1) selected neither a first- nor second-choice option, 2) selected a first- or second-choice option(s) along with additional nonrecommended therapies, or 3) selected a medication from the alternative choice alone.

Statistical analysis

In order to evaluate the hypothesis that PCPs and respiratory specialists vary with regard to key outcomes (utilization of GOLD global strategy-recommended diagnostic tests and guideline-concordant behavior), all countries were combined to obtain a sufficient sample size. While there was some heterogeneity observed across countries, the direction of association was similar (see Supplementary materials for country-specific data). These physician sample data are not weighted because standardized and reliable estimates of the key demographic parameters of the universe of physicians in each country were not readily available. Multivariate logistic regression models, built for each outcome separately, considered physician type as the main exposure and included potential confounding variables. While several potential confounders were considered (knowledge and influence of local/professional guidelines, knowledge and influence of GOLD global strategy, sex, year since graduated medical school, and participation in COPD-based continuing education courses), only awareness of the GOLD global strategy was significantly associated with each outcome and with physician type in univariate analyses. Therefore, all models were adjusted for awareness of the GOLD global strategy and country, and the statistical tests reported herein represent the *P*-value of the physician-type β -coefficient from this final adjusted model.

Results

Demographics of physician sample

In the global sample from 12 countries, approximately three-quarters of the physicians were male and about half graduated from medical school after 1990, with a similar pattern observed for PCPs and respiratory specialists (Table 3). The proportion of physicians in a multispecialty practice was slightly higher for PCPs (56%) compared with respiratory specialists (48%). Respiratory specialists were more likely to be practicing in urban/city areas (55% versus 37% of PCPs) and to report that they treated COPD patients in an inpatient or hospital-based clinic (33% versus 14% of PCPs). Respiratory specialists had a higher case mix of COPD patients (59% reported at least a third of all patients they treat regularly have COPD versus 8% of PCPs). The majority of physicians had received some continuing education on COPD (88% of respiratory specialists, 71% of PCPs), and most reported using the term “COPD” when discussing the diagnosis with their patients.

Across countries, the proportion of male physicians was greater in Japan and South Korea and lower in Russia compared with the total population; Russia had very few single-specialty practices, and fewer physicians in Japan reported that they received some continuing education on COPD (19% of PCPs; 43% of respiratory specialists). The type, setting, and location of practices showed some variation across countries (Table 3).

Knowledge of guidelines

Across all countries, a high awareness of any professional guidelines for COPD diagnosis/management, including local guidelines, was reported for both PCPs (85%) and respiratory specialists (97%) ($P < 0.001$, Figure 1A). Results were generally consistent across countries, with the exception of France, where less than half of PCPs reported familiarity with any guidelines. The majority of physicians disclosed that professional guidelines informed their practice (88% of PCPs, 91% of respiratory specialists). Among those who stated that guidelines

Table 3 Demographic characteristics of physicians by country: Continuing to Confront COPD International Survey, 2012–2013

	Total n=1,307		USA n=200		Mexico n=101		Brazil n=101		France n=100		Germany n=100		Italy n=100	
	PCP %	RS %	PCP %	RS %	PCP %	RS %	PCP %	RS %	PCP %	RS %	PCP %	RS %	PCP %	RS %
Male	75	77	68	96	75	69	79	62	84	65	65	84	74	81
Patient setting														
Outpatient*	86	67	99	80	61	77	77	85	93	50	87	60	100	69
Inpatient†	14	33	1	20	39	23	23	15	7	50	13	40	0	31
Type of practice														
Single specialty	42	50	69	76	37	65	29	50	49	77	20	40	66	81
Multispecialty	56	48	31	25	61	35	67	50	51	23	77	60	34	15
Other	1	2	0	0	1	0	4	0	0	0	3	0	0	4
Graduated medical school														
Before 1980	11	13	9	29	4	12	11	19	12	0	13	0	31	23
1980s	35	30	35	57	9	23	17	19	46	35	31	32	58	31
1990s	26	35	36	10	5	39	25	35	19	50	36	52	5	31
2000 or after	25	21	19	4	75	23	45	27	20	15	11	12	5	12
Practice location														
Central city	37	55	18	39	81	85	79	81	31	31	24	52	27	46
Suburb/small city/town	53	43	72	57	15	15	21	19	41	69	52	44	73	54
Rural area	10	2	11	4	4	0	0	0	28	0	24	4	0	0
Continuing COPD education, yes	71	88	85	96	55	96	39	89	61	73	89	100	88	100
Percentage of patients seen with COPD														
>50%	2	27	1	18	3	23	3	15	0	19	3	32	1	54
31%–50%	6	32	3	47	4	27	8	31	2	54	4	32	3	27
11%–30%	30	34	28	32	44	35	41	50	20	19	40	36	17	4
≤10%	63	7	68	2	49	15	48	4	77	8	53	0	80	15
Use term “COPD” when discussing diagnosis with patients, yes	91	95	99	100	97	100	85	100	88	92	95	100	53	77

Notes: *Includes ambulatory care clinic; †includes hospital-based clinic.

Abbreviations: COPD, chronic obstructive pulmonary disease; PCP, primary care physician; RS, respiratory specialist.

Table 3 Demographic characteristics by country: Continuing to Confront COPD International Survey, 2012–2013 (continued)

	Spain n=100		UK n=100		NL n=101		Russia n=100		Japan n=101		SK n=103	
	PCP %	RS %	PCP %	RS %	PCP %	RS %	PCP %	RS %	PCP %	RS %	PCP %	RS %
Male	81	56	73	76	76	78	41	62	96	86	92	89
Patient setting												
Outpatient*	91	72	93	24	92	85	80	62	51	32	92	96
Inpatient†	9	28	7	76	8	15	20	39	49	68	8	4
Type of practice												
Single specialty	57	72	23	16	28	26	1	8	48	54	54	11
Multispecialty	40	24	77	84	70	70	99	92	52	46	41	74
Other	3	4	0	0	1	4	0	0	0	0	5	15
Graduated medical school												
Before 1980	17	8	13	8	10	7	5	12	8	18	4	4
1980s	47	40	41	8	41	15	26	19	45	36	20	22
1990s	23	32	25	40	30	56	24	12	32	21	43	63
2000 or after	12	20	17	40	16	19	45	58	12	25	26	11
Practice location												
Central city	27	44	16	56	39	70	19	23	29	43	74	96
Suburb/small city/town	63	56	67	44	58	30	80	73	55	39	22	4
Rural area	11	0	17	0	3	0	0	0	16	18	4	0
Continuing COPD education, yes	85	92	84	80	84	93	93	96	19	43	50	93
Percentage of patients seen with COPD												
51%–100%	1	40	3	40	3	26	10	54	1	14	0	4
31%–50%	2	28	4	32	2	33	33	31	0	11	1	19
11%–30%	43	32	25	28	15	33	41	12	30	64	15	56
1%–10%	53	0	68	0	80	7	16	4	69	11	84	22
Use term “COPD” when discussing diagnosis with patients, yes	96	96	100	100	99	100	92	89	84	82	93	100

Notes: *Includes ambulatory care clinic; †includes hospital-based clinic.

Abbreviations: COPD, chronic obstructive pulmonary disease; PCP, primary care physician; RS, respiratory specialist; NL, the Netherlands; SK, South Korea.

did not inform their practice (n=123 [11%]), the reasons most frequently given were: “I prefer to use my clinical experience” (n=41), “Guidelines do not allow for tailoring treatment to different patient circumstances” (n=35), “Guideline-suggested choice is not available” (n=31), “Guideline is not relevant/disagree with them” (n=27), and “Patient does not prefer/will not adhere to guideline-suggested choice” (n=18).

Respiratory specialists were statistically significantly more likely to report awareness of the GOLD global strategy (58% of PCPs versus 93% of respiratory specialists, $P<0.001$, Figure 1B); some variability across countries was observed. Despite lower awareness of the GOLD global strategy, PCPs were more likely to report they had made changes to their management of COPD patients based on these guidelines (61% of PCPs versus 51% of respiratory specialists). Among all physicians who reported that they had made changes to their management as a result of the GOLD global strategy (n=500 [57%]), changes included “Using different therapies than those previously used” (59%), “Incorporating lung function measurements” (25%) and “Incorporating the use of the COPD Assessment Test patient-reported outcome instrument” (20%).

Establishing a COPD diagnosis

Both PCPs and respiratory specialists reported frequently using spirometry testing to establish a COPD diagnosis (100% of respiratory specialists indicated they use spirometry versus 82% of PCPs [$P<0.001$]) (Table 4). An average of 16% of PCPs reported that spirometry was not available in their practice, ranging from 0 to 5% (Russia, UK, Spain, Netherlands, Germany, Brazil) to 46% in France and 82% in Italy (Table S2). Despite the GOLD global strategy recommendation that postbronchodilator spirometry is required for diagnosis and assessment of COPD severity, 22% and 15% of PCPs and respiratory specialists, respectively, indicated that they only use prebronchodilator spirometry. Patient-reported outcomes (eg, dyspnea measure or COPD Assessment Test) were used frequently by both PCPs (67%) and respiratory specialists (81%) as part of assessing COPD. Significantly greater proportions of respiratory specialists than PCPs reported the use of chest X-ray, blood tests/oximetry, bronchodilator responsiveness, computerized tomography or magnetic resonance imaging scans, and patient-reported outcome instruments. Diagnostic practices varied somewhat by country (Table S2).

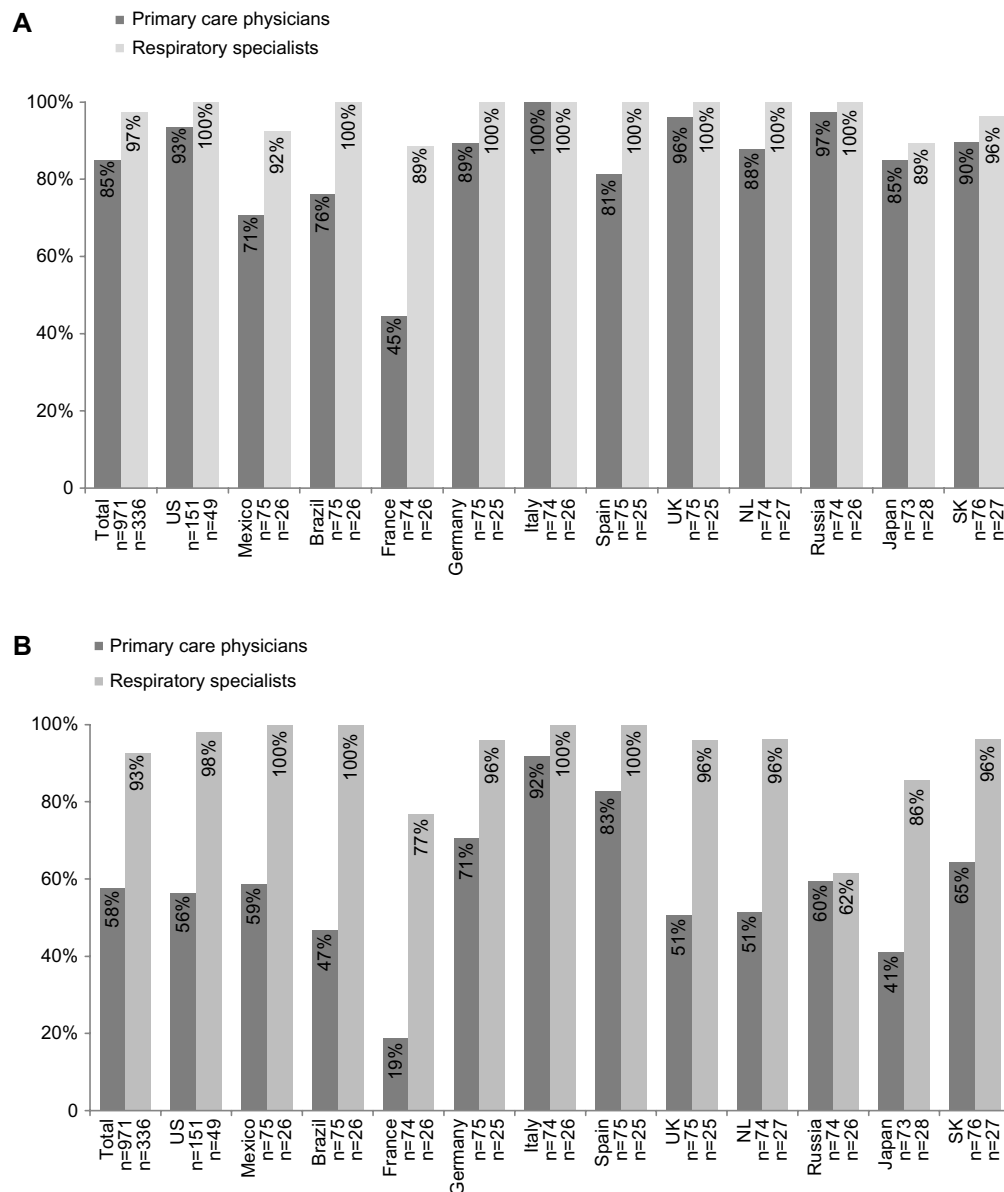


Figure 1 Awareness of (A) any professional guidelines and (B) 2011 GOLD global strategy guidelines.

Note: $P < 0.001$ comparing total primary care physicians to respiratory specialists, adjusted for country.

Abbreviations: GOLD, Global initiative for chronic Obstructive Lung Disease; COPD, chronic obstructive pulmonary disease; NL, the Netherlands; SK, South Korea.

In response to an open-ended question asking physicians to state up to three top patient factors they consider when establishing a COPD diagnosis, the most frequently reported indicators, as referenced in the GOLD global strategy, were “History of smoking/exposure to passive smoking” (PCPs 73%, respiratory specialists 79%, $P=0.031$), and “Chronic symptoms of airflow obstruction” (PCPs 47%, respiratory specialists 56%, $P=0.011$) (Table 5). This pattern was generally consistent across countries, with the exception of Russia, where “Chronic symptoms of airflow obstruction” followed by “Chronic cough with phlegm” were most frequently reported, and Mexico and Germany, where “History of smoking/exposure to passive smoking” followed by

“Occupational exposure to smoke/fumes/dust” were most frequently reported (Table S3).

Application of GOLD global strategy management guidelines using patient scenarios

For the GOLD category B patient scenario, only one in three PCPs (38%) provided a response that was concordant with treatment recommendations, with respiratory specialists statistically significantly more likely to provide a concordant answer (67%, $P < 0.001$, Figure 2). The most commonly selected concordant option among both types of physicians was LAMA (PCP 22%, respiratory specialists 39%).

Table 4 Tests typically used to establish a COPD diagnosis, by physician type: Continuing to Confront COPD International Survey, 2012–2013

Diagnostic test	PCP (n=971)			RS (n=336)			P-value*
	Yes	No	Not available	Yes	No	Not available	
Spirometry testing	82	2	16	100	0	0	<0.001
Prebronchodilator	22			15			
Postbronchodilator	7			21			
Both	69			64			
Peak expiratory flow	55	29	16	43	51	6	<0.001
Bronchodilator responsiveness	68	23	9	80	19	2	<0.001
Oral corticosteroid responsiveness	38	52	9	28	65	7	<0.001
Chest X-ray	76	11	13	89	10	2	<0.001
Blood test/oximetry	45	32	23	69	27	4	<0.001
CAT/CT/MRI scans	21	53	25	44	51	5	<0.001
Patient-reported outcomes (eg, dyspnea measure or COPD-assessment test)	67	28	5	81	18	1	<0.001

Note: *P-value comparing PCP to RS for responses of yes versus no/not available, adjusted for country and awareness of GOLD global strategy.

Abbreviations: COPD, chronic obstructive pulmonary disease; PCP, primary care physician; RS, respiratory specialist; CAT, computerized axial tomography; CT, computerized tomography; MRI, magnetic resonance imaging; GOLD, Global initiative for chronic Obstructive Lung Disease.

PCPs were far more likely to report a discordant option of either an ICS-containing regimen or alternative option (short-acting bronchodilator or theophylline alone) than respiratory specialists. Across countries, a similar pattern was observed, with the exceptions of Germany, Italy, and Japan, where the concordance was similar for PCPs and respiratory specialists (Table S4).

In contrast to the GOLD category B patient, PCPs and respiratory specialists performed similarly (40% and 38%, respectively; $P=0.181$) for the GOLD category C patient scenario (Figure 3). PCPs indicated that they would most likely

prescribe ICS/LABA combination inhalers alone (16%), while respiratory specialists commonly selected LAMA alone (13%). The most commonly mentioned discordant option reported by both physician types was triple therapy, which is only recommended for the more severe GOLD D-type patient (PCPs 16%, respiratory specialists 23%). Country-specific data were consistent with the main findings, other than in Spain, Germany, and Japan, where PCPs demonstrated higher levels of concordance versus respiratory specialists, and in Russia respiratory specialists were substantially more concordant than PCPs (Table S4).

For the GOLD category D patient scenario, both physician types performed similarly, with slightly over half providing a concordant response ($P=0.513$, Figure 4). The most commonly selected concordant option was triple therapy (27% of PCPs and 33% of respiratory specialists); ICS/LABA was also commonly selected. Discordant answers commonly included triple therapy in combinations not recommended by GOLD, including oral corticosteroids (PCPs 7%) and phosphodiesterase 4 inhibitors (respiratory specialists 10%). Countries that were not consistent with the overall pattern of concordance were the USA and Russia (less than 50% of PCPs and respiratory specialists were concordant) and Brazil and Germany (less than 50% of respiratory specialists were concordant) (Table S4).

Table 5 Key indicators for considering a COPD diagnosis: Continuing to Confront COPD International Survey, 2012–2013

Key indicator	PCP (n=971) %	RS (n=336) %	P-value*
Chronic symptoms of airflow obstruction (ie, wheezing, dyspnea)	47	56	0.011
Chronic cough with phlegm/sputum	39	44	0.050
History of cigarette smoking/exposure to passive smoking	73	79	0.031
Occupational exposure to smoke, fumes, or dust	20	16	0.064
Family history of emphysema/bronchitis/COPD	14	13	0.778

Notes: *P-value comparing PCP to RS, adjusted for country and awareness of GOLD global strategy. Percentages within a physician type will sum to greater than 100%; results from an open-ended question asking physicians to provide the top three most important factors in a patient's history when establishing a COPD diagnosis; no predefined list provided.

Abbreviations: COPD, chronic obstructive pulmonary disease; PCP, primary care physician; RS, respiratory specialist; GOLD, Global initiative for chronic Obstructive Lung Disease.

Discussion

The Continuing to Confront COPD International Physician Survey aimed to describe PCPs' and respiratory specialists' beliefs and behaviors in relation to COPD diagnosis

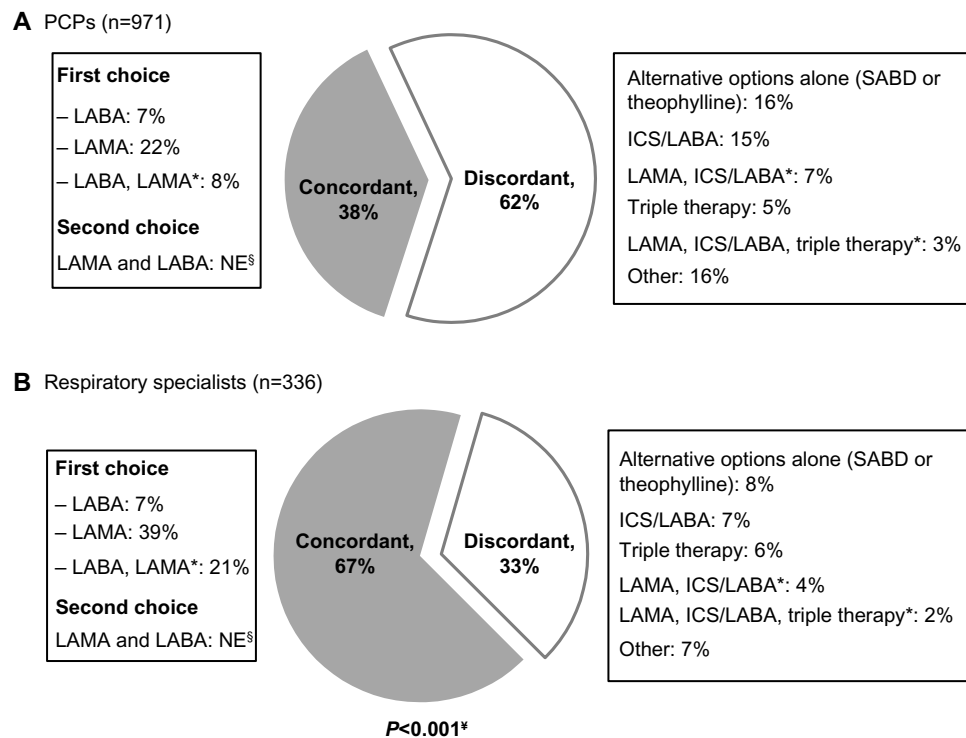


Figure 2 Proportion of (A) primary care physicians (PCPs) and (B) respiratory specialists concordant with first- or second-choice GOLD 2011 global strategy treatment options for GOLD category B patient.

Notes: Triple therapy defined as LAMA + LABA/ICS fixed-dose combination in two inhaler devices. GOLD B scenario: this patient has an mMRC dyspnea scale score of 2, a GOLD airflow-limitation classification of 2, and had one exacerbation in the past year. *Respondent independently selected all listed treatment options; does not necessarily reflect the respondent's intention to use these medications simultaneously; [§]second-choice option of LAMA and LABA not evaluable; [¶]P-value comparing PCPs to respiratory specialists, adjusted for country and awareness of the GOLD global strategy. Individual treatment choices may not add to concordant or discordant response percentage due to rounding.

Abbreviations: GOLD, Global initiative for chronic Obstructive Lung Disease; SABD, short-acting bronchodilator; LAMA, long-acting muscarinic antagonist; LABA, long-acting β_2 -agonist; ICS, inhaled corticosteroid; mMRC, modified Medical Research Council; NE, not evaluable.

and treatment. Most PCPs and respiratory specialists reported that professional guidelines for COPD diagnosis/management informed their practice, which was widely reflected in the frequent self-reported use of spirometry to establish a diagnosis of COPD. However, with respect to the application of the GOLD global strategy for COPD management, a large proportion of both PCPs and respiratory specialists chose nonconcordant treatments for different patient scenarios.

In the current survey of 12 countries, 85% of PCPs and 97% of respiratory specialists reported an awareness of any professional guidelines for COPD diagnosis/management, including local guidelines, which is higher than that reported in a PCP survey in the USA, which showed that only between a third and a half are highly familiar with GOLD and/or American Thoracic Society/European Respiratory Society guidelines.^{14,15} We observed that significantly fewer PCPs (58%) were familiar with the GOLD global strategy compared with respiratory specialists (93%), similar to findings in previous surveys.^{8,10} This may be related to perceptions that the new GOLD categories have limited application in

primary care and the previous suggestion that development of new treatment algorithms should involve the primary care community in order to fully engage their support.¹⁸

Despite the GOLD global strategy recommendation that spirometry is required to make a clinical diagnosis of COPD, barriers to using spirometry have previously been cited as a lack of access to spirometers, cost of testing/inadequate reimbursement for testing, patient reluctance to have the test, lack of familiarity with recommendation, and time constraints.^{15,16} The self-reported use of spirometry by physicians in the Continuing to Confront COPD International Physician Survey was 80%–100%, which is among the highest reported in similar surveys. In Aisanov et al, 10%–48% of physicians self-reported using spirometry as a COPD diagnostic tool,⁸ while other studies show that even when physicians agree on the importance of spirometry, the actual use is only 23%–54%.^{10,15} Self-reported spirometry use in our study is also higher than benchmarks of actual use captured in population-based electronic medical records and health care-claims databases in the USA and UK.^{19,20} In our

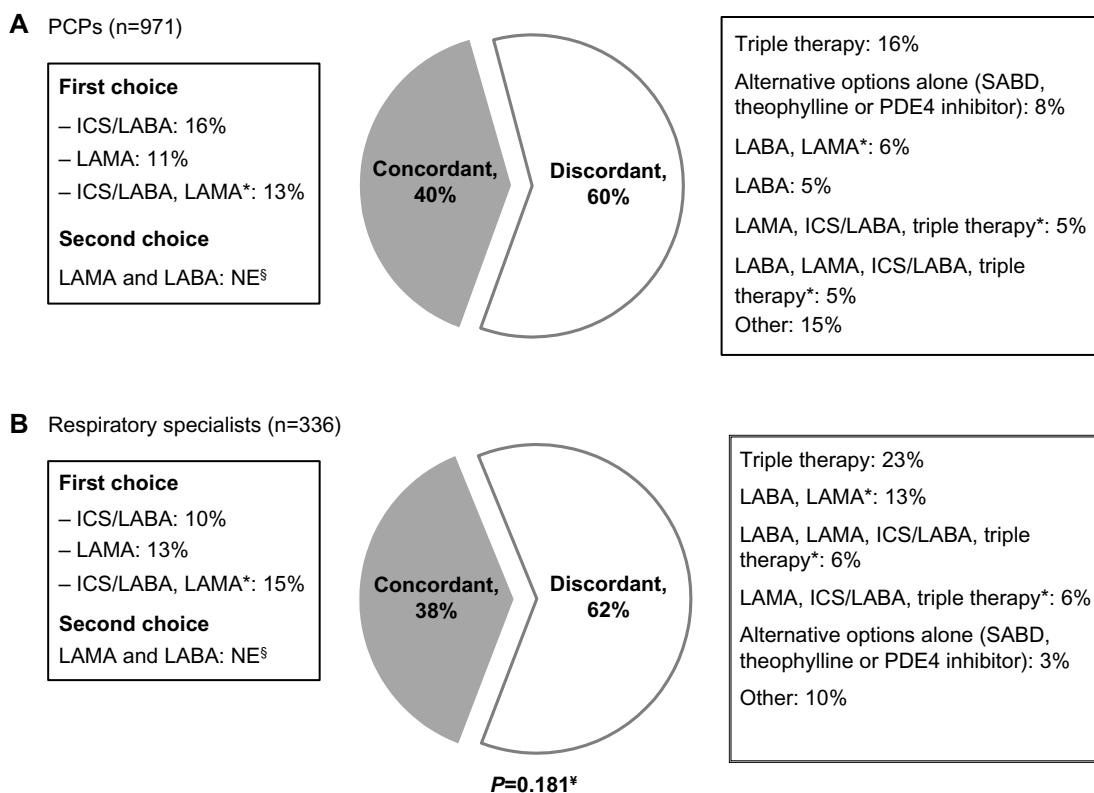


Figure 3 Proportion of (A) primary care physicians (PCPs) and (B) respiratory specialists concordant with first- or second-choice GOLD 2011 global strategy treatment options for GOLD category C patient.

Notes: Triple therapy defined as LAMA + LABA/ICS fixed-dose combination in two inhaler devices. GOLD C scenario: this patient has an mMRC dyspnea scale score of 0, a GOLD airflow-limitation classification of 3, and had one hospitalized exacerbation in the past year. *Respondent independently selected all listed treatment options; does not necessarily reflect the respondent's intention to use these medications simultaneously; [§]second-choice option of LAMA and LABA not evaluable; *P-value comparing PCPs to respiratory specialists, adjusted for country and awareness of the GOLD global strategy. Individual treatment choices may not add to concordant or discordant response percentage due to rounding.

Abbreviations: GOLD, Global initiative for chronic Obstructive Lung Disease; SABD, short-acting bronchodilator; LAMA, long-acting muscarinic antagonist; LABA, long-acting β_2 -agonist; ICS, inhaled corticosteroid; mMRC, modified Medical Research Council; NE, not evaluable; PDE, phosphodiesterase.

population, only 16% of PCPs and 0 respiratory specialists reported that they did not have access to spirometry, which may in part explain the higher rate of spirometry use in our survey. However, we did observe a large variation in lack of access by country, ranging from 0 (Russia, UK) up to 46% (France) and 82% (Italy), reported by PCPs. While there are likely some true intercountry differences in the availability of spirometry, some of the variability observed may have been due to differences in understanding of the questionnaire (ie, some respondents interpreted a lack of access as no direct access to spirometry in their clinic, while others interpreted it as no direct access plus no access via a specialist).

While reported diagnostic practices appear largely to reflect guideline recommendations, application of the GOLD global strategy management guidelines was considerably lower. Despite respiratory specialists being significantly more likely to report knowledge of the GOLD global strategy, they did not perform appreciably better than PCPs in providing

guideline-concordant answers, possibly suggesting that awareness does not necessarily translate into implementation, given the many variables that factor into the ultimate prescribing decision (eg, physician experience, local formulary, costs, and patient preferences). These findings are similar to those reported in a survey of PCPs and practice nurses in the UK, which showed high awareness levels of national COPD guidelines were not reflected in diagnoses or management strategies when presented with several case scenarios.⁹

However, these concordance findings must be interpreted within the limitations of the data available, as clinical scenarios are incomplete reflections of the complexity of physicians' treatment decision making in the clinic, including the role of constraints faced by physicians with regard to formularies or local guidelines. For example, respiratory specialists in our survey showed a greater reluctance to change their practice or fully adopt guidelines, with many stating they prefer to rely on their clinical experience or feel that guidelines do

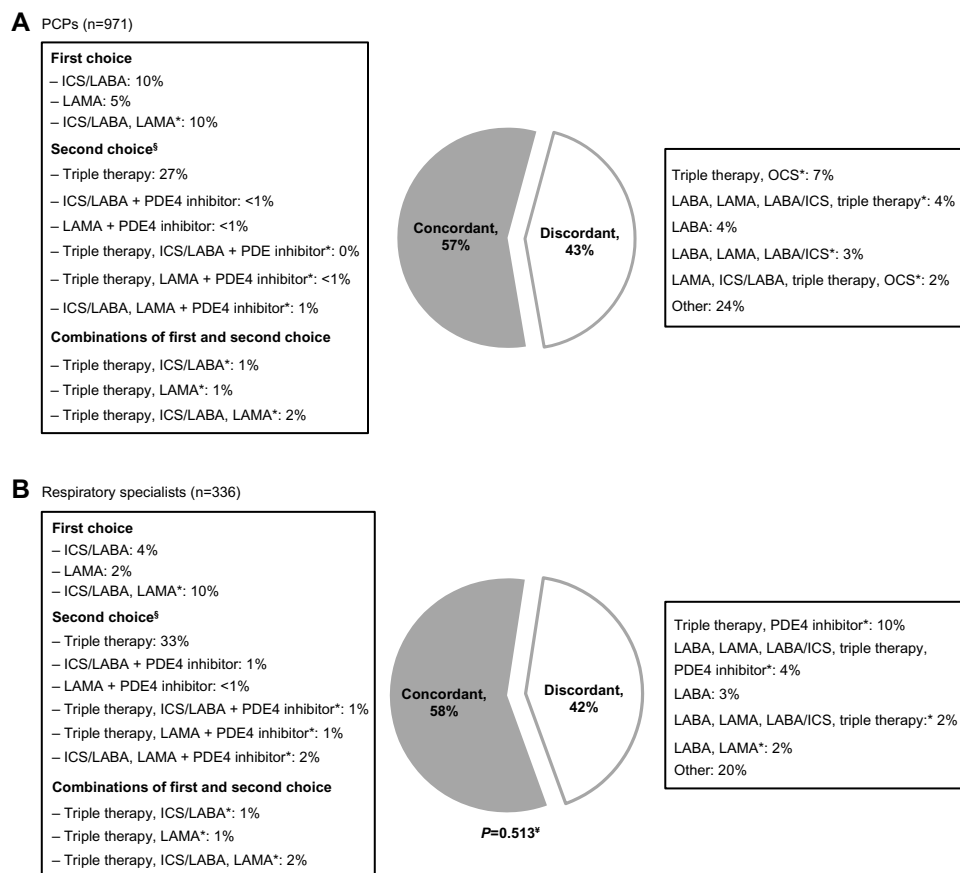


Figure 4 Proportion of (A) primary care specialists (PCPs) and (B) respiratory specialists concordant with first- or second- choice GOLD 2011 global strategy treatment options for GOLD category D patient.

Notes: Triple therapy defined as LAMA + LABA/ICS fixed-dose combination in two inhaler devices. GOLD D scenario: this patient has an mMRC dyspnea scale score of 2, a GOLD airflow-limitation classification of 3, and had two exacerbations in the past year. *Respondent independently selected all listed treatment options; does not necessarily reflect the respondent's intention to use these medications simultaneously; [§]second-choice options of 1) LAMA and LABA and 2) ICS and LAMA not evaluable; [†]P-value comparing PCPs to respiratory specialists, adjusted for country and awareness of GOLD global strategy. Individual treatment choices may not add to concordant or discordant response percentage due to rounding.

Abbreviations: GOLD, Global initiative for chronic Obstructive Lung Disease; OCS, oral corticosteroid; LAMA, long-acting muscarinic antagonist; LABA, long-acting β_2 -agonist; ICS, inhaled corticosteroid; mMRC, modified Medical Research Council; PDE; phosphodiesterase.

not adequately account for individual patient symptoms or circumstances, including ability to adhere to recommended medications. Further, our definition of a “concordant response” required a detailed knowledge of both the GOLD patient-severity schema (A–D) and the paired treatment recommendation for each patient type. PCPs in our sample were more likely to report following local guidelines, many of which have yet to adopt the GOLD patient-severity schema or have incorporated different multidimensional indices to define disease severity.²¹ As the GOLD global strategy evolves and is further incorporated into local guidelines, it will be of interest to repeat this type of analysis to evaluate improvement in concordance among PCPs and respiratory specialists.

Another limitation of the data that may have affected the percentage reporting a concordant response was that we could not ascertain if a physician who selected the GOLD

second-choice options of “LAMA and LABA” or “LAMA and ICS” intended for the products to be used together or as individual therapies. The impact of this limitation was likely to be minimal, however, as such combinations as “LABA and LAMA” were not commercially available in a single device, and concomitant prescriptions of the two medication classes were infrequent at the time of the survey.²²

The inclusion of both PCPs and respiratory specialists in the Continuing to Confront COPD International Survey provides a unique opportunity to compare physician types with regard to attitudes and behaviors. However, the overall sample from each country was fairly small, making inter-country comparisons challenging statistically. Further, the representativeness of the sample within certain countries may be limited due to low response rates. Such low response rates did not appear attributable to the type of interview technique

used in the survey, but were most notable in countries with the greatest issues relating to physician “contact”, and this, together with incentivizing respondents with a modest financial reward, may have introduced some responder bias. However, low physician response rates and varied response by country (10% in the USA to 38% in Spain) were broadly consistent with ranges previously reported in published surveys of representative physician samples,^{10,23,24} and may reflect the two-stage process of this survey (initial contact by post/email that invited the physician to contact the survey research organization for an appointment to complete the questionnaire at their convenience).

In summary, this global survey of PCPs and respiratory specialists showed high awareness of COPD-management guidelines. These guidelines appear to be widely followed by both PCPs and respiratory physicians with regard to diagnostic practices, including reported use of spirometry and frequent consideration of risk factors, including smoking history, symptom presentation, and family history. However, there appears to be less adoption of guidelines when applied to COPD treatment choice, with fewer physicians of both types selecting a suggested GOLD global strategy treatment choice in patient scenarios. Further research is needed to better understand the barriers to implementing treatment recommendations and rationale for alternative treatment choices using a tailored approach for different medical specialties. These data can inform physician-education strategies and public health infrastructure relevant to country-specific/local guidelines with the aim to improve COPD disease management and outcomes.

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advisory services. Scientific Advisory Committee members were not paid for authorship services.

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Supplementary materials

Table S1 Definitions used to identify responses concordant with the GOLD global strategy treatment recommendations

Patient scenario read to physician	GOLD group (answer not provided to respondent)	For a patient like this, what would you typically prescribe? (Multiple responses allowed)	"Concordant" response definition used for this analysis	Second choice
58-year-old female, quit smoking 10 years ago, breathlessness rated as "I walk slower than most people my age", FEV ₁ 65% of predicted, one moderate exacerbation requiring antibiotics in last year, unable to clean her house without becoming fatigued	B	<input type="checkbox"/> Short-acting bronchodilator <input type="checkbox"/> LAMA <input type="checkbox"/> LABA <input type="checkbox"/> ICS/LABA combination inhaler <input type="checkbox"/> Theophylline <input type="checkbox"/> Roflumilast <input type="checkbox"/> Triple therapy (LAMA + LABA/ICS fixed-dose combination in two inhaler devices) <input type="checkbox"/> Oral corticosteroids (chronic use)	LABA (± SABD or theophylline) or LAMA (± SABD or theophylline) or LABA, LAMA (respondents ticked both options) (± SABD or theophylline)	Not evaluated*
66-year-old male, active smoker since age 26 years, comorbid high cholesterol and diabetes, breathlessness rated as "only after vigorous exercise", FEV ₁ 40% of predicted, one severe exacerbation requiring hospitalization in last year, primary complaint is cough and sputum	C	<input type="checkbox"/> Short-acting bronchodilator <input type="checkbox"/> LAMA <input type="checkbox"/> LABA <input type="checkbox"/> ICS/LABA combination inhaler <input type="checkbox"/> Theophylline <input type="checkbox"/> Roflumilast <input type="checkbox"/> Triple therapy (LAMA + LABA/ICS fixed-dose combination in two inhaler devices) <input type="checkbox"/> Oral corticosteroids (chronic use)	ICS/LABA combination inhaler (± SABD, theophylline, or roflumilast) or LAMA (± SABD, theophylline, or roflumilast) or ICS/LABA combination inhaler, LAMA (respondents ticked both options) (± SABD, theophylline, or roflumilast)	Not evaluated*
83-year-old male, active smoker, comorbid coronary artery disease and a history of asthma, breathlessness rated as "I have to stop for breath even when walking on level ground at my own pace", FEV ₁ 32% of predicted, he is coming in for a follow-up after recovering from his second exacerbation in the last year	D	<input type="checkbox"/> Short-acting bronchodilator <input type="checkbox"/> LAMA <input type="checkbox"/> LABA <input type="checkbox"/> ICS/LABA combination inhaler <input type="checkbox"/> Theophylline <input type="checkbox"/> Roflumilast <input type="checkbox"/> Triple therapy (LAMA + LABA/ICS fixed-dose combination in two inhaler devices) <input type="checkbox"/> Oral corticosteroids (chronic use)	ICS/LABA combination inhaler (± SABD or theophylline) or LAMA (± SABD or theophylline) or ICS/LABA combination inhaler, LAMA (respondents ticked both options) (± SABD or theophylline) or Triple therapy (± SABD or theophylline) or ICS/LABA combination inhaler + roflumilast (respondents ticked both options) (± SABD or theophylline) or LAMA + roflumilast (respondents ticked both options) (± SABD or theophylline) or LAMA + LABA	Not evaluated* ICS + LAMA Not evaluated†

Notes: *The GOLD-recommended second choice of LABA and LABA was not provided in the predefined medication list on the survey, as no fixed-dose combination products were commercially available at the time of the survey. Further, it was not possible to ascertain if a physician who selected both of these responses individually intended to use the products together or separately, and thus we assumed that they intended them as separate potential options; †the GOLD-recommended second choice of LABA and ICS was not provided in the predefined medication list on the survey, as no fixed-dose combination products were commercially available at the time of the survey.

Abbreviations: GOLD, Global initiative for chronic Obstructive Lung Disease; SABD, short-acting bronchodilator; LAMA, long-acting muscarinic antagonist; LABA, long-acting β_2 -agonist; ICS, inhaled corticosteroid; FEV₁, forced expiratory volume in 1 second.

Table S2 Tests typically used to establish a COPD diagnosis by country and by physician type

	USA n=200		Mexico n=101		Brazil n=101		France n=100		Germany n=100		Italy n=100		Spain n=100		UK n=100		NL n=101		Russia n=100		Japan n=101		SK n=103			
	PC	RS	PC	RS	PC	RS	PC	RS	PC	RS	PC	RS	PC	RS	PC	RS	PC	RS	PC	RS	PC	RS	PC	RS		
Spirometry																										
Yes	84	100	84	100	93	100	50	100	96	100	15	100	96	100	100	100	96	100	100	100	100	100	79	100	83	96
No	5	0	1	0	1	0	4	0	1	0	3	0	0	0	0	0	1	0	0	0	0	0	4	0	0	4
Not available	11	0	15	0	5	0	46	0	3	0	82	0	4	0	0	0	3	0	0	0	0	0	16	0	17	0
Peak expiratory flow																										
Yes	63	35	61	54	49	38	77	50	77	88	18	50	59	28	72	16	41	26	38	35	45	45	71	50	33	33
No	30	65	15	46	33	58	12	50	16	12	43	50	28	72	28	84	55	74	34	8	27	18	28	63	63	63
Not available	7	0	24	0	17	4	11	0	7	0	39	0	13	0	0	0	4	0	27	58	27	11	22	4	4	4
Bronchodilator responsiveness																										
Yes	66	80	69	81	73	77	76	85	88	100	24	85	76	92	76	48	68	74	89	100	53	57	57	78	78	78
No	27	20	19	19	21	23	18	15	9	0	41	8	13	8	21	52	27	26	9	0	38	25	33	22	22	22
Not available	7	0	12	0	5	0	7	0	3	0	35	4	11	0	3	0	5	0	0	0	8	18	11	0	0	0
Oral corticosteroid responsiveness																										
Yes	32	29	55	23	44	35	46	23	52	64	28	42	35	32	37	4	35	11	14	23	36	39	50	7	7	7
No	60	71	31	73	49	62	45	77	44	36	55	54	53	68	60	88	62	89	57	12	60	50	39	89	89	89
Not available	7	0	15	4	7	4	9	0	4	0	16	4	12	0	3	8	3	0	26	62	4	11	9	4	4	4
Chest X-ray																										
Yes	84	86	91	92	84	92	58	88	59	80	5	77	91	96	84	84	55	81	99	96	96	100	91	93	93	93
No	12	14	7	8	12	8	16	12	15	20	15	8	8	4	13	16	30	15	1	4	3	0	3	7	7	7
Not available	4	0	3	0	4	0	26	0	27	0	80	15	1	0	3	0	15	4	0	0	0	1	7	0	0	0
Blood test/oximetry																										
Yes	38	84	80	73	53	62	30	85	33	84	4	58	53	68	37	40	26	44	92	85	78	86	22	52	52	52
No	53	16	13	15	29	35	28	12	24	16	19	27	29	32	49	60	53	48	8	12	12	11	43	44	44	44
Not available	9	0	7	12	17	4	42	4	43	0	76	15	17	0	13	0	22	7	0	4	10	4	34	4	4	4
CAT/CT/MRI scans																										
Yes	15	33	24	42	37	46	19	54	12	48	1	35	12	56	4	16	5	4	39	88	67	79	28	41	41	41
No	68	67	47	54	43	42	47	42	49	52	59	46	53	44	72	80	72	89	55	12	8	14	41	52	52	52
Not available	16	0	29	4	20	12	34	4	39	0	38	15	35	0	24	4	23	7	0	0	25	7	32	7	7	7
Patient-reported outcomes																										
Yes	75	82	84	92	95	92	65	65	79	84	53	96	55	92	64	60	78	81	59	88	37	71	54	70	70	70
No	19	18	13	8	4	8	31	27	16	16	38	4	39	8	32	36	19	19	39	12	53	29	38	26	26	26
Not available	5	0	3	0	1	0	4	8	5	0	8	0	7	0	4	4	3	0	0	0	10	0	8	4	4	4

Abbreviations: COPD, chronic obstructive pulmonary disease; NL, the Netherlands; SK, South Korea; PC, primary care; RS, respiratory specialist; CAT, computerized axial tomography; CT, computerized tomography; MRI, magnetic resonance imaging.

Table S3 Key indicators for considering a COPD diagnosis: GOLD global strategy by country and by physician type

	USA n=200		Mexico n=101		Brazil n=101		France n=100		Germany n=100		Italy n=100		Spain n=100		UK n=100		NL n=101		Russia n=100		Japan n=101		SK n=103	
	PC	RS	PC	RS	PC	RS	PC	RS	PC	RS	PC	RS	PC	RS	PC	RS	PC	RS	PC	RS	PC	RS	PC	RS
Chronic symptoms of airflow obstruction (wheezing, dyspnea)																								
Yes (%)	53	59	15	19	55	69	23	50	20	28	54	81	48	36	51	44	80	85	80	88	41	50	42	59
Chronic cough with phlegm/sputum																								
Yes (%)	36	41	11	15	44	62	38	50	20	12	61	65	37	24	49	24	59	81	61	73	22	32	32	44
History of cigarette smoking/exposure to passive smoking																								
Yes (%)	77	78	88	85	59	73	85	100	84	76	72	62	44	84	85	92	73	78	50	42	95	89	66	85
Occupational exposure to smoke, fumes, or dust																								
Yes (%)	9	6	59	77	8	4	27	15	31	20	30	15	8	4	15	16	8	0	15	12	19	14	24	19
Family history of emphysema/bronchitis/COPD																								
Yes (%)	11	10	4	8	15	12	23	15	11	20	7	4	32	48	19	16	8	0	16	23	4	11	18	0

Notes: Percentages within a physician type will sum to greater than 100%; results from an open-ended question asking physicians to provide the top three most important factors in a patient's history when establishing a COPD diagnosis; no predefined list provided.

Abbreviations: COPD, chronic obstructive pulmonary disease; GOLD, Global initiative for chronic Obstructive Lung Disease; NL, the Netherlands; SK, South Korea; PC, primary care; RS, respiratory specialist.

Table S4 Proportion of primary care physicians and respiratory specialists concordant with first- or second-choice GOLD 2011 global strategy treatment options by country

	USA n=200		Mexico n=101		Brazil n=101		France n=100		Germany n=100		Italy n=100		Spain n=100		UK n=100		NL n=101		Russia n=100		Japan n=101		SK n=103	
	PC	RS	PC	RS	PC	RS	PC	RS	PC	RS	PC	RS	PC	RS	PC	RS	PC	RS	PC	RS	PC	RS	PC	RS
GOLD category B patient ^{a,*}																								
Concordant (%)	21	67	19	62	29	65	55	81	67	72	50	54	48	84	49	84	51	89	8	27	47	54	28	63
GOLD category C patient ^{b,*}																								
Concordant (%)	24	37	32	23	28	31	38	31	49	32	58	54	32	16	48	48	50	52	28	62	59	25	51	48
GOLD category D patient ^{c,t}																								
Concordant (%)	24	41	63	65	56	38	74	69	68	44	68	69	53	56	72	88	72	85	49	38	62	64	57	52

Notes: ^aScenario described to physician: this patient has an mMRC dyspnea scale score of 2, and had one exacerbation in the past year; ^bscenario described to physician: this patient has an mMRC dyspnea scale score of 0, a GOLD airflow-limitation classification of 3, and had one hospitalized exacerbation in the past year; ^cscenario described to physician: this patient has an mMRC dyspnea scale score of 2, a GOLD airflow-limitation classification of 3, and had two exacerbations in the past year; ^tscenario described to physician: this patient has an mMRC dyspnea scale score of 2, a GOLD airflow-limitation classification of 3, and had two exacerbations in the past year; ^{*}second-choice option of LAMA and LABA not evaluable; [†]second-choice options of LAMA and LABA or ICS and LAMA not evaluable. Triple therapy defined as LAMA + LABA/ICS fixed-dose combination in two inhaler devices.

Abbreviations: GOLD, Global initiative for chronic Obstructive Lung Disease; NL, the Netherlands; SK, South Korea; PC, primary care; RS, respiratory specialist; LAMA, long-acting muscarinic antagonist; LABA, long-acting β_2 -agonist; ICS, inhaled corticosteroid; mMRC, modified Medical Research Council.

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