State of Practice: Preventing COPD Exacerbation

CHEST Clinical Perspectives™

Introduction

Chronic obstructive pulmonary disease (COPD) is the third leading cause of death in the United States.[1] Pulmonologists and pulmonary rehabilitation specialists are often involved in the care of the patients with COPD, especially patients with severe or advanced cases. Exacerbations of COPD contribute greatly to the disease burden, resource use, and costs associated with the disease.

Described as "acute, trajectory changing, and often deadly manifestations of COPD,"[2,3] exacerbations can range from a mild increase in dyspnea or productive cough to respiratory failure due to acute respiratory acidosis or hypoxemia.[4] Exacerbations are associated with frequent hospital admissions, relapses, and readmissions; contribute to death during hospitalization or shortly thereafter; and dramatically reduce quality of life. Inflammation in the lungs is often a trigger for exacerbations, and viral and bacterial respiratory tract infections and irritants such as smoke, air pollution, or seasonal allergens have all been implicated. Interventions that have been shown to reduce COPD exacerbations include smoking cessation, pulmonary rehabilitation, increased physical activity, proper use of medications (including metered-dose inhaler technique), and vaccination against seasonal influenza and pneumococcus.[4]

Preventing exacerbations is a primary goal of COPD management, and while various COPD guidelines have indicated exacerbations are preventable, the definition of "exacerbation" has varied, and clinical guidance regarding specific therapies has been lacking. In an attempt to address this gap, the American College of Chest Physicians, the Canadian Thoracic Society, and the American Thoracic Society supported the development of a guideline to address the prevention of acute exacerbations in COPD.[2,3] The Global Initiative for Chronic Obstructive Lung Disease (GOLD) provides an additional clinical resource.[5] The GOLD 5-year update, published in 2017, defines "exacerbation" and suggests using an assessment of airflow limitation in parallel with a combined assessment of an individual's symptoms and exacerbation history to guide therapy, shifting toward a more "comprehensive, personalized, and patient-centered approach."[6]

In this third *CHEST Clinical Perspectives*™ issue, CHEST is undertaking primary research with pulmonologists to understand their approaches to treating patients with COPD and reducing the risk of COPD exacerbation. More specifically, the objectives of this research are the following:

■ Understand how pulmonologists define and identify COPD exacerbation.

■ Assess the extent to which different tools and strategies, including GOLD 2017, are used to assess and manage patients with COPD.

■ Understand the adoption of different approaches for monitoring and assessing risk of COPD exacerbation.

■ Assess approaches to managing acute exacerbation and reducing risk of reoccurrence.

METHODOLOGY

CHEST conducted an online survey with a sample of 102 pulmonologists randomly selected from the CHEST member database. Respondents were screened to ensure that they manage patients with COPD and treat them when experiencing exacerbation. Respondents were sent a link to the survey from CHEST, and data were collected from September 6-11, 2017.

Stratified random sampling was employed to ensure an even mix of pulmonologists practicing in academic and nonacademic settings. This stratification was established in order to provide a minimum sample for viewing responses by practice setting (academic vs community-based pulmonologists). To ensure that responses across the entire data set are representative of the pulmonology community as a whole, the data were weighted according to the actual distribution of pulmonologists observed in the CHEST member database.
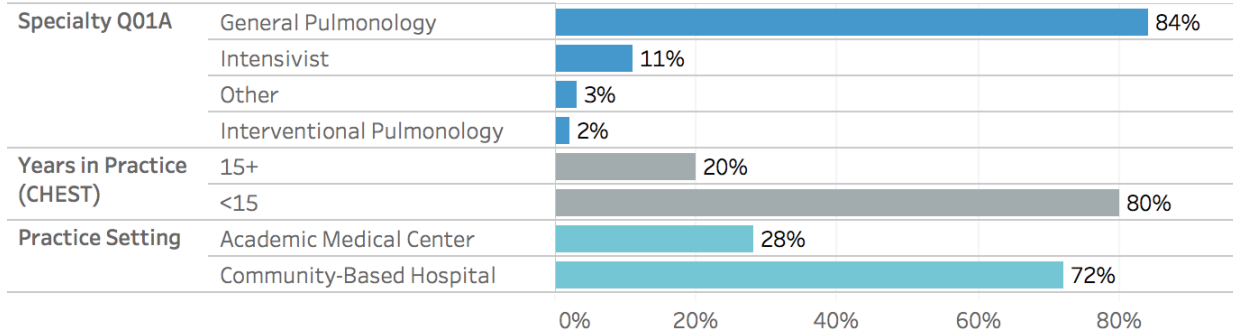
Descriptive statistics were used to assess distributions of the data across important behavioral variables. Inferential statistics were used to assess differences in descriptive and behavioral measures, which were cross-tabulated with patient volume and practice setting data. Depending on data type, a two-tailed independent samples t-test and a chi-square test were used to test for statistical significance ($P<.1$ considered statistically significant).

RESPONDENT PROFILES

Community-based pulmonologists manage a significant caseload of patients with COPD at high risk for exacerbation.
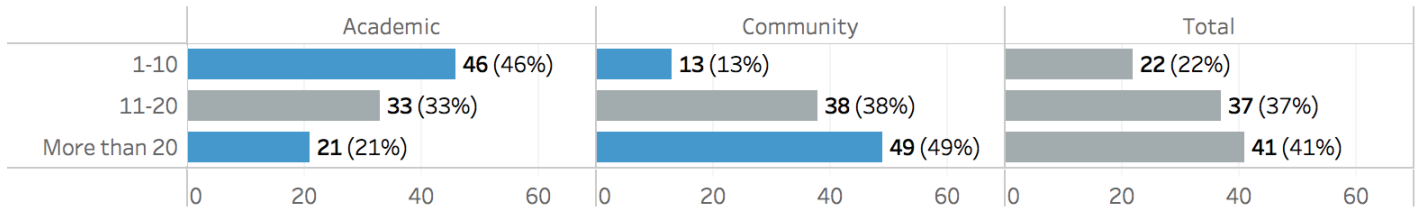
The majority of the respondent base is composed of general pulmonologists (84%), and the majority practice in community-based settings (72%). Most respondents have been in practice since fellowship for 15 or fewer years (80%).

Graph 1. Respondent Profile

Specialty Q01A	General Pulmonology	84%
	Intensivist	11%
	Other	3%
	Interventional Pulmonology	2%
Years in Practice (CHEST)	15+	20%
	<15	80%
Practice Setting	Academic Medical Center	28%
	Community-Based Hospital	72%

The largest share of respondents (78%) report seeing more than 10 patients with COPD each week during the course of normal practice. Almost half of academic respondents (46%) see 10 or fewer patients with COPD in a typical week. Reported COPD caseloads are considerably higher among pulmonologists practicing in community-based settings, where 38% see more than 10 patients with COPD per week and half (49%) say they see more than 20 patients with COPD in a typical week.

Graph 2. COPD Patients Seen in a Typical Week

	Academic	Community	Total
1-10	46 (46%)	13 (13%)	22 (22%)
11-20	33 (33%)	38 (38%)	37 (37%)
More than 20	21 (21%)	49 (49%)	41 (41%)

Blue bar values signify statistical difference

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AWARENESS AND ADOPTION OF GOLD 2017 RECOMMENDATIONS

Overall, respondents indicate that upwards of half their COPD patient base is at risk for exacerbation, depending on which indicators are considered. Based on spirometry stage, respondents say that 53% of their patients are categorized in GOLD spirometry stages 3 or 4 (FEV_1 <50% predicted); using GOLD grades, respondents indicate that 32% of patients are classified as Grade C, and 27% of patients are classified as Grade D. There are no reported variations in these classifications by practice setting, indicating that community-based practitioners are shouldering a significant caseload of patients who are at high risk of exacerbation. (Appendix, Table 1)

A significant percentage of pulmonologists have not adopted GOLD 2017 criteria for assessment/grading or treatment strategies, regardless of practice setting.

Half of respondents overall (49%) say they are very familiar with the GOLD standards released earlier this year. However, adoption is not universal, with only a third of respondents (34%) saying they follow these standards for assessing/grading the severity of COPD in their patients, and relatively few (12%) report following GOLD treatment strategies for all of their patients. Those who are very familiar with GOLD 2017 are significantly more likely (53%) than those who are less familiar (16%) to apply GOLD 2017 assessment and grading to all patients with COPD. There are no statistically significant differences in familiarity or application of GOLD 2017 among respondents who practice in academic settings vs those who are community-based. With respect to GOLD 2017 treatment recommendations, significantly more of those who are very familiar with GOLD 2017 (22%) follow treatment recommendations for all patients with COPD compared with only 3% of those who are less familiar with them. However, even among respondents who say they are very familiar with GOLD 2017, application for both assessing/grading and treatment strategy are far from universal. (Appendix, Table 2)

Spirometry practices are similar regardless of familiarity with GOLD 2017.

Spirometry, presence of symptoms, and smoking history are the main tools used to confirm a COPD diagnosis. (Appendix, Table 3) Half of respondents (49%) indicate they perform spirometry on their patients on an annual basis; additionally, a third (29%) perform the test more frequently. Alternatively, respondents indicate that spirometry is performed once at the time of diagnosis (20%) or only when there is a change in symptoms or medication (10%). (Appendix, Table 3) These findings do not vary by practice setting or reported familiarity with GOLD 2017.

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AWARENESS AND ADOPTION OF GOLD 2017 RECOMMENDATIONS

CONTINUED

Use of questionnaires to assess COPD symptoms is sporadic but higher when pulmonologists are familiar with GOLD 2017.

Reported use of questionnaires in clinic to assess symptoms of patients with COPD is sporadic. Only a fourth of respondents (25%) say they use such questionnaires for most or all of their patients; alternatively, a fifth (19%) indicate they never use assessment questionnaires. Incidence of reported use is higher among respondents who are very familiar with GOLD 2017 (89%) compared with those who are less familiar (74%). (Appendix, Table 4)

The COPD Assessment Test (CAT) is used most frequently (40%), followed by the mMRC Dyspnea Scale (33%). There is a degree of variation in which a questionnaire is used based on practice setting and GOLD familiarity. The mMRC Scale has higher levels of adoption among clinicians practicing in academic settings, as well as those who are very familiar with GOLD 2017; the Clinical COPD Assessment (CCQ) has much stronger uptake among community-based practitioners. (Appendix, Table 4)

Assessment of inhaler technique is suboptimal, regardless of practice setting.

Most respondents (89%) report that their practice has on-site staff resources that provide assessment and education related to inhaler device technique. Frequency of technique assessment, however, is suboptimal. Only a third of respondents (36%) say that technique assessment is a routine component of every COPD patient encounter. Respondents who are very familiar with GOLD 2017 are more likely to assess at every visit (44%) compared with those who are less familiar (29%); however, the difference was not statistically significant. There are no statistically significant differences in frequency of device technique assessment between pulmonologists practicing in academic vs community-based settings. (Appendix, Table 4)

Utilization of health communications technology is low, regardless of practice setting.

Pulmonologists have yet to fully leverage the monitoring, intervention, and educational potential of emerging health communications technology. Less than a third (29%) are currently using some form of digital health platform (EMR, telehealth) to manage patients with COPD. Pulmonologists in academic centers are significantly more likely to use a digital health platform to manage patients with COPD, though the percentage is still low (44%). (Appendix, Table 4)

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COPD EXACERBATION

Pulmonologists have not adopted a single definition of exacerbation.

Respondents express variability in how they define a COPD exacerbation. Fewer than half (43%) say that "sustained increase in symptoms beyond the normal day-to-day variation" is the best representation of a COPD exacerbation. Respondents are significantly more likely to rely upon this definition if they are very familiar with GOLD 2017 (55%) compared with those who are less familiar with it (31%). Slightly more than half (52%) point to definitions that are based on medication and utilization indicators (use of antibiotics/oral corticosteroids or unscheduled office and ED/inpatient encounters). (Appendix, Table 5)

Most pulmonologists identify high-risk patients based on past history of exacerbation.

Past history of exacerbation (74%) is the most commonly cited factor in identifying patients who are at highest risk for future exacerbation. Respondents are considerably less likely to cite symptom burden (17%) and spirometry stage (9%) as factors that classify a patient as high risk. Symptoms, use of rescue medications, and hospitalization are most likely to be identified as indicators that a patient is experiencing an episode of COPD exacerbation. (Appendix, Table 6)

Medication compliance and device technique are in the mix as far as being a trigger for exacerbation, though these issues are only mentioned with regard to a portion of patients with COPD. (Appendix, Table 6)

Pulmonologists rely upon inhaler and medication use to assess exacerbation risk.

Frequency of emergency inhaler use (82%), frequency of prescribing oral corticosteroids (52%), frequency of having to reassess medication (49%), and assessing individual triggers (44%) are the approaches that respondents say they use during every visit to assess exacerbation risk. Spirometry (11%) is mentioned much less frequently as a tool used during every visit to assess exacerbation risk. Respondents who are very familiar with GOLD 2017 are more likely to be using these prevention assessment approaches. (Appendix, Table 7)

PREVENTING EXACERBATION

Most pulmonologists do not develop an action plan to monitor patients at risk for exacerbation.

Only 16% of respondents say they develop action plans for all of their at-risk patients with COPD. Clinicians with high familiarity with GOLD 2017 are more likely to utilize this approach. Action plans (60%), patient diaries (30%), and use of peak flow meters (24%) are the approaches most frequently identified for monitoring exacerbation risk. (Appendix, Table 7)

Serum biomarkers are not routinely assessed in patients with COPD exacerbation.

Few clinicians, at this point, report using serum biomarkers in the workup of patients with COPD exacerbation. Reporting use is higher among pulmonologists practicing in academic settings; however, even half (49%) of these clinicians rarely or never do this type of workup. (Appendix, Table 7)

Clinic protocols for reducing exacerbation risk.

Vaccination, smoking cessation counseling, and assessing need for long-term oxygen therapy are the clinical practice approaches most frequently engaged in to reduce exacerbation risk. While all pulmonologists in academic settings counsel on smoking cessation, it is not 100% in community settings (92%), and significantly more academic pulmonologists (46%) recommend pulmonary rehabilitation compared with those in community settings (23%). (Appendix, Table 8)

Practice setting and familiarity with GOLD 2017 recommendations influence medication management for patients at high risk of exacerbation (GOLD D).

Physicians in community settings (59% vs 32%) and those who are very familiar with GOLD 2017 (63% vs 40%) are much more likely to prescribe LAMA + LABA for stable, exacerbation risk patients. For patients who are experiencing exacerbation, adding inhaled corticosteroids (ICS) to the LAMA + LABA regimen is the most common approach (50%), followed by roflumilast (16%) or azithromycin (14%). Respondents (47%)—especially those in academic settings (63%)—are likely to say they will add ICS to their patients' prescription regimen for any patient they considered to be at risk of exacerbation. (Appendix, Table 9)

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TREATMENT OF EXACERBATION

Most patients experiencing acute exacerbation are managed by community-based pulmonologists in clinic or office settings.

Most pulmonologists (67%), particularly community-based pulmonologists (72%), indicate that the majority of their patients experiencing acute exacerbation are cared for in a clinic or office setting. Most (78%) also indicate that their patients are under the care of a pulmonologist when being treated for this episode. (Appendix, Table 10)

Most pulmonologists use steroid and antibiotic therapy for patients experiencing COPD exacerbation.

Use of systemic steroids for treating patients who are experiencing exacerbation is the standard, with most pulmonologists (65%) indicating that they typically prescribe a 5-day course at 40 mg daily (66%). New variations in this approach are observed by practice setting or familiarity with GOLD 2017. A majority of pulmonologists (63%) report that they prescribe antibiotics for most of their patients who are experiencing an acute COPD exacerbation. Patients with a fever (100%) or with an abnormal chest exam (83%) are most likely to be prescribed antibiotics. (Appendix, Table 11)

Patients who are hospitalized for acute exacerbations may experience multiple changes in medication regimens.

Pulmonologists (25%) play a less significant role when their patients have been hospitalized for exacerbation and indicate that a hospitalist is most likely to be making decisions about medication during the inpatient phase (50%). Most pulmonologists indicate, however, that their patients' maintenance medication program is likely to be maintained while in hospital. Upon discharge, hospitals (65%) are most likely to be determining the patient's maintenance medication. (Appendix, Table 10)

Only a fourth of respondents (23%) say that the maintenance medication plan provided at discharge will be changed when they see the patient again in their office. Community-based pulmonologists (28%) are much more likely to change the medication plan in comparison to their colleagues who practice in academic-based settings. (Appendix, Table 10)

TREATMENT OF EXACERBATION
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Cost-related barriers and prevention of COPD

Respondents indicate that drug cost issues, eg, formulary restrictions and out-of-pocket expenses, are factors that contribute to suboptimal treatment of significant portions of their patients with COPD. Nearly half (40%) say that cost issues contribute to suboptimal treatment in most of their patients with COPD; an additional 46% say that cost impacts at least some of their patients. (Appendix, Table 12)

DISCUSSION

The GOLD 2017 update provides a framework of assessment and management that, if applied, can align practices to reduce the risk of exacerbation and potentially improve hospitalization and readmission rates in patients with COPD. This survey sought to better understand pulmonologist knowledge and behaviors that impact the prevention of COPD exacerbations and the extent to which they align with the GOLD 2017 recommendations.

Community pulmonologists care for a significant number of patients with COPD and exacerbation.

Overall, community pulmonologists shoulder a significant share of the care of patients with COPD, including those at risk for exacerbations and those being treated for exacerbations. While there is significant focus on care management of patients with COPD who have been hospitalized due to exacerbation, it is important to recognize that most respondents indicate that the majority of patients experiencing exacerbation are being treated in clinic settings. This is especially true among community-based pulmonologists.

Relative to pulmonologists who practice in the community setting, the survey found that:

- Pulmonologists in the community setting care for a significant number of patients with COPD. The majority (87%) see more than 10 patients per week, and almost half see more than 20 patients per week. Compared with their academic peers, more than twice as many see 20 or more patients per week.

- Community-based practitioners are also shouldering a significant caseload of patients who are at high risk of exacerbation. More than 50% of patients are categorized as GOLD spirometry stage 3 or 4 or GOLD grade C or D.

- The majority of patients experiencing exacerbations are treated in the clinic vs being hospitalized.

DISCUSSION

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Because so many patients receive care in community settings, it is important to ensure that these physicians (a) understand criteria for addressing treatment based on risk status and changes in risk status; and (b) have the knowledge and skills necessary to implement recommended monitoring, risk assessment, and prevention strategies.

There is not a consensus on the definition of COPD exacerbation.

Pulmonologists have not strongly coalesced around a single definition of COPD "exacerbation" and use a variety of criteria to identify exacerbations.

The 2017 GOLD update definition of exacerbation has been simplified, highlighting the importance of respiratory symptoms and disease development.[6] Per GOLD 2017, an exacerbation is defined as, "An acute event characterized by a worsening of the patient's respiratory symptoms that is beyond normal day-to-day variations and leads to a change in medication." This generally includes an acute change in one or more of the following cardinal symptoms: cough increases in frequency and severity, sputum production increases in volume and/or changes character, and dyspnea increases.

Respondents who are familiar with GOLD 2017 recommendations are more likely to apply a consistent definition of exacerbation. Many, however, continue to rely upon specific episodes, such as symptoms requiring change in medication, and/or administration of antibiotics/oral corticosteroids, or events, such as hospitalization, to identify exacerbations. "The choice of definition can significantly affect study outcomes, with varying criteria likely to result in different levels of demonstrated treatment success."[7]

Use of serum biomarkers to diagnose exacerbation is in its infancy, with clinicians indicating that these are used only on some patients. Again, uptake among pulmonologists practicing in academic settings is no further along than among community-based providers.

DISCUSSION

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COPD exacerbation assessment and management practices may be influenced by familiarity with GOLD 2017.

While practices were not significantly different between pulmonologists practicing in community and academic settings, there were some differences when comparing groups based upon familiarity with GOLD 2017 guidelines. Pulmonologists who are familiar with GOLD 2017 are more likely to: (a) rely upon a consistent definition of exacerbation; (b) use questionnaires as part of their assessment; (c) routinely assess risk of exacerbation among their patients.

- A significant percentage of pulmonologists have not adopted GOLD 2017 criteria for assessment/grading or treatment strategies, regardless of practice setting.

- Only half of pulmonologists who were treating COPD and COPD exacerbations say they are very familiar with the ABCD tool that assesses COPD symptom burden and guides pharmacologic treatment.

- Spirometry practices for diagnosis and assessment are similar regardless of familiarity with GOLD 2017.

- Most pulmonologists identify high-risk patients based on past history of exacerbation.

- Use of questionnaires to assess COPD symptoms is sporadic but higher when pulmonologists are familiar with GOLD 2017.

- Most pulmonologists do not develop an action plan to monitor patients at risk for exacerbation.

- Assessment of inhaler technique is suboptimal, regardless of practice setting.

- Practice setting and familiarity with GOLD 2017 recommendations influence medication management for patients at high risk of exacerbation (GOLD D).

- Vaccination, smoking cessation counseling, and assessing need for long-term oxygen therapy are the clinical practice approaches most frequently engaged in to reduce exacerbation risk, which align with the GOLD 2017 recommendations.

- Most pulmonologists use steroid and antibiotic therapy for patients experiencing COPD exacerbation.

DISCUSSION

CONTINUED

- Serum biomarkers are not routinely assessed in patients with COPD exacerbation.

- Utilization of health communications technology is low, regardless of practice setting.

GOLD 2017 requires spirometry to make a diagnosis of COPD, and it is described as "a fundamental tool for evaluating prognosis, disease progression, and nonpharmacologic treatment." However, unlike the previous version, spirometry is no longer included in the ABCD tool that is now centered exclusively on respiratory symptoms and history of exacerbation.[6] The survey results suggest that spirometry assessment in both academic and community settings is not performed to the extent suggested in GOLD 2017.

In GOLD 2017, ABCD categories should now be assigned based on respiratory symptoms and each patient's individual history of exacerbations. In terms of patient evaluation under the revised GOLD guidelines, a patient with COPD would undergo spirometry to determine the severity of airflow limitation (GOLD 1 to 4), then assessment of dyspnea using either a comprehensive assessment tool such as the COPD Assessment Test (CAT™) and the COPD Control Questionnaire (the CCQ).[5] Respondents in all settings are more likely to use the CAT, followed by the mMRC. Community-based practitioners were more likely to utilize the CCQ, while academic or GOLD-familiar respondents were more likely to use the British Medical Research Council questionnaire (mMRC). In previous versions of GOLD, the mMRC was considered adequate to evaluate breathlessness; however, the revised GOLD 2017 recommendations note "COPD poses symptomatic burdens beyond breathlessness," and suggest the CAT or CCQ, which measure disease-specific health status.[5]

Symptom assessment and exacerbation history are then used to categorize patients into four progressively more symptomatic groups (A through D) for treating stable COPD. As COPD becomes more severe, recommended treatments range from simple short-acting inhaled bronchodilators (for some group A patients) to combinations of two or three inhaled bronchodilators.[5] The findings that only half of pulmonologists who treat COPD and COPD exacerbations are very familiar with the ABCD tool and only a third use it, suggest that pulmonologists are using other criteria or tools, or perhaps they are not using anything. Follow-up surveys might explore if institutional protocols are in place, what tools they are using, how they recognize when a patient is moving into a higher risk group, and how and when they decide to move to a new treatment regimen.

TREATMENT AND SIDE EFFECTS

GOLD 2017 emphasizes the importance of proper assessment of inhaler technique; assessment of technique is recommended before concluding that a given bronchodilator therapy is insufficient and dose escalation is required. Additionally, GOLD 2017 recommends rechecking inhaler technique at each visit.[5] While most respondents have the resources to provide assessment and education related to inhaler device technique, only about a third of respondents routinely assess technique for every COPD patient encounter. Poor inhalation techniques are associated with decreased medication delivery and poor disease control in COPD.[8]

GOLD 2017 proposes a framework for the initiation, and subsequent escalation and/or de-escalation, of pharmacologic management of COPD according to the individualized assessment of symptoms and exacerbation risk.[5] GOLD 2017 recognizes the limitations of current evidence, especially relative to escalation and de-escalation. Key updates include:

- SABA/SAMA combination therapy seems to be superior to either SABA or SAMA alone.

- Patients in group A (milder symptoms, low exacerbation risk) may be initiated on either short- or long-acting bronchodilator therapy.

- Patients in group B (milder symptoms, increased exacerbation risk) should be initiated on LAMA monotherapy.

- LABA/LAMA combination therapy seems to be superior to LABA/ICS combination therapy and should be used when long-acting bronchodilator monotherapy fails to control symptoms or reduce exacerbations.

Only a minority of respondents (12%) follow GOLD treatment strategies for all of their patients. Physicians in academic settings and those who are very familiar with GOLD 2017 are much more likely to prescribe LAMA + LABA for stable, exacerbation risk patients. Respondents in all settings are likely to add ICS to their patients' prescription regimen for any patient they consider to be at risk of exacerbation, though this is more common in academic settings.

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TREATMENT AND SIDE EFFECTS
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The goal for treatment of COPD exacerbations is to minimize the negative impact of the current exacerbation and to prevent subsequent events. [GOLD 2017] With respect to managing exacerbations, key points in GOLD 2017 include:

- Short-acting inhaled beta$_2$-agonists, with or without short-acting anticholinergics, are recommended as the initial bronchodilators to treat an acute exacerbation.

- Maintenance therapy with long-acting bronchodilators should be initiated as soon as possible before hospital discharge.

- Systemic corticosteroids can improve lung function, oxygenation, and shorten recovery time and hospitalization duration. Duration of therapy should not be more than 5 to 7 days.

- Antibiotics, when indicated, can shorten recovery time, reduce the risk of early relapse, treatment failure, and hospitalization duration. Duration of therapy should be 5 to 7 days.

- Following an exacerbation, appropriate measures for exacerbation prevention should be initiated.

GOLD 2017 notes that more than 80% of exacerbations are managed in an outpatient setting using bronchodilators, corticosteroids, and antibiotics. [GOLD 2017] The findings in this survey also reflect that extent to which exacerbations are managed in the community setting. In patients who are experiencing an exacerbation, half of respondents will add an ICS to a LAMA+LABA regimen.

Multiple changes in medication regimens are common among patients hospitalized for acute exacerbations.

According to respondents, changes in medication regimens are commonplace when a patient is hospitalized for COPD exacerbation. While the patient's pulmonologist (or a colleague) may play a role in determining medication, more often, hospitalists are likely to be making these determinations, including the maintenance medication plan that the patient takes with them when they are discharged from the hospital. Further, in about a third of cases, the patient's pulmonologist changes the medication plan provided at discharge. Frequent changes in medication can be challenging, as each change may mean additional technique training and device or medication education.

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Key Takeaways

■ Community pulmonologists manage a significant number of patients at risk of or experiencing exacerbations.

　◆ Education and adoption of GOLD 2017 recommendations in this setting have the potential to impact a significant number of patients.

■ There is not a consensus on the definition of "exacerbation," and criteria for defining it differ.

　◆ Updated GOLD assessment and treatment recommendations rely upon a definition of exacerbation that, if adopted, would bring practices in all settings into alignment with current standards of care.

■ Practice patterns differ relative to familiarity with GOLD 2017 guideline recommendations, rather than practice setting.

　◆ Familiarity with GOLD 2017 recommendations influences assessment and management strategies in all settings.

■ Academic physicians are not practicing at a more advanced level than community-based pulmonologists with respect to COPD exacerbation.

　◆ Education relating to GOLD 2017 recommendations is needed in both academic and community settings.

■ Medication regimens are frequently changed in patients who are hospitalized for acute exacerbations.

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APPENDIX

Table 1. COPD Patient Classifications (%)

	Total
GOLD Spirometry Stage (Q9):	
1 (FEV$_1$ >80% predicted)	11
2 (FEV$_1$ 50-80% predicted)	36
3 (FEV$_1$ 30-49% predicted)	33
4 (FEV$_1$ <30% predicted)	20
GOLD Grade(Q10):	
A	14
B	27
C	32
D	27

Table 2. Familiarity and Use of GOLD 2017 (%)

		Practice Setting		GOLD Familiarity	
	Total	Academic	Community	Very	Some/Not
Familiarity with GOLD 2017 (Q7)					
Very familiar	49	56	46	100	--
Somewhat familiar	49	43	51	--	96
Not familiar	2	2	3	--	4
Frequency of following GOLD 2017 for assessing/grading of COPD (Q8)					
On all patients	34	42	32	**53**	**16**
On some patients	41	37	42	34	48
Occasionally	14	15	13	8	19
Rarely/Never	11	7	13	**5**	**17**
Frequency of following GOLD 2017 for treating COPD (Q25)					
On all patients	12	17	10	**22**	**3**
On some patients	62	68	59	61	62
Occasionally/rarely	21	**15**	**31**	**17**	**35**
Rarely/Never	6	4	5		

Highlighted data signify statistical difference.

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APPENDIX

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Table 3. Approaches to Confirming COPD Diagnosis (%)			
		Practice Setting	
	Total	Academic	Community
Approaches used to confirm diagnosis (Q4)			
Presence of airway obstruction/ spirometry	100	100	100
Presence of symptoms: cough, dyspnea, exercise intolerance	95	87	97
Smoking history	84	83	85
Exposure to pollutants	72	52	79
Frequency of spirometry (Q5)			
Once a year	49	49	49
Once at the time of diagnosis	20	19	21
Ever clinic visit/6 months	20	13	23
Every 6 months	9	5	10
Depending on symptoms or change in Rx	10	16	8

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APPENDIX

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Table 4. Presence of Tools and Resources for Managing Patients With COPD (%)					
			Practice Setting	GOLD Familiarity	
	Total	Academic	Community	Very	Some/Not
Frequency of using COPD questionnaires to assess symptoms (Q11)					
On every patient	14	10	15	11	16
On most patients	11	19	8	16	6
On some patients	18	24	15	20	15
Rarely	38	27	44	41	37
Never	19	21	18	11	26
Questionnaire most frequently used (Q12)					
COPD Assessment Test (CAT)	40	39	40	31	50
mMRC Dyspnea Scale	33	58	20	45	19
Clinical COPD Assessment (CCQ)	22	--	33	24	19
Our own questionnaire	5	3	7	--	12
Staff on site for device technique education (Q13)					
Yes	89	87	90	92	87
No	11	13	10	8	13
Frequency of assessing device technique (Q15)					
Once, at the time of diagnosis	11	13	10	6	16
Once each year	13	6	15	7	19
Only when the patient changes medication	33	38	31	36	29
At every visit	36	30	38	44	29
Rarely/never assess technique	7	13	5	7	7
Use digital health platform to manage COPD patients (Q16)					
Yes	29	44	23	38	20
Don't currently use but are evaluating	41	29	46	33	49
Don't currently use and not planning to	30	27	31	29	30

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Table 5. Q18 Core Definition of COPD Exacerbation (%)			
		GOLD Familiarity	
	Total	Academic	Community
Sustained increase in symptoms beyond the normal day-to-day variation	43	**55**	**31**
Increase in symptoms of COPD that require a change in medication	5	4	7
Increase in symptoms of COPD that require either antibiotics or oral corticosteroids	30	22	38
Increase in COPD symptoms that result in an un-scheduled office/ER visit or hospitalization	22	20	24

Highlighted data signify statistical difference.

Table 6. Identifying At-Risk Populations and COPD Triggers (%)			
		GOLD Familiarity	
	Total	Academic	Community
Patient population at highest risk for COPD exacerbation (Q24)			
Patients with a past history of exacerbation	74	65	82
Patients with a high symptom burden (mMRC >2 or CAT >10)	17	22	13
Patients with an FEV_1 <50% predicted	9	13	4
Principal indicators that patient is having a COPD exacerbation (Q23)			
Worsening respiratory symptoms	94	96	91
Increased use of rescue medications	87	93	81
ED visit or hospitalization due to breathing problems	83	81	78
Deterioration of lung function	55	54	53
Frequency with which poor compliance with maintenance medication or suboptimal use of inhaler device triggers exacerbation (Q22)			
All the time	--	--	--
Some of the time	76	83	70
Rarely/never	24	17	30

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Table 7. Measures Taken to Monitor and Assess Risk of COPD Exacerbation (%)					
			Practice Setting		GOLD Familiarity	
	Total	Academic	Community	Very	Some/Not
Frequency of serum biomarker use in workup of patients with COPD exacerbation (Q6)					
All the time	1	**5**	**--**	1	2
Some of the time	39	46	36	33	44
Rarely	41	**27**	**46**	48	34
Never	19	22	18	18	20

Approaches used to monitor COPD exacerbation risk (Q29)					
Action plan	60	60	61	66	55
Patient diary	30	32	29	34	25
Peak flow meter	24	25	24	27	21
Same day clinic appointment or telephone outreach	9	4	11	5	13
Mandatory education/ pulmonary rehabilitation	4	2	5	1	8
Telehealth or video visit	4	14	--	6	2

Frequency administering an action plan for patients at risk of COPD exacerbation (Q31)					
All the time	21	16	23	**29**	**13**
Some of the time	62	62	62	**53**	**70**
Rarely	14	17	13	17	12
Never	3	5	3	1	5

Frequency of using the following approach for assessing COPD exacerbation risk (Q30) (% who engage in activity during every visit)					
Spirometry	11	13	10	**17**	**5**
Assessing frequency of emergency inhaler use	82	75	85	82	81
Assessing frequency of prescribing oral corticosteroids	52	67	46	**59**	**45**
Assessing individual triggers	44	51	41	**55**	**33**
Frequency of having to reassess its medication	49	51	49	**58**	**41**
Don't currently use and not planning to	30	27	31	29	30

Highlighted data signify statistical difference.

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Table 8. Frequency of Engaging in Practices in Clinic to Reduce Risk of COPD Exacerbation (%)			
		Practice Setting	
	Total	Academic	Community
Frequency of using the following approach for assessing COPD exacerbation risk (Q33) (% who engage in activity during every visit)			
Counseling on smoking cessation	94	100	92
Administer influenza vaccine	91	95	90
Administer pneumococcal vaccine	86	90	85
Assess need for long-term oxygen therapy	73	68	74
Recommend pulmonary rehabilitation	30	46	23
Screen patients for depression and anxiety	18	19	18
Screen patients for CV	10	16	8
Screen patients for osteoporosis	10	16	8
Order a sleep assessment	10	11	10
Use noninvasive ventilation for chronic, stable COPD patients	4	6	3

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Table 9. Approach to Medication for Patients at High Risk (GOLD D) of COPD Exacerbation (%)

		Practice Setting		GOLD Familiarity	
	Total	Academic	Community	Very	Some/Not
Initial medication approach for GOLD D patients (not experiencing exacerbations) (Q34)					
Long-lasting anticholinergic (LAMA)	16	25	13	16	17
LAMA + LABA	51	**32**	**59**	**63**	**40**
LABA AND ICS	12	11	13	**3**	**21**
LAMA + LABA + ICS	20	**32**	**15**	19	21
Medication approach for GOLD D patients who are experiencing exacerbations (Q35)					
Long-lasting anticholinergic (LAMA)	2	--	3	4	2
Long-acting beta2-agonist (LABA)	--	2	--	1	--
LAMA + LABA	10	8	10	8	11
LABA AND ICS	8	8	8	9	6
LAMA + LABA + ICS	50	48	51	42	58
Roflumilast	16	24	13	19	13
Azithromycin	14	11	15	17	12
Frequency of prescribing antibiotics and oral steroid courses for patients to keep and use at the onset of an acute reservation (Q32)					
I do this with all my COPD patients	5	10	3	3	6
I do this for only those patients I consider to be at high risk of exacerbation	86	83	87	92	80
I rarely, if ever, do this	10	8	10	6	13
Factors determining prescription of ICS–containing regimen in patients at high risk of COPD exacerbation (Q36)					
Prescribe for all patients I consider high risk	47	**63**	**41**	**37**	**57**
Reversibility of airway obstruction at baseline	32	**14**	**38**	31	32
History of asthma	10	16	8	14	6
High baseline blood eosinophils	9	6	10	**14**	**4**

Highlighted data signify statistical difference.

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Table 10. Treating Acute COPD Exacerbation (%)

	Total	Practice Setting	
		Academic	Community
Most common site of care for treatment of COPD patients experiencing acute exacerbation (Q19)			
Clinic/office	67	56	72
Inpatient setting	15	22	13
ED	8	10	8
PCP/Urgent care setting	9	13	8
Type of clinician most likely to treat your patients when experiencing acute exacerbation (Q20)			
You/a pulmonologist	78	**67**	**82**
PCP	9	11	8
Hospitalist	8	14	5
ED physician	9	11	8
Clinician responsible for prescribing medication when patient is admitted to hospital with acute exacerbation (Q39)			
Patient's regular pulmonologist	25	**14**	**28**
Hospitalist	50	59	46
Pulmonologist on call	25	27	23
Clinician responsible for prescribing medication upon discharge (Q40)			
Patient's regular pulmonologist	31	**19**	**36**
Hospitalist	65	73	59
Pulmonologist on call	4	8	6
Likelihood that patient remains on maintenance medication regimen while being treated as an inpatient (Q42)			
Very likely	34	35	33
Somewhat likely	48	41	51
Not very likely	15	22	13
All maintenance medications are stopped	2	2	3
Likelihood that patient's maintenance medication will be changed when they are discharged (Q43)			
Very likely	23	**8**	**28**
Somewhat likely	39	40	38
Not very likely	38	52	34
Maintenance of hospital-ordered treatment plan (Q44)			
Maintain the treatment plan ordered in hospital	48	52	46
Devise a new treatment plan for the patient	52	48	54
Reported ALOS of <5 for inpatients with exacerbation (Q45)	79	79	79
% Indicating that all inpatients receive: (Q46)			
Smoking cessation counseling	65	62	67
Education on proper use of inhaler device	33	25	36
Assessment of inhaler device technique	30	22	33

Highlighted data signify statistical difference.

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Table 11. Use of Steroid and Antibiotic Therapy for Treating Acute COPD Exacerbation (%)

		Practice Setting	
	Total	Academic	Community
Prescribe systemic steroids (Q47)	98	100	97
Duration of steroid therapy (Q48)			
3 days	10	2	13
5 days	65	76	61
2 weeks	25	22	26
Steroid dosing (Q49)			
20 mg daily	10	10	11
40 mg daily	66	71	63
50 mg daily	7	6	8
60 mg daily with a slow taper of 10 mg every 3 days	13	13	13
Other	4	--	5
Prescribe antibiotics (Q50)			
On all patients	15	22	13
On most patients	63	54	67
Only on some patients	21	24	21
Patient type most likely to be prescribed antibiotics (Q51)			
Patient with a fever	100	100	100
Patient with an abnormal chest exam	83	73	88
Patient with no history of URTI	17	--	25

Table 12. (Q27) Prevalence of Cost-Related Barriers to Optimal COPD Management and Prevention of Exacerbation (%)

		Practice Setting	
	Total	Academic	Community
Cost factors contribute to suboptimal treatment on all of my patients	7	6	8
Cost factors contribute to suboptimal treatment and most of my patients	40	40	41
Cost factors contribute to suboptimal treatment on only some of my patients	46	48	44
Cost factors rarely, if ever, contribute to suboptimal treatment for my patients	7	6	8

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