Original Research

Trends in the Use of Triple Therapy in Patients With COPD in the United States, 2019 to 2022

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Running Head: **Trends in U.S. COPD Triple Therapy Use, 2019–2022**

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Abbreviations**:**

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ABSTRACT

Rationale: Inhaled triple therapy (TT) combining a long-acting beta-agonist, long-acting muscarinic antagonist, and inhaled corticosteroid is recommended for COPD patients with frequent exacerbations. Despite guideline criteria, TT is often initiated in patients unlikely to benefit.

Objectives: To characterize trends in the use of TT among COPD patients and concordance with guideline recommendations.

Methods: This observational study used de-identified commercial and Medicare Advantage Part D claims from the Optum Research Database (2018–2022). Patients ≥40 years old with COPD who initiated TT between 2019 and 2022 were included. Baseline characteristics, prior respiratory medication use, and exacerbation history during the 12-month period before TT initiation (index date) were summarized overall and stratified by calendar year and TT type (single-inhaler TT [SITT] vs multiple-inhaler TT [MITT]). A subgroup analysis evaluated maintenance-naive initiators, defined as no maintenance inhaler use in the prior 12 months.

Results: A total of 60,169 patients initiating TT were included. The proportion using SITT increased steadily from 53.0% in 2019 to 79.3% in 2022. Most patients (61.9%) had a low exacerbation history consistent with GOLD group A/B, increasing from 53.0% to 66.0% over the study period. Approximately 40% had zero exacerbations in the previous 12 months. One-third of initiators were maintenance-naive. SITT use was associated with significantly higher odds of guideline-discordant initiation relative to MITT (adjusted OR 5.04; 95% CI: 4.76–5.33).

Conclusions:
TT initiation discordant with GOLD recommendations has increased in the United States, coinciding with an increase in the use of SITT over the corresponding period.

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INTRODUCTION:

Chronic obstructive pulmonary disease (COPD) ranks as the third leading cause of death globally, responsible for 3.3 million fatalities in 2019.[1] COPD places a substantial economic burden on both patients and the healthcare system.[2] Exacerbations significantly contribute to this economic burden, accounting for an estimated 50%–75% of COPD-related healthcare costs.[3] In the United States, the total direct costs of COPD are anticipated to reach $40 billion annually until 2038.[4,5]

Evidence-based recommendations for the treatment of COPD have been provided by the Global Initiative for Chronic Obstructive Lung Disease (GOLD) report, which undergoes periodic updates to ensure alignment with the latest research and evidence-based clinical practice.[6,7] The 2017 GOLD report, the 4th major revision, included recommendations for the pharmacological management of COPD according to individualized assessment of symptoms and exacerbation risk. Bronchodilators were recommended as initial maintenance therapy across GOLD groups, with long-acting bronchodilators preferred over short-acting, except for patients with only occasional dyspnea (GOLD Group A). Dual therapy with long-acting muscarinic antagonist (LAMA) plus long-acting beta-agonist (LABA) was the recommended initial treatment for symptomatic patients with a history of exacerbations (GOLD Group D). Triple therapy (TT) with LAMA/LABA/inhaled corticosteroid (ICS) was not recommended as initial therapy, but only as an escalation from dual therapy.

Although specific treatment algorithms have changed over time, GOLD has consistently recommended TT be reserved for patients with continued exacerbations while on dual therapy. The 5th major revision of GOLD, introduced in 2023, added consideration of TT as initial treatment only for GOLD Group E (≥2 moderate or ≥1 severe exacerbation leading to hospitalization in the past year) patients with elevated blood eosinophils (≥300 cells/μL). [8,9] Similarly, the 2020 American Thoracic Society Clinical Practice Guideline provides a conditional recommendation for the use of TT in patients with dyspnea or exercise intolerance on LAMA/LABA and one or more exacerbations in the past year.[10]

Prior to the availability of single-inhaler TT (SITT), multiple inhalers were required for TT regimens, often with different devices and varying frequency of use. Although effective for lowering exacerbation frequency in certain populations, the ICS component of TT use has been associated with a higher risk of pneumonia and other ICS-related adverse effects relative to long-acting bronchodilator therapy, suggesting a need to limit use to those patients with a high likelihood of benefit.[11] The approval of single-inhaler fluticasone furoate/umeclidinium/vilanterol (FF/UMEC/VI) in September 2017 and budesonide/glycopyrrolate/formoterol fumarate (BGF) in July 2020 provided more convenient options for COPD patients using TT.[12,13]

Despite evidence-based treatment recommendations, real-world studies have found that patients with lesser disease burden are being prescribed TT.[2,14,15] We hypothesized that use of TT discordant with GOLD recommendations would increase following the availability of SITT and its increasing market uptake. Therefore, we aimed to characterize annual trends in the use of TT among patients with COPD.

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METHODS:

Data source and study design

This was a non-interventional study of commercial and Medicare Advantage Part D health plan members using existing de-identified administrative claims data for the period of 01 January 2018 through 31 December 2022 (study period) from the Optum Research Database (ORD). The ORD is a fully de-identified database, which includes medical and pharmacy claims from 1993 to present with linked enrollment information for more than 73 million commercial and Medicare Advantage health plan members.

Study Population

To be included in the study, subjects were required to have initiated multiple-inhaler TT (MITT) or SITT during the identification period (01 January 2019 through 31 December 22). MITT was defined as patients having ≥30 consecutive days of overlapping coverage for ICS + LAMA + LABA based on pharmacy claims, permitting up to a 7-day gap between refills for any of the three medications during the overlap period. The index date was defined as the first date with all three TT components on hand during the identification period. For SITT, the index date was defined as the date of the first pharmacy fill for FF/UMEC/VI or BGF during the identification period. Additionally, subjects had to be ≥ 40 years of age in the index year, continuously insured with both medical and pharmacy coverage for 364 days prior to the index date (baseline period), and have at least one medical claim with a diagnosis code for COPD (identified using ICD-10-CM diagnosis codes **[Supplemental Table S1]**) in any position prior to the index date.

Subjects having ≥2 medical claims on separate dates of service with diagnosis code (for the same condition) for asthma, cystic fibrosis, interstitial lung disease, or lung cancer in any position on non-diagnostic claims during the study period, ≥ 7 days of TT use during the 364 days prior to the index date, and/or missing demographic variables were excluded.

Study variables

Demographic characteristics consisted of age as defined at index year, gender, race, ethnicity, insurance and plan type, and geographic region. The Charlson Comorbidity Index was calculated based on the presence of diagnosis codes (any position) on medical claims during the baseline period[16,17] and indicates the cumulative likelihood of one-year mortality while serving as a proxy for burden of comorbidity. TT initiation type (SITT/MITT) was based on pharmacy claims.

Exacerbations were identified based on COPD-related utilization and categorized as moderate or severe. A severe exacerbation was defined by an inpatient admission or an emergency department visit with a COPD diagnosis code in the primary position or with an acute respiratory failure diagnosis in the primary position with a non-primary COPD diagnosis; moderate exacerbation was defined by a pharmacy claim for a COPD-guideline recommended antibiotic and/or a pharmacy claim for an oral corticosteroid within ±7 days of an office visit with a COPD diagnosis in any position on a medical claim.

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Symptom scales used to differentiate GOLD groups A vs B and C vs D (COPD Assessment Test [CAT] and modified Medical Research Council dyspnea questionnaire [mMRC]) were not available in the data source. For this reason, patients were classified as GOLD A/B (no baseline exacerbation or 1 baseline moderate exacerbation not leading to hospitalization) or GOLD E (≥ 2 baseline moderate exacerbations and/or ≥ 1 leading to hospitalization) using a 12-month baseline period before index date. Although the GOLD E designation was not an official category during the study period, the terminology was used instead of GOLD C/D for contemporary relevance to identify patients with high exacerbation risk, consistent with the GOLD 2023 framework.

Baseline medication utilization variables were created for respiratory medication classes and selected individual respiratory medications based on both pharmacy and medical claims (nebulizer treatments may appear in medical claims). Patients with no evidence of an ICS, LAMA, or LABA (maintenance medication) in any combination prior to initiating TT were classified as maintenance-naive. Evidence of tobacco use, lung volume reduction procedure, oxygen therapy, spirometry testing, nebulized medication delivery, provider specialty, emergency department (ED) visits, hospitalization, and blood eosinophil count (BEC) were also assessed. Eosinophil test results closest to the index date during the 6 months prior to index date (i.e., with the smallest absolute difference in days between the lab date and the index date) were captured. For multiple eosinophil laboratory results on the same date of service, the highest value was retained.

GOLD discordance was defined according to the pharmacological treatment algorithms from the relevant GOLD reports (2017-2019) at the time of the study period. TT was not recommended as initial treatment at the time; therefore, we considered maintenance naive patients to be GOLD-discordant. We also examined the subgroup of maintenance naive TT initiators with GOLD A/B exacerbation history for interpretation in the context of the 2023 GOLD report, which suggested consideration of TT as initial treatment in GOLD E patients with BEC ≥300 cells/µL.

Analysis

Study measures were presented for the overall population, as well as stratified by year of index date, index TT type, and for the subgroup of maintenance-naive individuals.

A multivariable logistic regression model was used to assess the association between index TT type (SITT vs. MITT) and use of TT in maintenance-naive patients with GOLD A/B exacerbation history (i.e. patients least appropriate for TT use). The model was adjusted for age group, gender, geographic region, insurance type, season, baseline Charlson Comorbidity Index, allergic rhinitis, dyspnea, pneumonia or acute bronchitis/bronchiolitis, and index provider specialty. This model was replicated in the subgroup of patients with an available BEC, additionally incorporating BEC results.

RESULTS:

Patient Characteristics

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Overall, 60,169 patients with COPD initiating TT between 01 January 2019 and 31 December 2022 were included in the final study sample **(see Supplemental Figure S1 for patient selection and subgroups**). The number of TT initiators increased each calendar year, except for in 2020, when there was a 14.7% decrease from 2019. The mean (SD) age of patients was 70.9 (9.0) years and 51.6% were female. Most patients (87.7%) had Medicare Advantage Part D insurance and over half (52.7%) were from the Southern region of the United States. Non-Hispanic White patients comprised 75.4% of the population and 13.0% of patients were non-Hispanic Black **(Table 1**). Most patients (92.0%) had a baseline diagnosis of metabolic syndrome and a significant proportion of patients had diagnosis of dyspnea (62.4%), diabetes mellitus type II (44.4%), and pneumonia (19.4%) **(Table 1**).

Overall, 67.9% of patients initiated SITT, with 57.6% on FF/UMEC/VI and 10.4% on BGF (**Table 2**). The remaining 32.1% of patients used MITT, primarily LABA/ICS + LAMA. Over time, the proportion of patients initiating SITT increased each year from 53.0% in 2019 to 79.3% in 2022. The specialty prescribing TT was most frequently pulmonology (28%) followed by primary care (25.3%), internal medicine (23.1%), and allied health professionals (22.9%) (**Table 2**).

Baseline respiratory medication use

Over 1/3 of patients (34.1%) did not use any maintenance inhalers in the 12 months prior to starting TT, i.e., maintenance naive (this increased from 26.3% in 2019 to 41.9% in 2022), while 65.9% had prior maintenance treatment (non-maintenance naive) (**Figure 1**). LABA/ICS was the most common maintenance therapy used during the baseline period (35.9%); this decreased from 43.1% in 2019 to 30.5% in 2022. Baseline use of LAMA was 19.8%; this decreased from 27.4% in 2019 to 14.4% in 2022, and baseline use of LAMA/LABA was 18.0%; rates remained relatively stable ranging from 17.6% in 2019 to 16.7% in 2022 **(Table 3)**.

Stratified by index TT type, the proportion of SITT initiators that were maintenance-naive was greater than that of MITT (42.9% vs 15.5%). Baseline use of LABA/ICS and LAMA was less common among SITT users, while a greater proportion of MITT users had baseline LAMA/LABA use (**Table 4**).

Baseline exacerbation history

Among patients initiating TT, 61.9% had a baseline exacerbation history consistent with GOLD group A/B, with an increase from 53.0% in 2019 to 66.0% in 2022. Additionally, 38.2% of patients initiating TT experienced zero exacerbations in the past 12 months, rising from 30.6% in 2019 to 41.3% in 2022. Further, 19.4% were hospitalized for an exacerbation (**Table 3**).

When stratified by index TT type, a greater proportion of SITT initiators had GOLD A/B exacerbation history compared to MITT initiators (65.4% vs 54.6%). Additionally, a lesser proportion of SITT initiators (15.6% vs 27.5%) had at least one baseline exacerbation leading to hospitalization (**Table 4**).

Blood Eosinophil Results

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Baseline BEC results were available for 25.5% of the overall study population. Of those with valid results, 28.5% had BEC ≥300 cells/μL. This decreased over time from 31.2% in 2019 to 26.3% in 2022. Approximately 16% of patients had BEC<100 cells/μL. This increased over time from 12.3% in 2019 to 17.6% in 2022 (**Table 1**).

Maintenance-naive Subgroup

From the overall study population, 20,523 patients comprised the maintenance-naive subgroup. Mean (SD) age was 70.6 (9.1) years and 51.4% were males. Additional demographic characteristics can be found in **Supplemental Table S2**.

A substantial proportion (85.5%) of the maintenance-naive subgroup population used SITT of whom 83.6% were on FF/UMEC/VI and 16.4% were on BGF. The remaining 14.5% used MITT, primarily LABA/ICS + LAMA. Index prescribing specialty was most frequently primary care providers (25.7%), internal medicine (25.2%), and pulmonology (24.7%) (**Supplemental Table S2**).

The majority (68.7%) of the maintenance-naive subgroup had GOLD A/B exacerbation history, while 31.3% had GOLD E exacerbation history (**Figure 1**). When stratified by index TT type, 71.5% of SITT users had GOLD A/B exacerbation history, compared with 52.4% of MITT users (**Supplemental Table S2**).

BEC results were available for 28.3% of the maintenance-naive subgroup. The distribution of BEC results was similar to that of the overall population of TT initiators, with 26.0% having BEC >300 cells/μL, 59.5% with BEC ≥100 - ≤300 cells/μL, and 15.2% with BEC <100 cells/μL (**Supplemental Table S2**).

Multivariable Analyses

Among the overall population of TT initiators, SITT was associated with 5.04 times (95% CI: 4.76-5.33; p<0.001) greater odds of being maintenance-naive with GOLD A/B exacerbation history at treatment initiation, as compared with those receiving MITT in adjusted multivariable logistic regression models (**Supplemental Table S3**).

Among the subgroup of patients with a baseline BEC result, SITT was associated with 4.64 (95% CI: 4.14-5.20; p<0.001) times greater odds of use in maintenance-naive patients with GOLD A/B exacerbation history, compared with MITT (**Supplemental Table S4**).

DISCUSSION:

In this real-world study of patients with COPD initiating TT, we observed an increasing use of SITT and GOLD-discordant treatment. From 2019 to 2022, the prescription of SITT shifted from about 50% to almost 80% of TT initiation. Most patients initiating TT had GOLD A/B exacerbation history and approximately 1/3 did not have evidence of maintenance therapy in the 12 months before TT initiation. At the time of the study period, GOLD did not recommend TT as an initial maintenance treatment. Additionally, 1 in 5 patients starting TT was maintenance-naive

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with GOLD A/B exacerbation history. Notably, this practice of broader use of TT increased over the duration of the study and coincided with increasing use of SITT.

A greater proportion of SITT initiators had GOLD A/B exacerbation history and were maintenance naive compared to MITT. This was most notable for maintenance-naive status, with 42.9% of SITT used as first-line maintenance therapy compared to 15.5% of MITT. Further, SITT initiators were significantly more likely to meet both criteria, even after adjustment for demographic and clinical factors that could impact prescribing decisions. Although there are demonstrable benefits associated with SITT over MITT, our findings also indicate that as the uptake of SITT has increased over time, it is being used more frequently in patients that have a low exacerbation history and lack of prior maintenance therapy use. Previous studies have found 50-80% of COPD patients on TT were found to have guideline-discordant prescribing.[18,19] We cannot, however, ascribe casualty to the association between increasing availability of SITT and the increase in guideline-discordant care. Other factors such as industry promotion, formulary coverage, physician familiarity, and post-COVID prescribing shifts may also explain the observed trend and warrant consideration in future analyses.

The IMPACT and ETHOS randomized controlled trials (RCTs) demonstrated superior efficacy of single-inhaler FF/UMEC/VI and BGF, respectively, compared to dual therapies in patients with COPD and high exacerbation risk. The inclusion criteria for these trials required at least one exacerbation in the prior year and use of maintenance therapy at screening. One study estimated that less than 10% of real-world patients with COPD would be eligible for either trial.[20] Our study suggests that TT is being used beyond the population studied in these trials. Other real-world studies have provided evidence that the efficacy seen in RCTs is not generalizable to the less severe COPD population treated with TT in routine clinical practice. Suissa et al. found that among ICS-naive patients, SITT was not more effective than dual bronchodilators at reducing the incidence of exacerbation, except among patients with multiple exacerbations in the past year. [21]

The GOLD strategy limits initial TT treatment to patients with BEC ≥300 cells/μL; however, post hoc analyses of the IMPACT and ETHOS trials suggest benefits may extend to patients with counts ≥100 cells/μL, with greater benefit observed at higher BEC levels.[22-24] We found that most patients (>70%) receiving TT did not have high eosinophil levels (≥300 cells/μL). Further, about 15% of our subgroup with eosinophil results had BEC <100 cells/μL, a population which is least likely to benefit from TT and may have increased risk of pneumonia. A real-world study comparing SITT with LAMA/LABA found no significant difference in the incidence of moderate or severe COPD exacerbations in patients with BEC ≤300 cells/μL, even among a subset of GOLD E patients.[25] The varying response to ICS reinforces the importance of consideration of BEC when prescribing TT. Systematic reviews indicate that ICS withdrawal from TT to dual bronchodilators generally does not increase exacerbation risk overall (HR ~0.96; 95% CI 0.80–1.15), though patients with BEC ≥300 cells/μL may experience higher risk (HR 1.35; 95% CI 1.00–1.82).[26] In conjunction, persistence and adherence studies strongly favor single-inhaler triple therapy (SITT) over multiple-inhaler regimens, with higher odds of adherence and persistence compared to MITT, and U.S. cohorts reporting 12-month persistence rates of 35.7% versus 13.9%.[27]

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Suboptimal compliance with GOLD treatment recommendations remains problematic, with noncompliance primarily due to overuse of ICS-containing therapies.[28] Use of triple therapy (TT) in populations contrary to recommendations may expose patients to unnecessary ICS-associated risks, such as increased pneumonia events among those with lower BEC.[29] ICS exposure has been shown to increase risk of certain costs and adverse events, including cataracts, pulmonary tuberculosis, diabetes onset and progression, and risk of fractures.[30-33] Low-value ICS has also been associated with increased outpatient healthcare visits and higher associated costs.[34] Compliance with GOLD recommendations has been associated with significant reductions in COPD-related medical costs, particularly, COPD-related inpatient utilization and their costs.[28] It has been also been seen in real-world studies that TT was not more effective compared to dual bronchodilators.[21,35]Although single-inhaler regimens offer convenience for both patients and providers, our findings indicate that the widespread availability of SITT may be contributing to guideline-discordant prescribing. Importantly, single-inhaler formulations of long-acting mono- and dual-bronchodilator therapies are also available, supporting the use of a stepwise treatment approach as recommended by GOLD to minimize inappropriate escalation to triple therapy. Recent evidence on ICS de-escalation strategies and SITT persistence/adherence patterns should be considered to provide a more balanced interpretation of clinical practice trends and inform future guideline implementation efforts. At a health system level, provider education and clinical decision support tools to assist with guideline-recommended prescribing could be implemented. SITT should be initiated mainly in patients with multiple exacerbations while, for most others, dual bronchodilators are just as effective whilst avoiding the excess risk of severe pneumonias.[21]

As patients with severe COPD are associated with the highest clinical and economic burden, benefits in this population are noteworthy.[36] Despite additional updates to COPD management guidelines over the years, efforts to inform prescribers about when to appropriately use TT or consider alternatives have not kept pace, potentially contributing to continued guideline-discordant prescribing.[2] Current recommendations provide ICS withdrawal by de-escalation as an optimized pharmacological therapy for stable COPD patients.[9] De-escalation of ICS can possibly reduce the risk of pneumonia and exacerbations as well as dyspnea.

The 2026 GOLD report introduced a revision to the criteria defining GOLD groups, requiring only one moderate or severe exacerbation in the prior year for GOLD group E.[37] Nealy half of the maintenance naive TT initiators had zero exacerbations in the past year, suggesting substantial GOLD discordance, even when applying this updated criterion. Future research should continue to monitor trends in the use of TT.

The limitations of this study merit careful consideration, particularly in guiding future research directions. First, the presence of a claim for a filled prescription does not indicate that the medication was taken as prescribed. Medications filled over-the-counter or provided as samples by the physician or in a clinical trial will not be observed in the claims data. Second, the presence of a diagnosis code on a medical claim may be incorrectly coded or included as exclusion criteria rather than actual disease. Although all individuals were included on the basis of initiation of triple therapy and with a prior COPD diagnosis claim, and patients with other lung diseases were excluded to improve specificity, misclassification remains possible. We also note that with the limitations of claims-based analyses, not all initiation of SITT is necessarily inappropriate.

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Lastly, COPD exacerbations were defined using claims only and possibly lead to misclassification. The algorithm employed in this study is, however, consistent with those utilized in other real-world evidence studies of COPD.[20,21]

In conclusion, this study provides real-world evidence that helps characterize COPD patients initiating TT and describes the annual trends in the use of TT. Overall, these data showed increasing use of SITT and GOLD-discordant prescribing. The evidence provided can potentially highlight the importance of provider education on treatment recommendations, appropriate use of ICS, treatment protocols, and prevention of inappropriate prescribing practices and associated adverse outcomes.

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Consent statement:
Institutional review board approval or waiver of approval was not required for this study because the study data were secondary and de-identified in accordance with the United States Department of Health and Human Services Privacy Rule's requirements for de-identification codified at 45 C.F.R. § 164.514(b). Patient consent was not required for this retrospective study. The study was conducted in accordance with the Declaration of Helsinki.

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References

1. Metrics I. Evaluation, Global Burden of Disease Collaborative Network. Global Burden of Disease Study 2016 (GBD 2016) Results. 2017. *Institute for Health Metrics and Evaluation Seattle*. 2019;
2. Bhatt SP, Blauer-Peterson C, Buysman EK, Bengtson LGS, Palli SR. Trends and Characteristics of Global Initiative for Chronic Obstructive Lung Disease Guidelines-Discordant Prescribing of Triple Therapy Among Patients with COPD. *Chronic Obstr Pulm Dis*. Apr 29 2022;9(2):135-153. doi:10.15326/jcopdf.2021.0256
3. Celli BR, MacNee W. Standards for the diagnosis and treatment of patients with COPD: a summary of the ATS/ERS position paper. *Eur Respir J*. Jun 2004;23(6):932-46. doi:10.1183/09031936.04.00014304
4. Guarascio AJ, Ray SM, Finch CK, Self TH. The clinical and economic burden of chronic obstructive pulmonary disease in the USA. *Clinicoecon Outcomes Res*. 2013;5:235-45. doi:10.2147/ceor.S34321
5. Zafari Z, Li S, Eakin MN, Bellanger M, Reed RM. Projecting Long-term Health and Economic Burden of COPD in the United States. *Chest*. Apr 2021;159(4):1400-1410. doi:10.1016/j.chest.2020.09.255
6. Agustí A, Celli BR, Criner GJ, et al. Global Initiative for Chronic Obstructive Lung Disease 2023 Report: GOLD Executive Summary. *Eur Respir J*. Apr 2023;61(4)doi:10.1183/13993003.00239-2023
7. Sharma M, Joshi S, Banjade P, Ghamande SA, Surani S. Global Initiative for Chronic Obstructive Lung Disease (GOLD) 2023 Guidelines Reviewed. *Open Respir Med J*. 2024;18:e18743064279064. doi:10.2174/0118743064279064231227070344
8. Venkatesan P. GOLD COPD report: 2023 update. *Lancet Respir Med*. Jan 2023;11(1):18. doi:10.1016/s2213-2600(22)00494-5
9. Venkatesan P. GOLD COPD report: 2025 update. *Lancet Respir Med*. Jan 2025;13(1):e7-e8. doi:10.1016/s2213-2600(24)00413-2
10. Nici L, Mammen MJ, Charbek E, et al. Pharmacologic Management of Chronic Obstructive Pulmonary Disease. An Official American Thoracic Society Clinical Practice Guideline. *Am J Respir Crit Care Med*. May 1 2020;201(9):e56-e69. doi:10.1164/rccm.202003-0625ST
11. Zheng Y, Zhu J, Liu Y, et al. Triple therapy in the management of chronic obstructive pulmonary disease: systematic review and meta-analysis. *Bmj*. Nov 6 2018;363:k4388. doi:10.1136/bmj.k4388
12. Mann M, Meyer RJ. Drug development for asthma and COPD: a regulatory perspective. *Respiratory Care*. 2018;63(6):797-817.
13. Nigro SC, Sobieraj DM. Budesonide/glycopyrrolate/formoterol fumarate co-suspension metered dose inhaler: A triple therapy for the treatment of chronic obstructive pulmonary disease. *Annals of Pharmacotherapy*. 2022;56(5):582-591.
14. Simeone JC, Luthra R, Kaila S, et al. Initiation of triple therapy maintenance treatment among patients with COPD in the US. *Int J Chron Obstruct Pulmon Dis*. 2017;12:73-83. doi:10.2147/copd.S122013
15. Wurst KE, Punekar YS, Shukla A. Treatment evolution after COPD diagnosis in the UK primary care setting. *PLoS One*. 2014;9(9):e105296. doi:10.1371/journal.pone.0105296

Published online July 22, 2026 https://doi.org/10.15326/jcopdf.2026.0781

16. Rosenberg SR, Kalhan R, Mannino DM. Epidemiology of Chronic Obstructive Pulmonary Disease: Prevalence, Morbidity, Mortality, and Risk Factors. *Semin Respir Crit Care Med*. Aug 2015;36(4):457-69. doi:10.1055/s-0035-1555607
17. Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. *J Chronic Dis*. 1987;40(5):373-83. doi:10.1016/0021-9681(87)90171-8
18. Palli SR, Buikema AR, DuCharme M, Frazer M, Kaila S, Juday T. Costs, exacerbations and pneumonia after initiating combination tiotropium olodaterol versus triple therapy for chronic obstructive pulmonary disease. *J Comp Eff Res*. Nov 2019;8(15):1299-1316. doi:10.2217/cer-2019-0101
19. Palli SR, Frazer M, DuCharme M, Buikema AR, Anderson AJ, Franchino-Elder J. Differences in Real-World Health and Economic Outcomes Among Patients with COPD Treated with Combination Tiotropium/Olodaterol Versus Triple Therapy. *J Manag Care Spec Pharm*. Oct 2020;26(10):1363-1374. doi:10.18553/jmcp.2020.20159
20. Whittaker HR, Torkpour A, Quint J. Eligibility of patients with chronic obstructive pulmonary disease for inclusion in randomised control trials investigating triple therapy: a study using routinely collected data. *Respir Res*. Jan 18 2024;25(1):43. doi:10.1186/s12931-024-02672-x
21. Suissa S, Dell'Aniello S, Ernst P. Single-Inhaler Triple versus Dual Bronchodilator Therapy in COPD: Real-World Comparative Effectiveness and Safety. *Int J Chron Obstruct Pulmon Dis*. 2022;17:1975-1986. doi:10.2147/copd.S378486
22. Pascoe S, Barnes N, Brusselle G, et al. Blood eosinophils and treatment response with triple and dual combination therapy in chronic obstructive pulmonary disease: analysis of the IMPACT trial. *Lancet Respir Med*. Sep 2019;7(9):745-756. doi:10.1016/s2213-2600(19)30190-0
23. Bafadhel M, Rabe KF, Martinez FJ, et al. Benefits of Budesonide/Glycopyrronium/Formoterol Fumarate Dihydrate on COPD Exacerbations, Lung Function, Symptoms, and Quality of Life Across Blood Eosinophil Ranges: A Post-Hoc Analysis of Data from ETHOS. *Int J Chron Obstruct Pulmon Dis*. 2022;17:3061-3073. doi:10.2147/copd.S374670
24. Ferguson GT, Rabe KF, Martinez FJ, et al. Triple therapy with budesonide/glycopyrrolate/formoterol fumarate with co-suspension delivery technology versus dual therapies in chronic obstructive pulmonary disease (KRONOS): a double-blind, parallel-group, multicentre, phase 3 randomised controlled trial. *Lancet Respir Med*. Oct 2018;6(10):747-758. doi:10.1016/s2213-2600(18)30327-8
25. Suissa S. Single-inhaler triple versus dual bronchodilator therapy for GOLD group E and other exacerbating patients with COPD: real-world comparative effectiveness and safety. *Eur Respir J*. Sep 2023;62(3)doi:10.1183/13993003.00883-2023
26. Calzetta L, Matera MG, Braido F, et al. Withdrawal of inhaled corticosteroids in COPD: A meta-analysis. *Pulm Pharmacol Ther*. Aug 2017;45:148-158. doi:10.1016/j.pupt.2017.06.002
27. Mannino D, Bogart M, Wu B, et al. Adherence and persistence to once-daily single-inhaler versus multiple-inhaler triple therapy among patients with chronic obstructive pulmonary disease in the USA: A real-world study. *Respir Med*. Jun 2022;197:106807. doi:10.1016/j.rmed.2022.106807
28. Palli SR, Zhou S, Shaikh A, Willey VJ. Effect of compliance with GOLD treatment recommendations on COPD health care resource utilization, cost, and exacerbations among

Published online July 22, 2026 https://doi.org/10.15326/jcopdf.2026.0781

patients with COPD on maintenance therapy. *J Manag Care Spec Pharm*. May 2021;27(5):625-637. doi:10.18553/jmcp.2021.20390
29. Pavord ID, Lettis S, Anzueto A, Barnes N. Blood eosinophil count and pneumonia risk in patients with chronic obstructive pulmonary disease: a patient-level meta-analysis. *Lancet Respir Med*. Sep 2016;4(9):731-741. doi:10.1016/s2213-2600(16)30148-5
30. Cumming RG, Mitchell P, Leeder SR. Use of inhaled corticosteroids and the risk of cataracts. *N Engl J Med*. Jul 3 1997;337(1):8-14. doi:10.1056/nejm199707033370102
31. Kim JH, Park JS, Kim KH, Jeong HC, Kim EK, Lee JH. Inhaled corticosteroid is associated with an increased risk of TB in patients with COPD. *Chest*. Apr 2013;143(4):1018-1024. doi:10.1378/chest.12-1225
32. Suissa S, Kezouh A, Ernst P. Inhaled corticosteroids and the risks of diabetes onset and progression. *Am J Med*. Nov 2010;123(11):1001-6. doi:10.1016/j.amjmed.2010.06.019
33. Weatherall M, James K, Clay J, et al. Dose-response relationship for risk of non-vertebral fracture with inhaled corticosteroids. *Clin Exp Allergy*. Sep 2008;38(9):1451-8. doi:10.1111/j.1365-2222.2008.03029.x
34. Duan KI, Spece LJ, Wong ES, et al. Low-Value Inhaled Corticosteroids in Chronic Obstructive Pulmonary Disease and the Association with Healthcare Utilization and Costs. *Ann Am Thorac Soc*. Jun 2021;18(6):989-996. doi:10.1513/AnnalsATS.202009-1128OC
35. Suissa S, Dell'Aniello S, Ernst P. Triple Inhaler versus Dual Bronchodilator Therapy in COPD: Real-World Effectiveness on Mortality. *Copd*. Dec 2022;19(1):1-9. doi:10.1080/15412555.2021.1977789
36. Iheanacho I, Zhang S, King D, Rizzo M, Ismaila AS. Economic Burden of Chronic Obstructive Pulmonary Disease (COPD): A Systematic Literature Review. *Int J Chron Obstruct Pulmon Dis*. 2020;15:439-460. doi:10.2147/copd.S234942
37. Venkatesan P. GOLD COPD report: 2026 update. *Lancet Respir Med*. Nov 26 2025;doi:10.1016/s2213-2600(25)00432-1

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Table 1. Baseline Characteristics of COPD patients Initiating Triple Therapy, by Index Year

	Total (N=60,169)	Index Year 2019 (N=13,926)	Index Year 2020 (N=11,875)	Index Year 2021 (N=15,888)	Index Year 2022 (N=18,480)
Age (years), mean (SD)	70.93 (9.01)	70.75 (9.09)	70.86 (9.07)	70.83 (9.04)	71.19 (8.87)
Age group (years), n (%)					
40-49	739 (1.2)	168 (1.2)	156 (1.3)	209 (1.3)	206 (1.1)
50-59	5,754 (9.6)	1,487 (10.7)	1,188 (10.0)	1,517 (9.6)	1,562 (8.5)
60-69	19,574 (32.5)	4,359 (31.3)	3,770 (31.8)	5,275 (33.2)	6,170 (33.4)
70-74	12,659 (21.0)	2,934 (21.1)	2,523 (21.3)	3,310 (20.8)	3,892 (21.1)
75+	21,443 (35.6)	4,978 (35.8)	4,238 (35.7)	5,577 (35.1)	6,650 (36.0)
Gender, n (%)					
Female	31,063 (51.6)	7,164 (51.4)	6,187 (52.1)	8,151 (51.3)	9,561 (51.7)
Male	29,106 (48.4)	6,762 (48.6)	5,688 (47.9)	7,737 (48.7)	8,919 (48.3)
Race/ethnicity, n (%)					
Non-Hispanic White	45,370 (75.4)	10,627 (76.3)	8,988 (75.7)	11,987 (75.5)	13,768 (74.5)
Non-Hispanic Black	7,842 (13.0)	1,957 (14.1)	1,635 (13.8)	2,050 (12.9)	2,200 (11.9)
Non-Hispanic Asian	618 (1.0)	141 (1.0)	131 (1.1)	165 (1.0)	181 (1.0)
Hispanic	2,880 (4.8)	653 (4.7)	576 (4.9)	749 (4.7)	902 (4.9)
Missing/unknown	3,459 (5.8)	548 (3.9)	545 (4.6)	937 (5.9)	1,429 (7.7)
Region, n (%)					
Northeast	8,402 (14.0)	1,824 (13.1)	1,741 (14.7)	2,258 (14.2)	2,579 (14.0)
Midwest	15,429 (25.6)	3,545 (25.5)	2,932 (24.7)	3,986 (25.1)	4,966 (26.9)
South	31,700 (52.7)	7,627 (54.8)	6,311 (53.2)	8,423 (53.0)	9,339 (50.5)
West	4,633 (7.7)	929 (6.7)	889 (7.5)	1,220 (7.7)	1,595 (8.6)
Other	5 (0.0)	1 (0.0)	2 (0.0)	1 (0.0)	1 (0.0)
Insurance type, n (%)					
Commercial	7,397 (12.3)	2,080 (14.9)	1,567 (13.2)	1,959 (12.2)	1,791 (9.7)
Medicare Advantage Part D	52,772 (87.7)	11,846 (85.1)	10,308 (86.8)	13,929 (87.7)	16,689 (90.3)
Charlson comorbidity score, mean (SD)	2.6 (9.8)	2.6 (9.8)	2.6 (9.8)	2.6 (9.6)	2.6 (9.9)
Baseline comorbidities					

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Metabolic syndrome	55,355 (92.0)	12,716 (91.3)	10,937 (92.1)	14,609 (92.0)	17,093 (92.5)
Dyspnea	37,563 (62.4)	9,025 (64.8)	7,414 (62.4)	9,616 (60.5)	11,508 (62.3)
Type II diabetes	26,732 (44.4)	5,961 (42.8)	5,183 (43.7)	7,102 (44.7)	8,486 (45.9)
Heart failure	15,999 (26.6)	3,932 (28.2)	3,225 (27.2)	4,068 (25.6)	4,774 (25.8)
Pneumonia	11,689 (19.4)	3,098 (22.3)	2,465 (20.8)	2,699 (17.0)	3,427 (18.5)
Baseline Blood Eosinophil count[1,2], n (%)	15,322 (25.5)	2,976 (21.4)	2,750 (23.2)	4,510 (28.4)	5,086 (27.5)
<100 cells µL	2,377 (15.5)	367 (12.3)	406 (14.8)	710 (15.7)	894 (17.6)
100 - < 300 cells/µL	8,572 (56.0)	1,682 (56.5)	1,534 (55.8)	2,503 (55.5)	2,853 (56.1)
≥300 cells/µL	4,373 (28.5)	927 (31.2)	810 (29.5)	1,297 (28.8)	1,339 (26.3)

[1]Baseline blood eosinophil counts were assessed over a 6-month baseline period
[2]Denominator for blood eosinophil count categories is those with available results

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Table 2. Index Medication Characteristics, by Year

	Total (N=60,169)	Index Year 2019 (N=13,926)	Index Year 2020 (N=11,875)	Index Year 2021 (N=15,888)	Index Year 2022 (N=18,480)
Index single inhaler TT, n (%)	40,875 (67.9)	7,382 (53.0)	6,868 (57.8)	11,979 (75.4)	14,646 (79.3)
fluticasone furoate/ umeclidinium/vilanterol	34,647 (57.6)	7,382 (53.0)	6,816 (57.4)	9,453 (59.5)	10,996 (59.5)
budesonide/glycopyrrolate/ formoterol fumarate	6,232 (10.4)	0 (0.0)	52 (0.4)	2,527 (15.9)	3,653 (19.8)
Index multiple inhaler TT, n (%)	19,294 (32.1)	6,544 (47.0)	5,007 (42.2)	3,909 (24.6)	3,834 (20.8)
LABA/ICS + LAMA	15,769 (26.2)	5,479 (39.3)	4,076 (34.3)	3,129 (19.7)	3,085 (16.7)
LAMA/LABA + ICS	1,894 (3.2)	543 (3.9)	487 (4.1)	433 (2.7)	431 (2.3)
ICS + LABA + LAMA	240 (0.4)	105 (0.8)	55 (0.5)	48 (0.3)	36 (0.2)
LABA/ICS + LAMA/LABA	1,391 (2.3)	417 (3.0)	389 (3.3)	319 (1.9)	282 (1.5)
Index prescribing provider specialty, n (%)[1,2]					
Pulmonology	16,646 (27.7)	4,121 (29.6)	3,338 (28.1)	4,394 (27.7)	4,793 (25.9)
Primary Care[3]	15,190 (25.3)	3,694 (26.5)	3,016 (25.4)	3,965 (25.0)	4,515 (24.4)
Internal medicine	13,875 (23.1)	3,393 (24.4)	2,877 (24.2)	3,566 (22.4)	4,039 (21.9)
Allied health professional	13,756 (22.9)	2,762 (19.8)	2,604 (21.9)	3,688 (23.2)	4,702 (25.4)
Other/unknown specialty	8,078 (13.4)	2,011 (14.5)	1,561 (13.1)	2,064 (13.0)	2,442 (13.3)

[1]Measured on the pharmacy claim(s) for first fill of the third component of triple therapy or first fill FF/UMEC/VI on the index date; if index claim provider specialty is unknown, measured on the last medical claim during the baseline or on the index date.
[2]Patients may have more than 1 provider specialty if there were multiple claims on the index date for their index treatment.
[3]Primary care includes Family Practice, General Practice, and Geriatrics.

Table 3. Baseline Respiratory Medication and COPD Exacerbation History by Index Year

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	Total (N=60,169)	Index Year 2019 (N=13,926)	Index Year 2020 (N=11,875)	Index Year 2021 (N=15,888)	Index Year 2022 (N=18,480)
Baseline Medication Use[1,2,3]					
No maintenance (Maintenance-naive)	20,523 (34.1)	3,656 (26.3)	3,461 (29.2)	5,667 (35.7)	7,739 (41.9)
Any maintenance (Non-maintenance-naive)	39,646 (65.9)	10,270 (73.7)	8,414 (70.8)	10,221 (64.3)	10,741 (58.1)
Maintenance medications					
ICS	3,511 (5.8)	948 (6.8)	782 (6.6)	853 (5.4)	928 (5.0)
LABA	584 (1.0)	197 (1.4)	146 (1.2)	126 (0.8)	115 (0.6)
LABA/ICS combination	21,620 (35.9)	5,999 (43.1)	4,593 (38.7)	5,393 (33.9)	5,635 (30.5)
LAMA	11,937 (19.8)	3,818 (27.4)	2,793 (23.5)	2,659 (16.7)	2,667 (14.4)
LAMA/LABA combination	10,814 (18.0)	2,457 (17.6)	2,276 (19.2)	2,989 (18.8)	3,092 (16.7)
Baseline Exacerbation history[5]					
GOLD A/B, n (%)	37,239 (61.9)	7,381 (53.0)	6,937 (58.4)	10,722 (67.5)	12,199 (66.0)
0 exacerbations	22,984 (38.2)	4,254 (30.6)	4,198 (35.4)	6,900 (43.4)	7,632 (41.3)
1 moderate exacerbation	16,503 (27.4)	3,956 (28.4)	3,268 (27.5)	4,220 (26.6)	5,059 (27.3)
1 severe exacerbation not leading to hospitalization	4,011 (6.7)	990 (7.1)	850 (7.2)	948 (6.0)	1,223 (6.6)
GOLD E, n (%)	22,930 (38.1)	6,545 (47.0)	4,938 (41.6)	5,166 (32.5)	6,281 (34.0)
2+ exacerbations	18,327 (30.5)	5,367 (38.5)	4,037 (34.0)	4,087 (25.7)	4,836 (26.2)
1+ severe exacerbation with hospitalization	11,688 (19.4)	3,436 (24.7)	2,509 (21.1)	2,530 (15.9)	3,213 (17.4)

[1]It is possible for an individual to have baseline medication use for a cohort therapy if the baseline use of that medication did not meet the requirements to qualify for a study cohort at that time.
[2]ICS includes inhaled/nebulized beclomethasone, betamethasone, budesonide, ciclensonide, dexamethasone, flunisolide, fluticasone, mometasone, triamcinolone.
[3]Identified by medical and pharmacy claims.

[5]Includes index date unless otherwise specified
Abbreviations: ICS, inhaled corticosteroids; LABA, long-acting beta agonist; LAMA, long-acting muscarinic antagonist;

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Table 4. Baseline Respiratory Medication and COPD Exacerbation History by Multiple inhaler/Single inhaler TT Initiation: 2019 to 2022

	Single inhaler TT (N=40,875)	Multiple inhaler TT (N=19,294)
Baseline Medication Use[1,2,3]		
No maintenance (Maintenance-naive)	17,542 (42.9)	2,981 (15.5)
Any maintenance (Non-maintenance-naive)	23,333 (57.1)	16,313 (84.5)
Maintenance medications		
ICS	1,833 (4.5)	1,678 (8.7)
LABA	273 (0.7)	311 (1.6)
LABA/ICS combination	11,486 (28.1)	10,134 (52.5)
LAMA	4,169 (10.2)	7,768 (40.3)
LAMA/LABA combination	8,176 (20.0)	2,638 (13.7)
Baseline Exacerbation history		
GOLD A/B	26,711 (65.4)	10,528 (54.6)
0 exacerbations	16,538 (40.5)	6,446 (33.4)
1 moderate exacerbation	11,393 (27.9)	5,110 (26.5)
1 severe exacerbation not leading to hospitalization	2,638 (6.5)	1,373 (7.1)
GOLD E	14,164 (34.7)	8,766 (45.4)
2+ exacerbations	11,753 (28.8)	6,574 (34.1)
1+ severe exacerbation with hospitalization	6,391 (15.6)	5,297 (27.5)

[1]It is possible for an individual to have baseline medication use for a cohort therapy if the baseline use of that medication did not meet the requirements to qualify for a study cohort at that time.
[2]ICS includes inhaled/nebulized beclomethasone, betamethasone, budesonide, ciclensonide, dexamethasone, flunisolide, fluticasone, mometasone, triamcinolone.
[3]Identified by medical and pharmacy claims.

[5]Includes index date unless otherwise specified

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Abbreviations: ICS, inhaled corticosteroids; LABA, long-acting beta agonist; LAMA, long-acting muscarinic antagonist; SABA, short-acting beta agonist; SAMA, short-acting muscarinic antagonist

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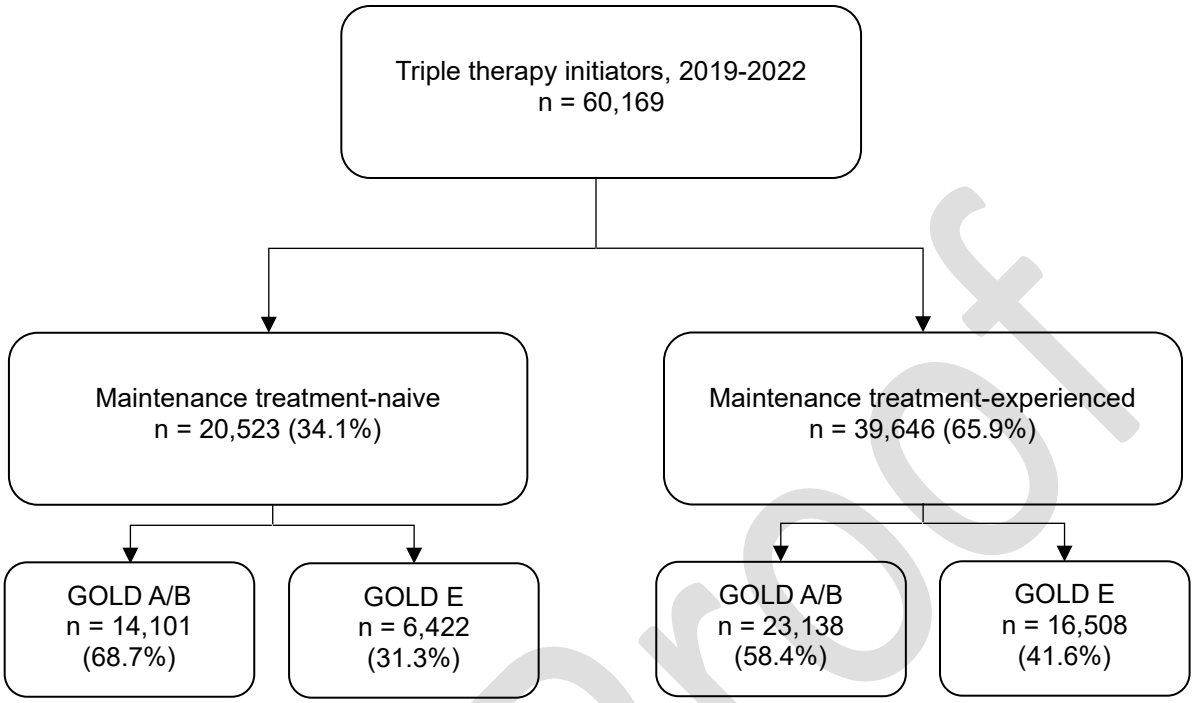
Figure 1. Distribution of GOLD groups according to maintenance treatment status among TT initiators



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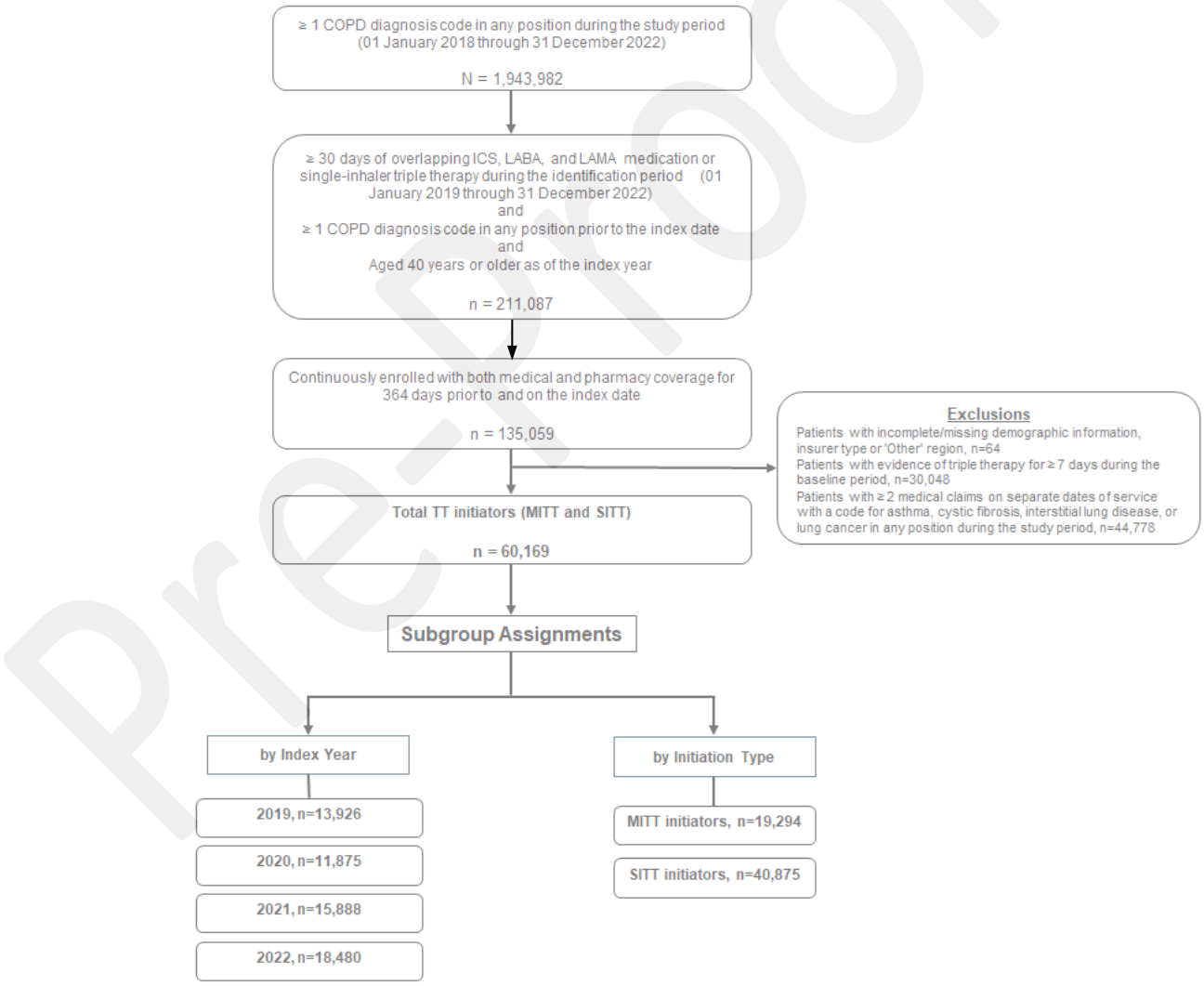
Online Supplement

Figure S1. Patient Selection and Subgroups



Abbreviations: COPD, chronic obstructive pulmonary disease; ICS, inhaled corticosteroids; LABA, long-acting beta agonist; LAMA, long-acting muscarinic antagonist

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Supplemental Table S1. COPD ICD-10 Codes

J41.0	ICD-10 Dx	Simple chronic bronchitis
J41.1	ICD-10 Dx	Mucopurulent chronic bronchitis
J41.8	ICD-10 Dx	Mixed simple and mucopurulent chronic bronchitis
J42	ICD-10 Dx	Unspecified chronic bronchitis
J43.0	ICD-10 Dx	Unilateral pulmonary emphysema (MacLeod's syndrome)
J43.1	ICD-10 Dx	Panlobular emphysema
J43.2	ICD-10 Dx	Centrilobular emphysema
J43.8	ICD-10 Dx	Other emphysema
J43.9	ICD-10 Dx	Emphysema, unspecified
J44.0	ICD-10 Dx	Chronic obstructive pulmonary disease with acute lower respiratory infection
J44.1	ICD-10 Dx	Chronic obstructive pulmonary disease with (acute) exacerbation
J44.9	ICD-10 Dx	Chronic obstructive pulmonary disease, unspecified

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Supplemental Table S2. Baseline Patient Characteristics of the Maintenance-naive subgroup: 2019 to 2022

	Maintenance-naive (N=20,523)
Demographics	
Age (years), mean (SD)	70.6 (9.1)
Age group (years), n (%)	
40-49	331 (1.6)
50-59	2,051 (10.0)
60-69	6,740 (32.8)
70-74	4,285 (20.9)
75+	7,116 (34.7)
Gender, n (%)	
Female	9,971 (48.6)
Male	10,552 (51.4)
Race/ethnicity, n (%)	
Non-Hispanic White	15,238 (74.3)
Non-Hispanic Black	2,753 (13.4)
Non-Hispanic Asian	223 (1.1)
Hispanic	1,055 (5.1)
Missing/unknown	1,254 (6.1)
Region, n (%)	
Northeast	2,492 (12.1)
Midwest	4,800 (23.4)
South	11,970 (58.3)
West	1,259 (6.1)
Insurance type, n (%)	
Commercial	2,553 (12.4)
Medicare Advantage Part D	17,970 (87.6)
Baseline Blood Eosinophil count[1,2], n (%)	5,731 (27.9)
<100 cells µL	872 (15.2)
100 - < 300 cells/µL	3,278 (57.2)
≥300 cells/µL	1,581 (27.6)

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Additional categories	
<300 cells/uL	4,150 (72.4)
≥100 cells/uL	4,859 (84.8)
Index medication characteristics	
Index single inhaler TT, n (%)	17,542 (85.5)
fluticasone furoate/umeclidinium/vilanterol	14,666 (71.5)
budesonide/glycopyrrolate/formoterol fumarate	2,878 (14.0)
Index multiple inhaler TT, n (%)	2,981 (14.5)
LABA/ICS + LAMA	2,822 (13.8)
LAMA/LABA + ICS	5 (0.0)
ICS + LABA + LAMA	24 (0.1)
LABA/ICS + LAMA/LABA	47 (0.2)
Index prescribing provider specialty, n (%)[1,2]	
Pulmonology	5,069 (24.7)
Primary Care[3]	5,267 (25.7)
Internal medicine	5,178 (25.2)
Cardiology	326 (1.6)
Allied health professional	4,489 (21.8)
Allergy and immunology	90 (0.4)
Other specialty	1,284 (6.3)
Unknown specialty	936 (4.6)
Exacerbation history, n (%)	
GOLD A/B	14,101 (68.7)
0 exacerbations	9,070 (44.2)
1 moderate exacerbation	5,357 (26.1)
1 severe exacerbation not leading to hospitalization	1,212 (5.9)
GOLD E	6,422 (31.3)
2+ exacerbations	4,626 (22.5)
1+ severe exacerbation with hospitalization	3,388 (16.5)

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Supplemental Table S3. Multivariable Logistic Regression of Maintenance Naive and GOLD A/B Status among all Patients

Independent variables	Maintenance naive + GOLD A/B status			
	odds ratio	lower 95% CI	upper 95% CI	p-value
Cohort				
MITT on index date	ref.	–	–	–
SITT on index date	5.0	4.8	5.3	<0.001
Age group				<0.001
40-49	ref.	–	–	–
50-59	0.7	0.6	0.8	<0.001
60-64	0.6	0.5	0.7	<0.001
65-69	0.6	0.5	0.7	<0.001
70-74	0.6	0.5	0.7	<0.001
75+	0.6	0.5	0.7	<0.001
Gender				
Female	ref.	–	–	–
Male	1.2	1.2	1.3	<0.001
Geographic region				<0.001
West[1]	ref.	–	–	–
Northeast	1.0	0.9	1.1	0.9
Midwest	1.0	0.9	1.1	0.6
South	1.2	1.1	1.3	<0.001
Insurance type				
Commercial	ref.	–	–	–
Medicare Advantage	0.9	0.9	1.0	0.0
Part D				
Index season				
Fall	ref.	–	–	–
Winter	0.9	0.8	1.0	<0.001

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Spring	0.9	0.9	1.0	0.0
Summer	0.9	0.9	1.0	0.0
Baseline Charlson comorbidity score excluding COPD (continuous)	1.0	1.0	1.0	0.2
Other baseline comorbidities				
Allergic rhinitis	0.9	0.8	0.9	<0.001
Dyspnea	0.7	0.7	0.8	<0.001
Pneumonia or acute bronchitis/bronchiolitis	0.6	0.5	0.6	<0.001
Index prescribing provider specialty				<0.001
Pulmonology	0.7	0.7	0.8	<0.001
Primary care	ref.	–	–	–
Internal medicine	1.1	1.0	1.1	0.0
Allied health professional	0.8	0.7	0.8	<0.001
Other or unknown specialty	0.9	0.8	1.0	0.0

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Supplemental Table S4. Multivariable Logistic Regression of Maintenance-naive and GOLD A/B Status among Patients with Eosinophil Lab Results

Independent variables	Maintenance naive + GOLD A/B status			
	odds ratio	lower 95% CI	upper 95% CI	p-value
Cohort				
MITT on index date	ref.	–	–	–
SITT on index date	4.6	4.1	5.2	<0.001
Value of last eosinophil blood count test prior to index date				<0.001
< 100 cells/μL	ref.	–	–	–
100 - < 300 cells/μL	1.1	1.0	1.2	0.1
300+ cells/μL	0.9	0.8	1.0	0.1
Age group				0.0
40-49	ref.	–	–	–
50-59	0.7	0.5	1.0	0.0
60-64	0.6	0.5	0.9	0.0
65-69	0.6	0.5	0.9	0.0
70-74	0.6	0.4	0.8	0.0
75+	0.6	0.5	0.9	0.0
Gender				
Female	ref.	–	–	–
Male	1.2	1.2	1.3	<0.001
Geographic region				0.0
West[1]	ref.	–	–	–
Northeast	1.1	0.9	1.3	0.3
Midwest	1.1	0.9	1.3	0.5
South	1.2	1.0	1.4	0.0
Insurance type				
Commercial	ref.	–	–	–

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Medicare Advantage Part D	0.9	0.8	1.0	0.2
Index season				
Fall	ref.	–	–	–
Winter	0.8	0.7	0.9	<0.001
Spring	0.9	0.8	1.0	0.0
Summer	0.9	0.8	0.9	0.0
Baseline Charlson comorbidity score excluding COPD (continuous)	1.0	1.0	1.0	0.0
Other baseline comorbidities				
Allergic rhinitis	0.9	0.8	1.0	0.0
Dyspnea	0.7	0.7	0.8	<0.001
Pneumonia or acute bronchitis/bronchiolitis	0.6	0.5	0.6	<0.001
Index prescribing provider specialty				<0.001
Pulmonology	0.8	0.7	0.9	0.0
Primary care	ref.	–	–	–
Internal medicine	1.1	1.0	1.2	0.1
Allied health professional	0.9	0.8	1.0	0.1
Other or unknown specialty	1.0	0.9	1.2	0.9

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