



## Early View

Review

# Influence of ethnicity on adherence to non-surgical interventions for COPD: scoping review

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## **Influence of ethnicity on adherence to non-surgical interventions for COPD: scoping review**

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### **Take home message:**

People living with COPD, from minority ethnic communities, tended to have poor adherence to non-surgical interventions to treat their disease. Identifying individual-related factors underpinning this variation may help to improve disease outcomes amongst people living with COPD regardless of ethnicity.

## **Abstract**

### **Objective:**

Poor therapeutic adherence and the contributing factors have been extensively researched in several chronic diseases, including COPD. However, the influence of ethnicity on adherence to non-surgical treatment interventions for COPD (*e.g.*, smoking cessation and pulmonary rehabilitation) is not well understood. This scoping review was performed to better understand variations in adherence amongst people from minority ethnic communities diagnosed with COPD.

### **Method:**

This scoping review was designed based on the refined frameworks of Arksey and O'Malley, developed by the Joanna Briggs Institute (JBI). Systematic searches were performed across three data bases: CINHAL (EBSCO), Medline (OVID), and EMBASE (OVID).

### **Results:**

Out of 3654 identified records, 37 studies were deemed eligible for inclusion; these were conducted in various countries and involved populations of diverse ethnic groups diagnosed with COPD. The included studies considered provision and/or adherence to: medication (n=8, 21.6%), smoking cessation (n=11, 29.7%), influenza vaccinations (n=7, 18.9%), pulmonary rehabilitation (n=11, 29.7%), and oxygen therapy (n=2, 5.4%). Outcomes varied widely between studies within a single intervention (*e.g.*, initiation, adherence, and complete the pulmonary rehabilitation program). However, most of the included studies suggested the presence of inequalities linked to ethnicity across interventions.

### **Conclusion:**

This review indicated the presence of poor adherence to non-surgical interventions amongst people from minority ethnic backgrounds living with COPD. However, due to the heterogeneity in population groups considered and compared within the individual studies, it is challenging to identify and understand the key inequalities influencing adherence to non-surgical interventions. Further research is needed to better explore this.

## Introduction

Chronic obstructive pulmonary disease (COPD) is a condition characterised by airflow obstruction, which eventually leads to respiratory symptoms such as dyspnoea, cough, wheezing, and sputum production.(1) According to the World Health Organisation (WHO), COPD is ranked as the third leading cause of death globally, with reports of more than 3 million deaths worldwide in 2019.(2) More specifically, in the United Kingdom (UK), 30,000 deaths per year are attributed to COPD.(3) As well as being a cause of mortality, COPD is associated with disability that affects a person's quality of life.(4) This disease exhausts healthcare budgets worldwide and, consequently, creates an indirect economic burden within healthcare systems.(5) In the UK, the National Health Service (NHS) spends £800 million on COPD management, and people with COPD lose around 24 million working days annually.(3) Breathlessness is the most commonly-experienced symptom amongst individuals diagnosed with COPD and leads to panic and anxiety attacks.(4) Additionally, Acute exacerbation (AE) is a major event of COPD which is associated with an increased risk of dyspnoea and negatively affects health status, increases likelihood of hospitalization, higher readmission rates, and disease progression.(1)

According to the Global Initiative for Obstructive Lung Disease (GOLD) organisation, in addition to pharmacological treatment, people with COPD benefit greatly from adhering to non-surgical therapies in terms of lowering the frequency and severity of exacerbations, enhancing health status, and raising the quality of life.(1) These include smoking cessation, influenza vaccination, pulmonary rehabilitation, and long-term oxygen therapy.(1) Evidence has reported that early cessation of smoking is an essential intervention for COPD to slow down decline in lung function.(6, 7) Infections are responsible for approximately 70% of disease exacerbations in people diagnosed with COPD, with the influenza virus being identified as the second most common viral cause;(8) therefore, the GOLD organisation recommended that all individuals diagnosed with COPD should receive an annual influenza vaccine.(1) Pulmonary rehabilitation is an important component of COPD management as it has the potential to improve a person's physical and psychological well-being.(7, 9) Moreover, long-term oxygen therapy is a gold standard for individuals living with advanced COPD and those who experience hypoxia at rest.(10) Evidence has proved its benefit in terms of prolonging survival, and improving pulmonary haemodynamic as well as neuropsychological

health of people living with COPD.(1, 10) Individuals diagnosed with COPD should also be advised about the importance of medication adherence, with emphasis placed on proper inhaler technique.(1) Many factors have been documented to have a potential influence on adherence, including: patient (*e.g.*, medication knowledge), disease (*e.g.*, severity of disease), medication (*e.g.*, medication side effects), and healthcare system-related factors (*e.g.*, access to care).(11) Additionally, McQuaid and Landier reported that perceived ethnic discrimination, medication beliefs, use of alternative medication including natural products (*e.g.*, herbals) or body practices (*e.g.*, yoga), and limited English language proficiency are possible key factors that may contribute to the variation of adherence associated with ethnicity.(12) Authors found these factors may illustrate the disparities in health outcomes between different ethnic groups across several chronic conditions (*e.g.*, diabetes, asthma, depression, and hypertension).(12) Evidence has shown that ethnicity is also associated with disparities in the application of non-pharmacological interventions in COPD, including smoking cessation, influenza vaccination, and long-term oxygen therapy.(13)

Given that COPD-related hospitalisation and death also varied among different ethnic groups (14-16), it is crucial to determine how individuals from different ethnic backgrounds living with COPD adhere to non-surgical interventions. Understanding how ethnicity influences COPD treatment may help to identify the barriers related to poor adherence to non-surgical interventions. However, due to the variety of objectives within a single intervention (*e.g.*, medication adherence, compliance, persistence) (*e.g.*, smoking cessation, receiving advice from professionals about smoking cessation, using and utilizing of smoking cessation agents) (*e.g.*, initiation, adherence, completion of pulmonary program), as well as the heterogeneity of scales and measures used to evaluate medication adherence. Moreover, a wide variety of ethnic groups were reported as the included studies originated in various countries (*e.g.*, USA, Denmark, Canada, UK, New Zealand, Australia, and the UK) results cannot be compared and a scoping review might be a better option. This scoping review aimed: (1) to map and illustrate the breadth of the available evidence investigating the inequalities within COPD management between individuals from different minority ethnic communities; (2) to identify knowledge gaps within the concept of ethnicity influence on adherence to non-surgical interventions amongst people with COPD.

## **Method**

This scoping review was designed based on the refined frameworks of Arksey and O'Malley, developed by the Joanna Briggs Institute (JBI).(17) An *a priori* protocol specified the objective, inclusion criteria and methods in advance and was registered with the Open Science Framework (OSF) on February 3<sup>rd</sup>, 2023.(18)

### **Research question/objective**

The objective was to investigate the influence of ethnicity on adherence to non-surgical interventions amongst people from minority ethnic communities diagnosed with COPD.

### **Inclusion criteria**

We used the Participant, Concept and Context (PCC) protocol by the JBI to frame the inclusion criteria.

**Participants:** individuals diagnosed with COPD from minority ethnic communities, irrespective of their age, disease stage, and the presence of comorbidities. According to the UK Office of National Statistics 'Ethnic group, national identity and religion,(19) the term "ethnic minority individuals" was defined as any population that did not speak the language of the study country, was an immigrant, or identified as an ethnic minority.

**Concept:** the factors associated with medication adherence, enrolment and persistence with pulmonary rehabilitation, uptake of the influenza vaccine, adherence to long-term oxygen therapy, smoking cessation, or receiving assistance and advice to quit smoking amongst people living with COPD.

**Context:** influence of ethnicity on adherence to non-surgical interventions amongst individuals diagnosed with COPD worldwide.

**Types of studies:** we only considered primary research in this review. Observational studies, including prospective and retrospective cohort studies, analytical cross-sectional studies, descriptive observational studies, and descriptive cross-sectional studies, were considered for inclusion. Reviews, conference abstracts, letters, and opinions were excluded, as these cannot address the primary question/objective. The search was not limited by any time frame, patient age range, or geographical location, but was restricted to studies published in the English language only, based on a lack of available translation services within the scope of this project. Studies were not excluded based on quality.

### **Search Strategy**

An initial, scoping search was developed for MEDLINE (PubMed) and CINAHL to identify relevant articles on the topic. The identified keywords and index terms of the retrieved papers were used to develop the final search strategy. A second search across CINAHL (EBSCO), Medline (OVID), and EMBASE (OVID) was undertaken using all identified keywords and index terms to identify eligible studies. Screening the reference list of the included studies and searching the grey literature (*e.g.*, WorldWideScience.org, and OpenGrey) were undertaken to identify additional relevant articles.

### **Source of evidence screening and selection**

All identified articles were exported into EndNote 20.4 and duplicates removed. The authors AKH, HN, and SA screened titles and abstracts based on the prespecified inclusion and exclusion criteria. Potentially relevant articles were imported into Rayyan software (20) where they were independently assessed by HN, AR-B, and SA based on the full text of the selected papers. AKH was involved to solve any disagreements between reviewers. The Preferred Reporting Items for Systematic Reviews and Meta-analyses extension for scoping review (PRISMA-ScR) guidelines were followed to report this scoping review. (21)

### **Data extraction**

The final data from the eligible studies were extracted to answer the review question according to the method developed by Peters *et al.* (22) A refined table template, developed in the protocol, was used for the data extraction. The extracted data included: Author, Year, Country, Aim(s), Study population, Methodology, and Key findings related to the objective of this review.

### **Analysis and synthesis**

We categorised the influence of ethnicity on adherence to non-surgical interventions amongst people living with COPD into five main aspects: medication adherence, smoking cessation, influenza vaccination, pulmonary rehabilitation, and long-term oxygen therapy. A narrative synthesis approach was used to present the results and answer the review question. Due to the nature of scoping review, the assessment of paper quality is not applicable.

### **How ethnicity data are reported**

In this review, we decided to use the term 'ethnicity' rather than 'race', unless the authors of the included studies specifically used it. The term 'ethnicity' is preferred since it includes cultural and regional characteristics and enables us to consider more confounding factors that can contribute in the variation of adherence to treatment. We defined 'ethnicity' according to Senior and Bhopal who state that 'ethnicity implies one or more of the following: shared origins or social background; shared culture and traditions that are distinctive, maintained between generations, and lead to a sense of identity and group; and a common language or religious tradition'.(23) While it is preferred to use the term 'race' which is one of the main human groupings and is typically distinguished by physical characteristics like skin colour, to explain racism or another social phenomenon.(23) The Notional Institute of Health guides were used to report ethnicity data in this review.(24)



## **Results:**

Our search strategy retrieved a total of 3,679 citations and an additional eleven relevant citations were identified from the manual screening of reference lists and searching grey literatures. Thirty-two duplicates were detected and removed. After reviewing the titles and abstracts, 3,426 studies were excluded. Two-hundred and thirty-two citations were considered for further full-text assessment. Of these, one-hundred ninety-five studies were excluded due to the following reasons: individuals with COPD were not included, ethnicity was not included as a predictor, the paper was published as a conference-abstract or written in a language other than English.

A total of 37 citations were eligible for inclusion in this review. (3, 25-60) A PRISMA-ScR flow diagram, reporting the selection process of the included studies, is shown in Figure 1.

### **Article characteristics**

Our search strategy yielded 37 studies that examined the influence of ethnicity on non-surgical interventions amongst people diagnosed with COPD. The publication dates of these studies ranged between 2003 and 2022. Included studies were conducted in various countries but the most common was the USA (n=26, 70.2%), (25, 26, 28, 29, 31, 33-36, 38-40, 42-51, 53, 57, 58, 60) followed by Denmark (n=4, 10.4%),(32, 54-56) New Zealand (n=3, 8.10%),(27, 37, 41) and the UK (n=2, 5.4%).(3, 30) Two studies were also included from Australia and Canada.(52, 59) Based on the type of the intervention, the included studies were distributed as follows: medication adherence (n=8, 21.6%),(28, 32-34, 36, 43, 55, 57) smoking cessation (n=11, 29.7%),(3, 25, 30, 35, 39, 40, 42, 53, 54, 56, 58) influenza vaccinations (n=7), (3, 26, 29, 31, 48, 59, 60) pulmonary rehabilitation (n=11, 29.7%),(3, 27, 37, 38, 41, 46, 47, 49-52) and long-term oxygen therapy (n=2, 5.4%).(44, 45) A list of the included studies, with their characteristics in Table 1.

### **Medication adherence**

The included studies evaluated medication adherence amongst individuals living with COPD using a range of measures. The Medication Adherence Reporting Scale (MARS) was employed

as a self-reported measure in two studies.(34, 57) While five studies were found to use measures based on the electronic database data such as Refill Compliance (ReComp), proportion of days covered (PDC), Medication Possession Ratio (MPR), and Defined Daily Doses (DDD).(28, 32, 33, 36, 55) The remaining study used placebo inhalers to observe how individuals with COPD utilised the inhalers.(43)

Across five studies originating from the USA aiming to examine the relationship between ethnicity and adherence to COPD medication, findings indicated that people from Black and Hispanic ethnic groups were less likely to be adherent to COPD medications compared to those of White ethnicity.(28, 33, 34, 36, 57) The differences in adherence were reported to be significant in four studies.(28, 33, 34, 36) While Unni *et al.* reported insignificant variation in medication adherence amongst individuals from minority ethnic groups diagnosed with COPD.(57) Two studies in Denmark reported that those from backgrounds other than ethnic Danes had a higher risk of poor adherence to COPD medications.(32, 55) Additionally, people of Black ethnicity living with COPD have higher odds of using their inhalers improperly for almost all devices.(43) (supplementary table 1).

### **Smoking cessation**

In terms of the impact of ethnicity on smoking cessation amongst people living with COPD, Two UK-based studies found that people of Black ethnicity were less likely to be current smokers compared with Whites when they were diagnosed with COPD.(3, 30) Another two studies conducted among Denmark's COPD population were included in this review.(54, 56) Tøttenborg *et al.* aimed to identify the predictors for using of smoking cessation medication among individuals living with COPD.(54) The results revealed lower odds of utilising smoking cessation medications (SCMs) by people of non-Danish origin compared with native Danes.(54) While the another study by Tøttenborg *et al.* intended to identify the factors related to quitting smoking within patients from Danish outpatient clinics.(56) Authors found insignificant difference between immigrant and Danish individuals living with COPD in terms of participation in smoking cessation [HR (95% CI) 1.17 (0.79-1.74)].(56) Two American studies reported that people of Non-Hispanic White ethnicity, living with COPD had a higher rate of successfully quitting smoking compared with other minority ethnic groups.(39, 40) Adams *et*

*al.* classified the study sample into three groups, former, intermittent, and current smokers.(25) Authors found significantly more people of African American ethnicity in the intermittent smokers' groups compared to White people and significantly fewer people of Hispanic ethnicity in the current smoker groups compared with other ethnic groups.(25) The remaining three studies assessed the disparities in use of smoking cessation agents amongst individuals living with COPD in the USA.(35, 42, 58) Melzer *et al.* document lower odds of receiving treatment for smoking cessation amongst people of Black ethnicity within 48 hours of discharge from hospital following admission for exacerbation of COPD.(42) Kwak *et al.* results revealed higher prescription rates among people of Hispanic ethnicity living with COPD and bupropion was found to be the more likely prescribed agent for this group.(35) On the contrary, Vaidya *et al.* showed a lower utilisation of smoking cessation agents by smokers of Hispanic ethnicity diagnosed with COPD in comparison to non-Hispanic groups.(58) Furthermore, in comparison with White people, people of African American ethnicity were less likely to utilise smoking cessation agents.(58) Interestingly, US-based study reported a significant difference in receiving advice to quit smoking from a physician based on ethnicity ( $p=0.033$ ).(53) (supplementary table 2).

## **Influenza vaccine**

The majority of the included studies about influenza vaccination uptake were conducted in the USA.(26, 29, 31, 48, 60) All of these studies concluded that being of Black ethnicity is a predisposing factor for the lower likelihood of receiving influenza vaccine compared to the White COPD population.(26, 29, 31, 48, 60) Martin *et al.* found that people of South Asian ethnicity were more likely to receive the influenza vaccine compared to people of White and Black ethnicities living with COPD in London.(3) Another study aimed to identify sociodemographic factors associated with low uptake amongst Canadian individuals diagnosed with COPD.(59) The results showed an insignificant difference between Caucasian (White ethnicity) and those from minority communities in receiving the influenza vaccine.(59) (supplementary table 3).

## **Pulmonary rehabilitation**

Six out of eleven pulmonary rehabilitation related studies were conducted in the USA.(38, 46, 47, 49-51) Authors of these studies confirmed that people of non-Hispanic White ethnicity with COPD were more likely to receive, initiate, and adhere to pulmonary rehabilitation.(38, 46, 49-51) Conversely, Oates *et al.* found that White ethnicity was predictive of low adherence to pulmonary rehabilitation compared with Black people diagnosed with COPD.(47) In London, White people diagnosed with COPD were found to be more likely to receive pulmonary rehabilitation compared with those of South Asian and Black ethnicities.(3) Results of an Australian study revealed insignificant differences in the referral, attendance, and completion of pulmonary rehabilitation between culturally and linguistically diverse (CALD) and non-CALD groups.(52) However, individuals living with COPD from CALD backgrounds were found to have lower awareness of pulmonary rehabilitation compared with non-CALD.(52) Two more studies conducted in New Zealand identified a significantly lower session attendance amongst Māori and Pacific Island people diagnosed with COPD compared to those of European origin.(27, 41) (supplementary table 4).

## **Long-term oxygen therapy**

Both of the retrieved studies that investigated the influence of ethnicity on adherence to long-term oxygen therapy amongst individuals diagnosed with COPD were based in the USA. Nishi *et al.* examined the impact of patient characteristics on adherence to long-term oxygen therapy use amongst people living with COPD,(45) they found that the population of non-Hispanic white ethnicity was associated with higher odds of receiving oxygen therapy compared with Black and other ethnic groups.(45) On the other hand, Moy *et al.* prescribed the study sample either continuous or intermittent oxygen therapy and they assessed adherence over short (0-30 days), medium (9-19 months), and long (month 13 to last follow-up) intervals.(44) The results showed no statistical difference between people living with COPD of White ethnicity and those of other ethnicities in both groups amongst the three intervals.(44) (supplementary table 5).

## Discussion

To our knowledge, this is the first scoping review that has aimed to examine the impact of ethnicity-related differences on non-surgical interventions amongst individuals living with COPD.

Most of the studies included in this review suggest the presence of disparities in the management of COPD based on ethnicity. Given that non-surgical interventions are the gold standard for managing and improving COPD outcomes, our findings may assist to demonstrate the influence of ethnicity on the severity of COPD-related disability and the mortality rate of COPD.

All of the included studies demonstrated a significant difference in adherence to medication amongst individuals living with COPD based on ethnicity except the study by Unni *et al.*, (28, 32-34, 36, 43, 55, 57) Smoking cessation as well as uptake of the influenza vaccine, which play vital roles in the management of COPD were found to be significantly influenced by ethnicity across all of the included studies in this review. In several study settings, disparities in pulmonary rehabilitation engagement by ethnicity were also reported, (3, 27, 37, 38, 41, 46, 47, 49-52) whilst only one study found a significant association between ethnicity and receiving oxygen therapy amongst people with COPD. (45) In addition to ethnicity, authors of the included studies reported other possible determinants of nonadherence such as low income, low level of education, severity of the disease, presence of comorbidities, absence of insurance, young age, living alone, or miscommunication due to language barriers. Most of these factors are commonly reported within minority communities, which may contribute to the variation in adherence by ethnicity.(54) However, the influence of ethnicity persisted in most studies despite the controlling of various confounders (*e.g.*, socioeconomic status, education level) attributing the association between ethnicity and adherence to non-surgical interventions of COPD management.

A systematic review by Swiatoniowska *et al.* emphasised that sociodemographic (*e.g.*, Income), psychological (*e.g.*, depression, cultural beliefs), and clinical factors (*e.g.*, disease stage, comorbidities) were the most common factors that negatively affect adherence to medication amongst people living with COPD.(61) Additionally, Brehm and Celedon reported

that cultural beliefs and misconceptions about smoking may influence motivation to quit smoking.(62) Schmid *et al.* concurs with our findings in terms of variation in uptake of the influenza vaccine by ethnicity.(63) Authors speculated that a lack of access to healthcare, physician discrimination, and medical mistrust may all contribute to low vaccination rates amongst minority communities.(63) However, Schmid *et al.* noted that further research is needed to fully understand this behaviour because ethnicity may only serve as a carrier variable of explanatory factors that actually affect vaccine hesitancy.(63) Criner *et al.* supported our findings and reported the potential reasons for the underutilisation of pulmonary rehabilitation programs amongst minority communities living with COPD.(64) These include a lack of awareness or trust in the benefits of pulmonary rehabilitation, frequent hospitalisation and ED visits, limited transportation, and poor communication with medical professionals.(64) Therefore, further work is needed to evaluate individuals' lived experiences and adherence behavior to address ethnicity-related factors that may account for the variance in the management of COPD. In consequence, providing individualised recommendations to encourage and incentivise engagement in non-surgical interventions may enhance the health status and quality of life amongst people living with COPD despite their ethnic background and potentially have a positive impact on reducing the economic burden of the disease within healthcare systems.

### **Strengths and limitations**

To conduct the review with the required rigor and transparency, comprehensive searching, screening, and reporting frameworks (JBI and PRISMA-ScR) were followed. We were able to extract some relevant data from studies that were not specifically designed to evaluate the impact of ethnicity, but did report relevant outcomes by ethnic minority groupings. We used broad inclusion criteria, and this allowed us to identify knowledge gaps in the disparities of COPD management according to ethnic differences. This review is limited to papers published in English only, thus leaving out potentially important information from relevant papers written in other languages.

It is critical to acknowledge the heterogeneity across included studies in terms of settings, which consequently leads to discrepancies in reporting the data about ethnicity and inclusion of a broad range of ethnic groups (*e.g.*, Hispanic/white non-Hispanic, South Asian, Maori,

Europeans, native/non-native, ethnic Danes). Moreover, several concepts to define adherence to smoking cessation, pulmonary rehabilitation, and uptake of the influenza vaccine as well as numerous tools to measure medication adherence and access to pulmonary rehabilitation were used across included studies. Taken together, this makes the process of interpreting key findings challenging, and impossible to determine key priorities for the most influential outcomes. The observational nature of the study design was considered a limitation by the authors of the included studies due to the inability to assess causal relationships from the results.(25, 26, 31, 40, 42, 48, 53, 58, 59) There was also a probability of recall bias and social desirability bias because several of the included studies used self-reported measures of adherence. (26, 31, 39, 40, 42, 48, 56, 58, 59)

## **Conclusion**

The results of the review showed that different ethnic groups had different levels of adherence to non-surgical interventions for COPD. These differences persisted in some studies despite adjusting for possible confounders (such as sociodemographic factors). Therefore, the barriers and facilitators of adherence to non-surgical interventions amongst minority ethnic people living with COPD need to be better understood through additional future research. Identifying patient-related factors of this variation will help to develop tailored protocols and strategies for optimising treatment and improving disease outcomes of individuals diagnosed with COPD regardless of their ethnic background.

Table 1: Characteristics of included studies

Author, year	Type of intervention	Country	Study design
<i>Cecere et al, 2012(28)</i>	Adherence to (LABA) and (ICS)	USA	Secondary analysis of a randomized trial
<i>Hu et al, 2017(32)</i>	Persistence with LABD	Denmark	Cohort study
<i>Krauskopf et al, 2015(34)</i>	Medication adherence	USA	Observational study
<i>Unni et al, 2021(57)</i>	Medication adherence	USA	Cross-sectional survey
<i>Melzer et al, 2018(43)</i>	Inhaler technique	USA	Cross-sectional study
<i>Tottenborg et al, 2016(55)</i>	Medication adherence	Denmark	Prospective cohort study
<i>Jung et al, 2009(33)</i>	Medication adherence and persistence	USA	Retrospective cohort study.
<i>Le et al, 2022(36)</i>	Medication adherence	USA	Retrospective cohort study.
<i>Gilkes et al, 2016(30)</i>	Smoking history	UK	Retrospective cross-sectional study
<i>Liu et al, 2022(40)</i>	Smoking cessation	USA	Cross-sectional study
<i>Tilert and Chen, 2015(53)</i>	Receipt of smoking-cessation advice	USA	Cross-sectional survey
<i>Melzer et al, 2016(42)</i>	Smoking cessation medications	USA	Cohort study
<i>Kwak et al, 2018(35)</i>	Smoking cessation medications	USA	Retrospective observational study
<i>Vaidya et al, 2014(58)</i>	Smoking cessation medications	USA	Retrospective study
<i>Tottenborg et al, 2018(54)</i>	Smoking cessation medications	Denmark	Prospective design
<i>Tottenborg et al, 2016(56)</i>	Smoking cessation	Denmark	Prospective design
<i>Lindsay et al, 2021(39)</i>	Quit attempt	USA	Cross-sectional study
<i>Martin et al, 2012(3)</i>	Smoking cessation, Influenza vaccination, Referral to PR	UK	Cross-sectional study
<i>Adams et al, 2006(25)</i>	Smoking cessation	USA	Cross-sectional survey
<i>Egede and Zheng, 2003(29)</i>	Influenza vaccination	USA	Cross-sectional study
<i>Vozoris and Loughheed, 2008(59)</i>	Influenza vaccination	Canada	Cross-sectional study
<i>Young-Xu et al, 2022(60)</i>	Influenza vaccination	USA	Retrospective observational cohort study
<i>Hsu et al, 2016(31)</i>	Influenza vaccination	USA	Cross-sectional study
<i>Arabyat et al, 2017(26)</i>	Influenza vaccination	USA	Cross-sectional study
<i>Saeed et al, 2021(48)</i>	Influenza vaccination	USA	Cross-sectional study
<i>Nishi et al, 2016(46)</i>	Receipt of PR	USA	Retrospective study
<i>Oates et al, 2017(47)</i>	Adherence to PR.	USA	cross-sectional analysis
<i>Spitzer et al, 2020(49)</i>	Rates of PR participation	USA	Retrospective study
<i>Lindenauer et al, 2020(38)</i>	Initiation of PR	USA	Retrospective cohort study.
<i>Levack et al, 2016(37)</i>	Uptake of PR	New Zealand	Grounded theory methods
<i>Stefan et al, 2021(51)</i>	Initiation of PR	USA	Retrospective cohort study
<i>Spitzer et al, 2019(50)</i>	Receipt of PR	USA	Cohort study
<i>Tang et al, 2022(52)</i>	Engagement in PR	Australia	prospective cross-sectional study design
<i>Candy et al, 2020(27)</i>	Attended the PR	New Zealand	Retrospective analysis
<i>McNaughton et al, 2016(41)</i>	Attended the PR	New Zealand	Retrospective cohort study
<i>Nishi et al, 2015(45)</i>	Oxygen therapy	USA	Retrospective study
<i>Moy et al, 2019(44)</i>	Oxygen initiation and adherence	USA	We conducted a secondary analysis of LOTT

Key: LABA: long-acting beta-agonist; ICS: inhaled corticosteroids; LABD: long-acting bronchodilators; PR: pulmonary rehabilitation; LTOTT: long-term oxygen treatment trial



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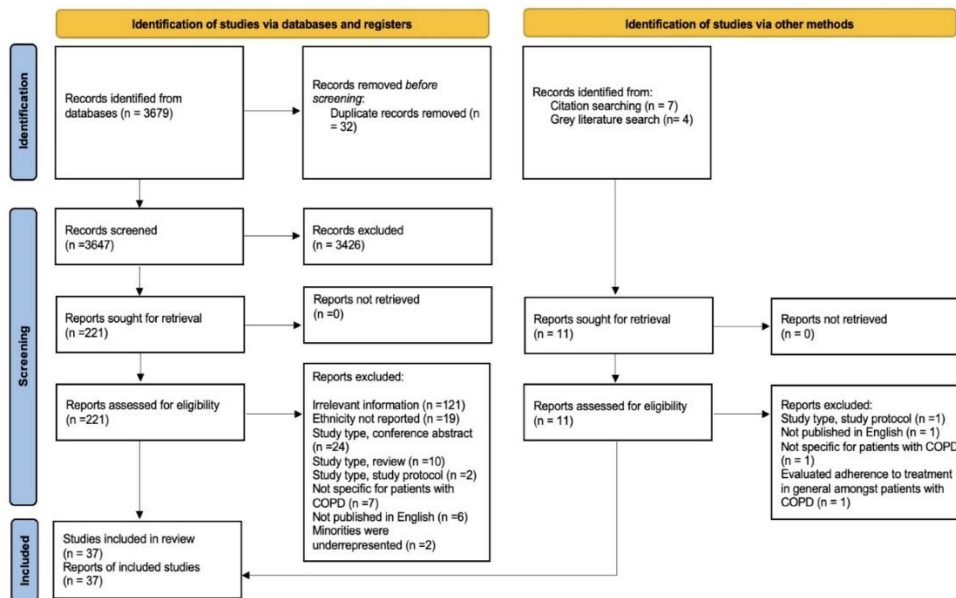


Figure 1: PRISMA flowchart of the studies' selection

## Supplementary Data

Table S1: The effect of ethnicity upon medicines adherence amongst people with COPD

Authors/Year/Origin	Type of intervention	Study population/ Sample size	Method	Key findings
<i>Cecere et al, 2012</i>  USA	Adherence to (LABA) and (ICS)	N= 376 <b>LABA; Non-Adherent</b> Ethnicity: 75% White <b>LABA; Adherent</b> Ethnicity: 80% White  <b>ICS; Non-Adherent</b> Ethnicity: 76% White <b>ICS; Adherent</b> Ethnicity: 80% White	Secondary analysis of a randomized trial.	Black ethnicity was associated with lower adherence.
<i>Hu et al, 2017</i>  Denmark	Persistence with LABD	N= 1129 <b>Monotherapy (n=306)</b> Ethnicity: 94.1% Danes <b>Two-drug therapy (n=642)</b> Ethnicity: 92.4 Danes <b>Combination therapy (181)</b> Ethnicity: 95% Danes	Cohort study	Patients living with COPD from other than Danish ethnic background discontinued COPD maintenance therapy more often than ethnic Danes
<i>Krauskopf et al, 2015</i>  USA	Adherence to COPD medications.	N= 188 <b>Adherent (n= 79)</b> Ethnicity: 53% White <b>Non-Adherent (n=109)</b> Ethnicity: 25% White	Observational study	Compared to adherent participants, those non-adherent participants were more likely to be Black or Hispanic (p=0.001).
<i>Unni et al, 2021</i>  USA	Adherence to COPD medicines	N= 1632 Ethnicity: 85.17% White	Cross-sectional survey	When the top reasons and the number of days missed were compared based on gender and race for COPD, the differences were insignificant.
<i>Melzer et al, 2018</i>  USA	Proper inhaler technique	N= 688 Ethnicity: 70.1% White	Cross-sectional study	Black race associated with increased odds of poor inhaler technique for nearly all devices.
<i>Tottenborg et al, 2016</i>  Denmark	Adherence to inhaled medication	N= 13,369 Ethnicity: 96% Danes	Prospective cohort study	Immigrants were at increased risk of poor adherence (aRR= 1.29, 95%CI 1.17-1.44) and non-use (aRR = 1.56, 95% CI 1.17-2.08) compared to ethnic Danes.
<i>Jung et al, 2009</i>  USA	Adherence and persistence to medications	N= 5913 Ethnicity: 69.96% White	Retrospective cohort study	<b>Medication compliance</b> African American race (p < 0.0001) was associated with significantly lower MPRs.  <b>Medication persistence</b> African Americans had a 1.2 times higher risk of discontinuation than Caucasians, who served as the reference group (HR =1.204, p =0.0048)

<p><i>Le et al, 2022</i></p> <p>USA</p>	<p>Adherence to COPD MMs</p>	<p>N= 56,436</p> <p><b>Prevalent use cohort (11,271)</b></p> <p><b>Adherence (4,886)</b></p> <p>Ethnicity: 85.4% White</p> <p><b>Nonadherence</b></p> <p>Ethnicity: 83.4% White</p> <p><b>New use cohort Adherence</b></p> <p>Ethnicity: 87.9% White</p> <p><b>Nonadherence</b></p> <p>Ethnicity: 84.8% White</p>	<p>Retrospective cohort study.</p>	<p>Non-White race was significantly associated with a greater risk of COPD MM nonadherence.</p>
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Key: LABA: long-acting beta-agonist; ICS: inhaled corticosteroids; LABD: long-acting bronchodilators; (FDC): fixed dose combinations; GOLD: global initiative for chronic obstructive lung disease; aRR: adjusted relative risks; CI: confidence interval; MPRs: Medication possession ratios; HR: hazard ratio; SD: standard deviation MM: maintenance medication.

Table S2: The effect of ethnicity upon smoking cessation amongst people with COPD

Authors/Year/Origin	Type of intervention	Study population/ Sample size	Method	Key findings
<i>Gilkes et al, 2016</i> UK	Smoking cessation	N= 3630 Ethnicity: 73% White	Cross-sectional study	Black patients were significantly less likely to be current smokers than white patients (OR, 0.56; CI, 0.44–0.71). All ethnic groups were significantly more likely to have never smoked than the white group.
<i>Liu et al, 2022</i> USA	Smoking cessation	N= 161,233 <b>COPD</b> Ethnicity: 79.2% White <b>Non-COPD</b> Ethnicity: 71.7% White	Cross-sectional survey	Most subgroups with COPD reported a lower quit ratio than their counterparts without COPD except for minority race/ethnic.
<i>Tilert and Chen, 2015</i> USA	Receipt of smoking-cessation advice	N= 1102 <b>Receiving advice:</b> Ethnicity: White 73.5% <b>Not receiving advice:</b> Ethnicity: White 68.9%	Cross-sectional survey	Bivariate chi-square analyses revealed significant differences between those who received advice to quit smoking from a physician and those who did not receive advice and the levels of a number of covariates, including age (p=0.049); race and ethnic origin (p=0.033)
<i>Melzer et al, 2016</i> USA	Treatment for tobacco use	N= 1511 <b>SCM at discharge (Yes):</b> Ethnicity: White= 86.2% <b>SCM at discharge (No):</b> Ethnicity: White= 82.9%	Cohort study	In comparison to white patients, black patients had significantly lower odds of receiving medications at discharge for exacerbation of COPD (OR 0.34, 95 % CI 0.12–0.97).
<i>Kwak et al, 2018</i> USA	Prescription rates of smoking cessation medications	N= 53 107 842 patients with COPD were estimated to be active smokers.	Retrospective observational study	Hispanic race associated with higher prescription rates (OR, 5.15; 95% CI, 1.59 to 16.67).
<i>Vaidya et al, 2014</i> USA	Using smoking cessation agents	COPD smoker patients 1423 Ethnicity: 88.32% White	Retrospective study	African-Americans were less likely to utilize smoking cessation agents than whites (OR = 0.532, 95% CI 0.246–1.152). Hispanics were less likely to utilize smoking cessation agents compared to non-Hispanics (OR = 0.107 95% CI 0.023–0.502) which was found to be significant.
<i>Tøttenborg et al, 2018</i> Denmark	Use smoking cessation medications (SCMs)	N= 4,165 Ethnicity: 96% Danish origin	Prospective design	Confounder adjusted analyses suggested that smokers of non-Danish origin have substantially lower odds of redeeming an SCM (OR 0.35, 95% CI 0.11–1.12) compared with native Danes.
<i>Tøttenborg et al, 2016</i> Denmark	Smoking cessation	N=3,233 Ethnicity: Danish= 96%	Prospective design	Probability of smoking cessation according to sociodemographic factors [HR (95% CI)]: Crude: Danish [1 (Ref)] Immigrant [1.06 (0.76-1.49)] Adjusted: Danish [1 (Ref)] Immigrant [1.17 (0.79-1.74)]
<i>Lindsay et al, 2021</i> USA	Quit attempts	N=4448 <b>Unsuccessful quitters:</b> Ethnicity: African American= 48% <b>Successful quitters:</b> Ethnicity: African American = 17%	Cross-sectional study	The strongest predictor of successful quitting in the logistic model was non-Hispanic White race



<i>Martin et al, 2012</i> UK	Smoking cessation	N= 7901 Ethnicity: Black= 0.6%	Cross-sectional study	South Asian and black patients with COPD are much less likely to be current smokers than white patients. This suggests that these groups are more likely to stop smoking when there is a diagnosis of COPD.
<i>Adams et al, 2006</i> USA	Smoking-cessation	N= 89337 <b>Former smoker: (58482) 65%</b> Ethnicity: White= 86.5% <b>Intermittent smoker: (5260) 6%</b> Ethnicity: White= 79.4% <b>Current smoker: (25595) 29%</b> Ethnicity: White= 87%	Cross-sectional survey	Significantly fewer whites and more African Americans were in the intermittent smokers group than in the former and current smoker, and there were significantly fewer Hispanics in the current smokers group.

Key: OR: odd ratio; CI: confidence interval; IMD: Index of Multiple Deprivation; BRFSS: Behavioural Risk Factor Factors Surveillance System; GOLD: global initiative for chronic obstructive lung disease; SCMs: smoking cessation medications; HR: hazard ratios; Ref: reference; COPDGene: COPD Genetic Epidemiology stud

Table S3: The effect of ethnicity upon receiving of the influenza vaccine amongst people with COPD

Authors/Year/ Origin	Type of intervention	Study population/ Sample size	Method	Key findings
Egede and Zheng, 2003 USA	Influenza vaccination	N= 1529 Ethnicity: 86.91 % White	Cross-sectional study	Whites were more likely to be vaccinated compared with Blacks.
Martin et al, 2012 UK	Influenza vaccination	N= 7901 Ethnicity: Black= 0.6%	Cross-sectional study	South Asians are more likely to receive both influenza immunisation compared with white or black populations.
Vozoris and Lougheed, 2008 <sup>5</sup> Canada	Influenza vaccination	N= 5532 Ethnicity: 91% Caucasian	Cross-sectional study	AOR for reporting influenza vaccination in the past year among individuals with COPD Race (Caucasian (AOR 1.0), Visible minority (AOR 0.7) (CI 0.5-1.1). Immigrant (Yes (AOR 0.9), No (AOR 1.0) (CI 0.6-1.2)
Young-Xu et al, 2022 USA	Influenza vaccination	N= 1,690,585 Ethnicity: 81.4 % White	Retrospective, observational cohort study	Black (Total: 155,244; VAC: 90,327; UNVAC: 64,917 – SMD= 10.6) White (total: 1,375,920; VAC: 921,523; UNVAC: 454,397; SMD= 10.3)  SMDs were significant among black and white only, not sig between Asian, American Indian, Alaskan Native
Hsu et al, 2016 USA	Influenza vaccination	N= 36,811 Ethnicity: 73.3% White	Cross-sectional study	Predisposing factor associated with a lower likelihood of receiving an influenza vaccination included black or non-white/non-Hispanic/non-black race/ ethnicity.  AOR (95% CI): Black: 0.68 (.0.56-0.83); Hispanic: 0.98 (0.77-1.25); Other: 0.71 (0.53-0.94)
Arabyat et al, 2017 USA	Influenza vaccination	N= 38,816 Ethnicity: 80.63% White	Cross-sectional study	Non-Hispanic Whites had higher influenza vaccination coverage than non-Hispanic Blacks.  Being Black or Hispanic reduced the likelihood of vaccination (AOR =0.68, 95% CI: 0.62-0.75 and AOR = 0.75, 95% CI: 0.67-0.85, respectively).
Saeed et al, 2021 USA	Influenza vaccination.	N= 10,192 Ethnicity: 32.4% White	Cross-sectional study	Lack of vaccination was more frequent among non-Hispanic blacks (37.7%), and Hispanics (39.7%). Vaccination rates were particularly lower non- Hispanic blacks.

GP: general practitioner; AOR: adjusted odd ratio; CI: confidence interval; VAC: vaccinated UNVAC: unvaccinated; SMD: standardized mean difference

Table S4: The effect of ethnicity upon on referral, adherence, and persistence with PR amongst people with COPD

Authors/Year/ Origin	Type of intervention	Study population/ Sample size	Method	Key findings
Nishi et al, 2016 USA	Receipt of PR	<b>2003: (n= 33526)</b> Ethnicity: 90.9% White <b>2008: (n= 31142)</b> Ethnicity: 91.38% White <b>2012: (n= 33446)</b> Ethnicity:90.62% White	Retrospective study	In a multivariable analysis, factor associated with receipt of PR was <b>non-Hispanic white race</b> (OR 1.20; 95% CI: 1.13-1.27)
Oates et al, 2017 USA	Adherence to PR.	N= 415 Ethnicity: 69.9% White	Cross-sectional analysis	Patient characteristics predictive of lowest adherence to PR was White race.  White race doubled the relative risk of low vs high adherence ( $p < 0.05$ )
Spitzer et al, 2020 USA	Variation in PR program density	N= 223,832 Ethnicity: 85% White	Retrospective study	Among black beneficiaries with COPD, PR rates were significantly lower than among NHW beneficiaries, regardless of the density of programs.
Lindenauer et al, 2020 USA	Initiation of PR	N=197 376 <b>PR within 90 D of Discharge (n=2721):</b> Ethnicity: 92.6% White <b>PR within 91-365 D after Discharge (n=194655)</b> Ethnicity: 85.1% White	Retrospective cohort study.	Compared with those who never participated or who initiated pulmonary rehabilitation after 90 days of discharge, those who initiated within 90 days were <b>more often non-Hispanic white</b> (92.6% vs 85.1%; ASD, 0.24).
Levack et al, 2016 New Zealand	Uptake of PR	N= 25 Ethnicity: 60% Māori	Grounded theory methods.	Lack of attention to cultural factors in the delivery of pulmonary rehabilitation may be a barrier to its uptake by indigenous, minority ethnic groups, such as New Zealand Māori.
Stefan et al, 2021 USA	Initiation of PR	N= 197,376 patients Ethnicity: 85.2 % White	Retrospective cohort study	Compared with patients who did not initiate PR or started after 90 days, those who initiated PR within 90 days of discharge were more likely to be <b>non-Hispanic White</b> .
Spitzer et al, 2019 USA	Receipt of PR	N= 223,832. Ethnicity: 84.8 % White	Cohort	Compared with non-Hispanic white patients, African American patients were 31% less likely to receive PR, and Hispanic patients were 41% less likely to receive PR.
Tang et al, 2022 Australia	Engagement in PR	N= 97 CALD (n=36) Non-CALD (n=61)	Prospective cross-sectional study	Both groups were similar in their rate of attendance and completion of previous PR, and willingness to participate in future PR programmes.  Older age and being from a CALD background were associated with reduced awareness of PR.
Candy et al, 2020 New Zealand	Complete the PR programme	N= 2,756 <b>Attenders (n=1695)</b> Ethnicity: 60.1% Māori <b>Non-Attenders (n=1061)</b> Ethnicity: 39.9% Māori	Retrospective analysis	Compared with Europeans, Māori were 53% (OR 0.47, 95% CI 0.35–0.65, $p < 0.001$ ) and Pacific Island people were 46% (OR 0.64, 95% CI 0.44–0.92, $p < 0.001$ ) less likely to complete the programme.

<i>McNaughton et al, 2016</i> New Zealand	Referral rates, uptake, and completion rates of PR	N= 256 Ethnicity: 76.6% European	Retrospective cohort study	Lower session attendance was significantly associated with ethnicity, $P=0.002$ , with European compared to Māori relative rate of 1.34 (95% [CI] 1.07 to 1.73) and compared to Pacific Island 1.82 (95% CI 1.18 to 2.80)
<i>Marin et al, 2012</i> UK	Referral rates of PR	N= 7901 Ethnicity: Black= 0.6%	Cross-sectional study	Both South Asian and Black patients are less likely to receive pulmonary rehabilitation referral compared with white patients.

OR: odd ratio; CI: confidence interval; NHW: non-Hispanic white; ASD: absolute standardized differences; CALD: culturally and linguistically diverse group; GP: general practitioner

Table S5: The effect of ethnicity upon the initiation of/adherence to oxygen amongst people with COPD

Authors/Year/Origin	Type of intervention	Study population/ Sample size	Method	Key findings
<i>Nishi et al, 2015</i> USA	Oxygen therapy use	N= 329,482 Ethnicity: White 91.2%	Retrospective study	Factors associated with higher odds of receiving oxygen therapy and sustained oxygen therapy include female gender, <u>non-Hispanic white race</u> , and low socioeconomic status.
<i>May et al, 2019</i> USA	Oxygen initiation and adherence	N= 359 <b>Continuous group (n=214)</b> Ethnicity: White 86.4%  <b>Intermittent Group (n=145)</b> Ethnicity: White 82.1%	Secondary analysis of LOTT	<b>Adherence to LTOT:</b> <u>Continuous group</u> : short term: White race (vs. other): P: 0.24 Medium term: White race (yes vs. no): P:0.90 Long term: White race (yes vs. no): P: 0.52  <u>Intermittent Group</u> : short term: White race (vs. other): P: 0.60 Medium term: White race (vs. other): P:0.60 Long term: White race (vs. other): P: 0.06

LTOTT: long-term oxygen treatment trial Medline and Embase search strategy

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1. exp Pulmonary Disease, Chronic Obstructive/
  2. Chronic obstructive lung disease.mp.
  3. COPD.mp.
  4. Chronic obstructive pulmonary diseases.mp.
  5. Chronic obstructive lung diseases.mp.
  6. 1 or 2 or 3 or 4 or 5
  7. exp Medication Adherence/
  8. medication compliance.mp.
  9. Treatment.mp.
  10. adherence.mp. or exp "Treatment Adherence and Compliance"/
  11. Management.mp.
  12. exp Oxygen Inhalation Therapy/ or Long term oxygen therapy.mp.
  13. pulmonary rehabilitation.mp.
  14. Smoking Prevention/ or Smoking cessation.mp. or exp Smoking Cessation/
  15. exp Vaccination/
  16. Influenza vaccine.mp. or exp Influenza Vaccines/
  17. 7 or 8 or 9 or 10 or 11 or 12 or 13 or 13 or 15 or 16
  18. 6 and 17
  19. exp Ethnicity/
  20. Race.mp. or exp Racial Groups/
  21. Racial disparities.mp.
  22. Racial difference\$.mp.
  23. Ethnic groups.mp.
  24. exp Minority Groups/
  25. Ethnic difference\$.mp.
  26. exp African Americans/
  27. exp Blacks/
  28. exp Whites/
  29. non-Hispanic\$.mp.
  30. Hispanic\$.mp.
  31. Black\$.mp.
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- [REDACTED]
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32. exp "Hispanic or Latino"/
  33. Belief.mp. or exp Culture/
  34. exp Sociodemographic Factors/
  35. Sociodemographic.mp.
  36. Ethnic inequality.mp.
  37. South asian\$.mp.
  38. exp Mexican Americans/
  39. Mexican\$.mp.
  40. 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 3
  41. 18 and 40
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