

The Analysis Study of Prevalence of Chronic Kidney Disease in Patients with Chronic Obstructive Pulmonary Disease : A Comprehensive Systematic Review

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ABSTRACT

Background: The relationship between COPD and chronic kidney disease (CKD) is complex, with CKD often overlooked in older populations. The study aims to investigate the prevalence, risk factors, and impact of CKD on mortality and renal failure, highlighting the need for comprehensive health care. **Methods:** Following PRISMA 2020 guidelines, this systematic review focused exclusively on full-text articles published in English between 2011 and 2024. **Result:** The study conducted a comprehensive review of over 8,000 publications sourced from reputable databases, including ScienceDirect, SagePub, and PubMed. Following an initial screening, eight publications were identified as warranting more in-depth analysis. Consequently, a thorough review of these selected studies was performed to ensure a detailed and rigorous evaluation. **Conclusion:** CKD is a significant risk factor for COPD patients, with 15.6% diagnosed aged 40 and older. Common risk factors include advancing age, diabetes, hypertension, elevated BMI, and cigarette smoking. COPD is associated with systemic inflammation, contributing to conditions like diabetes, muscle wasting, and kidney disease. Proactive management approaches are needed to address renal implications. **Keyword:** CKD, COPD, impact, prevalence, relationship

INTRODUCTION

The Global Burden of Disease Study published in 2015 revealed that chronic obstructive pulmonary disorder (COPD) caused the demise of 3.2 million individuals. This figure represents an 11.6% increase from 1990, primarily attributed to greater life expectancy and population growth.¹ COPD is a respiratory condition that can be prevented and treated.² It is distinguished by a partial inability to reverse airflow blockage. Historically, it was classified as either chronic bronchitis or emphysema depending on the main symptoms (shortness of breath for emphysema and cough with mucus production for chronic bronchitis) and was linked to an inflammatory response to harmful particles or gases.^{2,3}

COPD is often accompanied by several comorbidities, some of which are linked to it in terms of their underlying physiological processes, such as pulmonary artery disease and malnutrition. However, other comorbidities are not directly associated with COPD, such as

anxiety, depression, osteoporosis, diabetes, obesity, and anemia.⁴ Irrespective of any connection to the underlying disease process, the presence of comorbidities in individuals with COPD leads to higher rates of illness and financial burden, as well as making the management of COPD more challenging.^{5,6} Approximately 50% of the cost burden was linked to comorbidities, whereas only 26% was directly ascribed to COPD.⁵ Hence, it is imperative to prioritize the prevention and treatment of concurrent medical issues in this specific group. Chronic kidney disease (CKD) is a significant coexisting condition of COPD that is often overlooked, particularly in older populations.^{7,8} CKD is defined as a glomerular filtration rate (GFR) of less than 60 ml/min/1.73 m² and/or the presence of certain indicators of kidney impairment for more than three months, according to the Kidney Disease: Improving Global Outcomes (KDIGO) guidelines.⁹ If a patient's glomerular filtration rate (GFR) is

abnormal and their serum creatinine level increases, they may have overt chronic renal failure (CRF). For CRF to be hidden, the level of creatinine in the blood must be within the normal range, even while the GFR is abnormal.⁸

Common systemic diseases, such as vasculitides and autoimmune disorders, have been observed to impact both lung and kidney function.¹⁰ Furthermore, under normal physiological settings, the lungs and kidneys work together to regulate the acid-base balance and manage blood pressure through the renin-angiotensin-aldosterone axis.¹¹ The global prevalence of chronic renal disease is estimated to be between 11% and 13%.¹² The relationship between COPD and CKD has not been extensively investigated. This study is a comprehensive analysis of the relationship between COPD and CKD. It focuses on determining the prevalence and risk factors of this coexisting condition, examining its impact on mortality compared to each condition separately, and investigating the physiological mechanisms through

which COPD can contribute to the development of renal failure.

METHODS

Protocol

The study was conducted with meticulous adherence to the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) 2020 standards, ensuring rigorous compliance with established methodological guidelines. The adherence to PRISMA 2020 reflects a commitment to enhancing the transparency, reproducibility, and methodological rigor of the review process. This included comprehensive strategies for literature search, data extraction, and synthesis of findings, which were systematically employed to mitigate biases and ensure the robustness of the conclusions.

Criteria for Eligibility

This study provides an in-depth analysis of the research conducted over the past decade on the prevalence of chronic kidney disease (CKD) among patients with chronic obstructive pulmonary disease

(COPD). By systematically reviewing and synthesizing data from a range of studies, this research aims to elucidate patterns and inform the refinement of patient care strategies for this co-morbid population.

The primary objective of this thesis is to underscore key themes emerging from a broad spectrum of academic literature, thereby contributing to a more nuanced understanding of CKD prevalence in the COPD patient cohort. To ensure the rigor and accuracy of the analysis, stringent inclusion and exclusion criteria were applied. Only peer-reviewed studies published in English between 2014 and 2024 were eligible for inclusion. Materials considered for inclusion must also have a DOI to verify their authenticity. Conversely, the analysis excluded non-research documents such as reviews, editorials, and duplicate entries from the same journal to maintain the focus and integrity of the dataset.

This methodical approach ensures that the data utilized in the analysis is both relevant and reliable, providing a robust foundation for

drawing meaningful conclusions and advancing clinical practice.

Search Strategy

We used "psychosis OR weight management OR impact OR health promotion." as keywords. The search for studies to be included in the systematic review was carried out using the PubMed, SagePub, and Sciencedirect databases.

Data retrieval

The authors conducted a meticulous preliminary assessment of each article by reviewing its abstract and title to ensure relevance before proceeding with the comprehensive investigation. Only those studies that aligned with the study's objectives and met the predefined inclusion criteria were given further consideration. This approach enabled the identification of a consistent and unambiguous pattern across the research.

Full-text submissions were restricted to articles published in English, ensuring uniformity in the language of the included studies. A rigorous screening process was

employed to select content that was directly pertinent to the study's focus and adhered to all established inclusion criteria. Studies failing to meet these criteria were systematically excluded from detailed analysis and were not considered in the final evaluation.

The evaluation process encompassed a broad range of data, including but not limited to study factors, titles, authors, publication dates, research locations, and methodologies. This comprehensive approach ensured that the content included in the analysis was of the highest relevance and quality, thereby enhancing the robustness of the study's findings.

Quality Assessment and Data Synthesis

The authors conducted a meticulous review of each article's abstract and title to identify those warranting further investigation. Following this initial screening, every document deemed relevant was subjected to an in-depth examination. The evaluation outcomes guided the selection process for review papers,

ensuring that only those with the highest relevance were advanced for detailed analysis. This rigorous criterion streamlined the selection process, allowing for a more thorough and nuanced assessment of prior research and the context of its evaluation.

Table 1. Search Strategy

<i>Database</i>	<i>Search Strategy</i>	<i>Hits</i>
Pubmed	<i>("chronic kidney disease" OR "chronic obstructive pulmonary disorder" AND "prevalence")</i>	11407
Science Direct	<i>("chronic kidney disease" OR "chronic obstructive pulmonary disorder" AND "prevalence")</i>	134
Sagepub	<i>("chronic kidney disease" AND "chronic obstructive pulmonary disorder" AND "prevalence")</i>	14

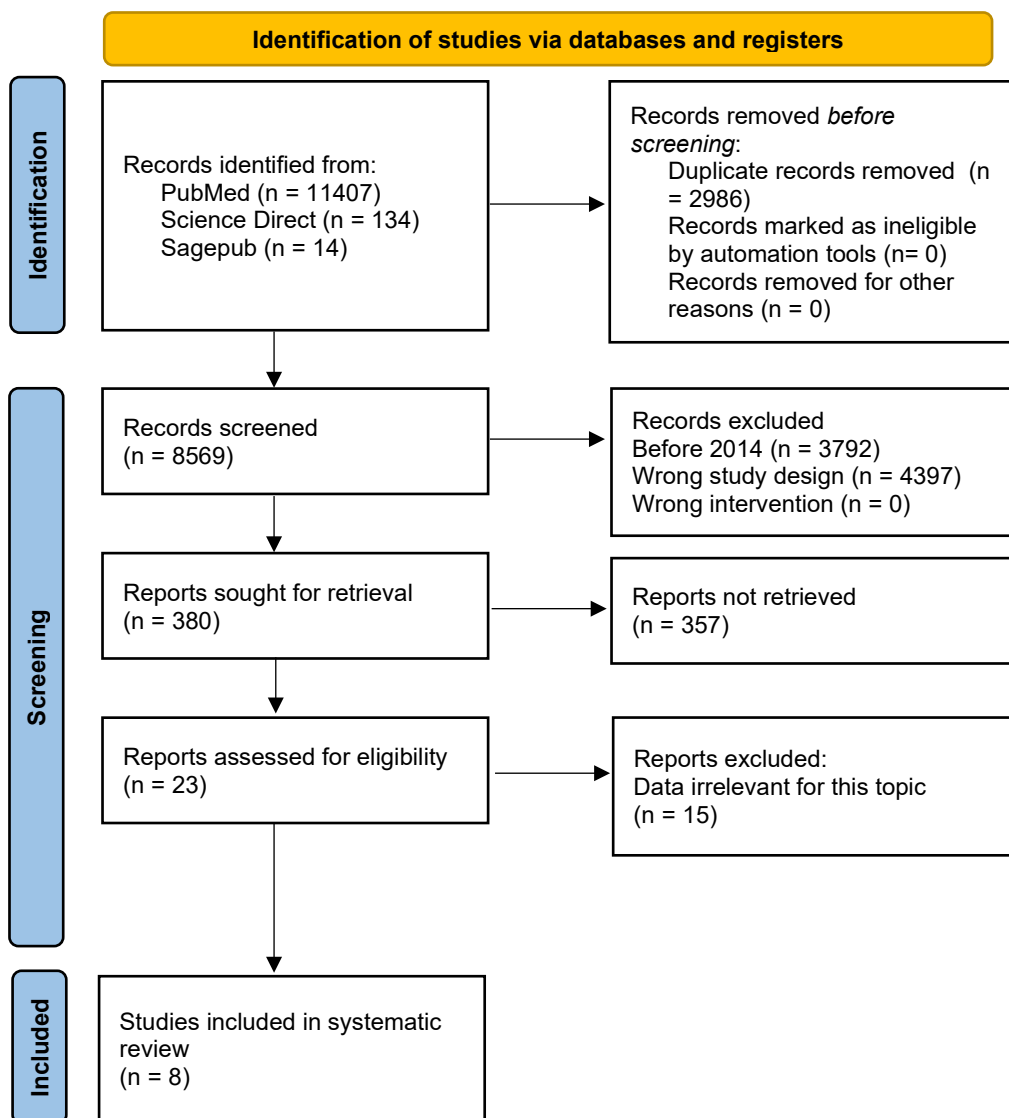


Figure 1. Article search flow chart

Table 2. Critical appraisal of Study

Parameters	(Yoshi zawa et al., 2015)	(Abde lhali m et al., 2016)	(Chen & Liao., 2016)	(Gadd am et al., 2016)	(Kim et al., 2017)	(Zeng et al., 2017)	(Pelai a et al., 2021)	(Madou ros et al., 2022)
1. Bias related to temporal precedence								
Is it clear in the study what is the “cause” and what is the “effect” (ie, there is no confusion about which variable comes first)?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2. Bias related to selection and allocation								
Was there a control group?	Yes	Yes	Yes	No	No	Yes	No	No
3. Bias related to confounding factors								
Were participants included in any comparisons similar?	Yes	Yes	No	No	No	Yes	Yes	No
4. Bias related to administration of intervention/exposure								
Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest?	Yes.	Yes.	No.	Yes.	No.	Yes.	No.	No.
5. Bias related to assessment, detection, and measurement of the outcome								
Were there multiple measurements of the outcome, both pre and post the intervention/exposure?	No	No	No	Yes	No	No	No	No
Were the outcomes of participants included in any comparisons measured in the same way?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Were outcomes measured in a reliable way?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
6. Bias related to participant retention								
Was follow-up complete and, if not, were differences between groups in terms of their follow-up adequately described and analyzed?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
7. Statistical conclusion validity								
Was appropriate statistical analysis used?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No

RESULT

We initiated the investigation by systematically gathering a significant assortment of papers from reputable sources such as Science Direct, PubMed, and SagePub. After a thorough three-stage screening process, we selected eight papers that were considered very pertinent to our ongoing systematic inquiry. Subsequently, we selected certain topics for further examination and meticulously evaluated each report. In order to expedite our study, we have included a concise summary of the evaluated information in Table 3.

Table 3. The literature included in this study

Author	Origin	Method	Sample	Result
Yoshizawa et al.¹³ (2015)	Japan	Experimental Study	181 participants	The study found that the Cr level was higher in the COPD group, but eGFR based on serum Cr (eGFRCr) was not significantly different between the two groups. The Cys level was higher in the COPD group, but eGFR based on serum Cys (eGFRcys) was lower. The prevalence of CKD was 31% in the COPD group and 8% in the non-COPD group, while 53% in the COPD group and 15% in the non-COPD group.
AbdelHalim et al.¹⁴ (2016)	Egypt	Case Control	240 patients	The study found significant differences in estimated glomerular filtration rate between COPD and control groups. COPD group had worse renal function and a higher percentage of concealed chronic renal failure. Group 2 had a higher percentage of concealed chronic renal failure than group 1 and control. Serum creatinine correlations were found with COPD assessment test, exacerbations, hospitalizations, predicted FVC, FEV1/FVC, maximum mid-expiratory flow, and peak expiratory flow. Estimated glomerular filtration rate also showed significant correlations with clinical and spirometry data.
Chen & Liao.¹⁵ (2016)	Taiwan	Cohort	23217 participants	The study analyzed the incidence rate of chronic kidney disease (CKD) per 104 person-years and adjusted hazard ratio (HR) between the case and control groups. The case group had a higher CKD incidence than the control group, with an adjusted HR of 1.61 times higher than the control group. Age also played a role in the incidence of CKD, with male patients experiencing a higher adjusted HR of 1.64 compared to the control group.
Gaddam et al.¹⁶ (2016)	USA	Systematic Review	19 studies	A systematic review of 19 eligible studies found that COPD was associated with CKD in

				epidemiological studies conducted in many countries. The odds ratio was 2.20, indicating a significantly increased prevalence of CKD. However, due to the nature of the research question, a randomized control trial was not possible due to the inclusion of observational studies.
Kim et al.¹⁷ (2017)	Korea	Retrospective Study	3393 participants	A study of 3393 participants found that 15.6% were diagnosed with COPD. Factors significantly associated with COPD included older age, lower education, BMI, pulmonary tuberculosis, current bronchial asthma, smoking, and CKD. The prevalence of eGFR levels in those with NLF and COPD varied.
Zeng et al.¹⁸ (201)	China	Prospective Study	212 participants	A study of 106 COPD and non-COPD patients found significantly higher incidences of concealed CRF. ADAMTS-13, D-dimer, and C-reactive protein were significantly associated with concealed CRF. The specificity and sensitivity of these markers were 100% and 81.2% at an ADAMTS-13 cutoff, respectively, with an area under the ROC curve of 0.959.
Pelaia et al.¹⁹ (2021)	Italy	Cohort	707 patients	CKD, a condition characterized by high serum uric acid levels and lower FEV1, was identified as a predictor of incident CKD in a study of 707 outpatients. The study found that UA and diabetes were independent predictors of rapidly declining renal function, while an increase in UA, an increase in baseline eGFR, and the presence of diabetes were independent predictors of CKD.
Madouros et al.³ (2022)	USA	Review	-	The correlation between COPD and CKD prevalence is evident in recent studies. COPD patients often have a higher prevalence of CKD, which increases the risk of mortality if these diseases coexist. This study gathered data from 2010-2021, focusing on observational studies on the prevalence and prognosis of comorbid COPD and CKD. Further research is needed to support this correlation.

DISCUSSION

The primary objective of this study was to evaluate the prevalence of chronic kidney disease (CKD) within the population of individuals diagnosed with chronic obstructive pulmonary disease (COPD) and to explore the potential associations between these two chronic conditions. Specifically, the study sought to quantify how common CKD is among COPD patients and to assess whether the presence of CKD is linked with specific characteristics or outcomes in COPD.

In the research conducted by Kim et al., it was reported that 15.6% of individuals aged 40 years and older were diagnosed with COPD. Within this cohort of COPD patients, 8.7% were found to have concomitant CKD. This finding highlights a notable overlap between these two conditions, suggesting a significant comorbidity rate.¹⁷ Further analysis, which controlled for various COPD-related factors, revealed a robust association between CKD and COPD. This association underscores the importance of considering CKD as a relevant factor in the management of

COPD patients, as it may influence clinical outcomes and overall patient management strategies.¹⁶ The study's results align with broader findings in the literature, such as those discussed by Barnes (2016), which emphasize the intertwined nature of CKD and COPD and suggest that integrated care approaches may be beneficial for this patient population.²⁰

CKD and COPD share several common risk factors, including advancing age, diabetes, hypertension, elevated body mass index (BMI), and cigarette smoking.²¹ Among never-smokers, additional risk factors include advancing age, a history of asthma, severe respiratory issues during childhood, passive smoking, and exposure to biomass fuel used for heating. Conversely, ever-smokers with COPD are particularly impacted by increased age, a history of asthma, and severe childhood respiratory problems.²² A comprehensive meta-analysis further corroborated these associations by accounting for potential confounding variables such as age, gender, BMI, and smoking status. This rigorous adjustment allowed for a clearer

understanding of the independent relationship between CKD and COPD, providing robust evidence of their interconnection.¹⁶ This meta-analysis underscores the importance of considering these risk factors in both research and clinical practice to better understand and manage the coexistence of CKD and COPD.¹⁶

Chronic obstructive pulmonary disease, a progressive lung condition, is increasingly recognized as a significant risk factor for CKD. While the exact mechanisms linking COPD with CKD remain incompletely understood, several contributing factors are hypothesized. Notably, the elderly population with COPD often has additional comorbidities such as diabetes, hypertension, and coronary artery disease (CAD)—all of which are established risk factors for CKD.^{23,24} COPD is also associated with systemic inflammation, including elevated levels of tumor necrosis factor-alpha (TNF- α), which exacerbates endothelial inflammation and accelerates atherosclerosis. This inflammatory cascade can contribute to the development of various

conditions, including diabetes, muscle wasting, and kidney disease.^{25,26} Supporting this, a meta-analysis of observational studies identified elevated serum concentrations of multiple inflammatory mediators in COPD patients, a phenomenon partly attributable to smoking.²⁷ These insights underscore the complex interplay between systemic inflammation, comorbid conditions, and the risk of CKD in COPD patients, highlighting the need for further research to elucidate the underlying mechanisms and develop targeted interventions.

COPD has been associated with several renal complications, including microalbuminuria, reduced renal blood flow, and heightened activity of the renin-angiotensin system, particularly in patients experiencing hypercapnia and hypoxia. These findings suggest that systemic microvascular injury may play a significant role in the progression of CKD among individuals with COPD.²⁸ Furthermore, the management of COPD often involves medications

that may have nephrotoxic potential. Patients with COPD are frequently prescribed drugs such as certain antibiotics, proton pump inhibitors (PPIs), and specific cardiovascular medications, which can adversely affect renal function over time. This association highlights the need for careful consideration of medication-related risks in the management of COPD.²⁹

The elevated prevalence of CKD in COPD patients underscores the substantial clinical implications of this comorbidity. It calls for a heightened awareness and proactive management approach to address the renal implications of COPD, ensuring that both the pulmonary and renal aspects of patient care are effectively integrated.

CONCLUSION

Chronic kidney disease (CKD) is a significant risk factor for COPD patients, with 15.6% of those aged 40 and older diagnosed with COPD. This study found a robust association between CKD and COPD, highlighting the importance of considering CKD in COPD

management. Common risk factors include advancing age, diabetes, hypertension, elevated BMI, and cigarette smoking. COPD is also associated with systemic inflammation, which can contribute to the development of conditions like diabetes, muscle wasting, and kidney disease. The elevated prevalence of CKD in COPD patients calls for proactive management approaches to address the renal implications of COPD.

DISCLOSURE STATEMENT

Disclosure Statement : The authors have no conflicts of Interest to declare

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