



BEYOND THE LUNGS: THE BURDEN OF SYSTEMIC MULTIMORBIDITY IN CURRENT TOBACCO SMOKERS

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ABSTRACT Background: Tobacco smoking is a major preventable cause of morbidity and mortality worldwide. While respiratory diseases such as chronic obstructive pulmonary disease (COPD) are well-recognized consequences of smoking, tobacco exposure affects multiple organ systems including the cardiovascular, renal, metabolic, gastrointestinal, skeletal, and nervous systems. The cumulative burden of these coexisting diseases among current smokers remains underexplored. **Objectives:** To study the clinical profile and prevalence of systemic comorbidities among current tobacco smokers and to characterize multimorbidity patterns among current tobacco smokers. **Methods:** A cross-sectional observational study was conducted among 400 current tobacco smokers attending a tertiary care center. Clinical records were reviewed for smoking-related comorbidities. Multimorbidity was defined as the presence of two or more chronic conditions, while complex multimorbidity was defined as three or more chronic conditions. Frequencies of individual comorbidities and multimorbidity combinations were analyzed. **Results:** The mean age of participants was 57.2 ± 12.3 years and the mean smoking exposure was 37.6 ± 17.7 pack-years. Hypertension was the most prevalent comorbidity (38.8%), followed by COPD (34.3%), cardiovascular disease (32.5%), chronic kidney disease (23.5%), diabetes mellitus (19.3%), pneumonia (15.8%), gastroesophageal reflux disease (11.3%), and respiratory failure (10.5%). Multimorbidity was present in 241 participants (60.3%), while complex multimorbidity was observed in 132 (33.0%). The prevalence of multimorbidity increased significantly with smoking burden, ranging from 27.3% among smokers with <20 pack-years to 83.3% among those with ≥ 60 pack-years ($\chi^2 = 29.33$, $df = 3$, $p < 0.001$) which is statistically significant. The most frequent dual-comorbidity cluster was chronic kidney disease with cardiovascular disease ($n=18$), while chronic kidney disease, hypertension, and pneumonia constituted the most common triple-comorbidity cluster ($n=9$). **Conclusions:** Current tobacco smokers attending a tertiary-care hospital exhibited a substantial burden of systemic multimorbidity extending far beyond the lungs. Cardiometabolic disorders predominate, with hypertension serving as the central disease hub linking cardiovascular, renal, metabolic, and respiratory conditions. These findings reinforce the importance of smoking cessation at all ages to prevent the progressive accumulation of tobacco-related comorbidities.

KEYWORDS : Smoking, Tobacco, Multimorbidity, Hypertension, Chronic Kidney Disease, Cardiovascular Disease, COPD, Smoking Cessation

INTRODUCTION

Tobacco smoking remains one of the leading preventable causes of disease and premature mortality worldwide. Despite substantial progress in tobacco control measures over recent decades, approximately 1.2 billion people continue to use tobacco globally, representing nearly one in five adults worldwide. Tobacco use is responsible for more than 8 million deaths annually and remains a major contributor to the global burden of non-communicable diseases. The majority of tobacco users reside in low- and middle-income countries, where smoking-related morbidity and mortality impose considerable healthcare and socioeconomic challenges.

Among the many adverse health consequences of smoking, chronic obstructive pulmonary disease (COPD) is one of the most important and well-recognized smoking-related disorders. COPD affects an estimated 400 million individuals worldwide and is a leading cause of disability and death globally. However, the harmful effects of tobacco exposure extend far beyond the respiratory system. Through mechanisms involving chronic systemic inflammation, oxidative stress, endothelial dysfunction, immune dysregulation, and accelerated biological aging, smoking contributes to the development of hypertension, COPD, cardiovascular disease, chronic kidney disease, diabetes mellitus and numerous other chronic conditions.

Increasing evidence suggests that tobacco smoking should be viewed as a multisystem disease process rather than a risk factor confined to pulmonary pathology. The coexistence of multiple chronic diseases, commonly referred to as multimorbidity, has emerged as a major global healthcare challenge. Multimorbidity is associated with reduced quality of life, increased healthcare utilization, polypharmacy, functional decline, and higher mortality. Smokers are particularly vulnerable to multimorbidity because the pathogenic effects of tobacco simultaneously affect multiple organ systems, promoting the accumulation of interconnected chronic diseases over time.

Although extensive research has examined individual smoking-related diseases, relatively few studies have evaluated the overall burden and

clustering patterns of systemic multimorbidity among current tobacco smokers. Understanding these patterns is important for identifying high-risk individuals, facilitating integrated disease management, improving screening strategies, and strengthening smoking cessation interventions. Demonstrating the widespread systemic consequences of tobacco exposure may also enhance public awareness regarding the benefits of smoking cessation at any stage of life.

Therefore, the present study was undertaken to evaluate the prevalence of systemic comorbidities among current tobacco smokers, characterize multimorbidity patterns, and assess the overall burden of tobacco-associated multisystem disease.

MATERIALS AND METHODS

Study Design and Setting

This cross-sectional observational study was conducted at the Department of Pulmonary Medicine, a tertiary care teaching hospital, between January 2025 to May 2026

Study Population

A total of 400 current tobacco smokers were included in the study. Consecutive eligible participants presenting during the study period were enrolled after fulfilling the predefined inclusion and exclusion criteria.

Inclusion Criteria

1. Adults aged ≥ 18 years.
2. Current tobacco smokers with a documented history of active smoking.
3. Individuals with available clinical records containing details regarding smoking history and comorbid illnesses.
4. Participants who provided informed consent for the use of their clinical data for research purposes.

Exclusion Criteria

1. Former smokers who had completely abstained from smoking.
2. Never-smokers.

3. Patients with incomplete clinical records.
4. Patients unwilling to participate in the study.
5. Individuals with acute illnesses without adequate documentation of chronic comorbid conditions

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using SPSS (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation (SD) or median with range, while categorical variables were expressed as frequencies and percentages. The association between smoking burden and multimorbidity was assessed using the chi-square test. A p-value <0.05 was considered statistically significant.

RESULTS TABLES

Table 1. Baseline Characteristics of the Study Population

Variable	Value
Mean age, years (SD)	57.2 ± 12.3
Median age, years	56
Age range, years	26–88
Mean pack-years (SD)*	37.6 ± 17.7
Median pack-years	36
Pack-year range	5–120

Table 2. Prevalence of Systemic Comorbidities Among Current Tobacco Smokers (n=400)

Comorbidity	n (%)
Hypertension	155 (38.8)
COPD	137 (34.3)
Cardiovascular disease	130(32.5)
Chronic kidney disease	94 (23.5)
Diabetes mellitus	77 (19.3)
Pneumonia	63 (15.8)
Gastroesophageal Reflux disease (GERD)	45 (11.3)
Respiratory failure	42 (10.5)
Hernia	17 (4.3)
Old pulmonary tuberculosis	13 (3.3)
Malignancy	12 (3.0)
Osteopenia/Osteoporosis	11 (2.8)
Cerebrovascular accident	7 (1.8)
Ventricular tachycardia	5 (1.3)
OSA	2 (0.5)
ILD	2 (0.5)
Dilated cardiomyopathy	2 (0.5)
Pulmonary arterial hypertension	3(0.8)
Hypoxic seizures	2 (0.5)

Table 3. Top Five Singly Occuring Comorbidities -

Comorbidity	n
COPD	66
Respiratory Failure	17
Pneumonia	12
Hypertension	10
Malignancy	9

Table 4. Top Five Dual-comorbidity Clusters

Cluster	n
CKD + Cardiovascular Disease	18
CKD + Pneumonia	13
COPD + Osteopenia/Osteoporosis	11
COPD + Cardiovascular Disease	10
Cardiovascular Disease + Pneumonia	9

Table 5. Top Five Triple-comorbidity Clusters

Triple-Comorbidity Cluster	n
CKD + Hypertension + Pneumonia	9
Hypertension + COPD + Cardiovascular Disease	8
CKD + Diabetes Mellitus + Hypertension	7
Cardiovascular Disease + Diabetes Mellitus + Hypertension	6
CKD + Cardiovascular Disease + Hypertension	6

Table 6. Top Five 4-Comorbidity Cluster

Four-Comorbidity Cluster	Patients	(n)
CKD + Cardiovascular Disease + Diabetes Mellitus + Hypertension		9
CKD + Diabetes Mellitus + GERD + Hypertension		5
Cardiovascular Disease + Diabetes Mellitus + Hypertension + Pneumonia		4

CKD + COPD + Diabetes Mellitus + Hypertension	3
CKD + Diabetes Mellitus + Hypertension + Pneumonia	3

Table 7. Top Five 5-Comorbidity Cluster

5-Comorbidity Cluster	n
CKD + Cardiovascular Disease + Diabetes Mellitus + GERD + Hypertension	3
CKD + Cardiovascular Disease + Diabetes Mellitus + Hypertension + Pneumonia	1
CKD + Cardiovascular Disease + GERD + Hypertension + Pneumonia	1
CKD + COPD + Cardiovascular Disease + Diabetes Mellitus + Hypertension	1
CKD + COPD + Cardiovascular Disease + GERD + Hypertension	1

Table 8. 6-Comorbidity Cluster

Six-Comorbidity Cluster	Patients(n)
CKD + Cardiovascular Disease + Diabetes Mellitus + GERD + Hypertension + Pneumonia	1
CKD + COPD + Cardiovascular Disease + Diabetes Mellitus + Hypertension + Pneumonia	1
CKD + COPD + Cardiovascular Disease + Diabetes Mellitus + GERD + Hypertension	1
CKD + Cardiovascular Disease + Diabetes Mellitus + GERD + Hypertension + Respiratory Failure	1
Total	4

Table 9. Burden of Multimorbidity

Number of Comorbidities	Patients (n)	Percentage (%)
0	10	2.5
1	149	37.3
2	109	27.3
3	73	18.3
4	47	11.8
5	8	2.0
6	4	1.0
Total	400	100.0

Table 10. Prevalence of SIMPLE Multimorbidity and Complex Multimorbidity

Measure	n (%)
No comorbidity	10 (2.5)
Single comorbidity	149 (37.3)
Simple Multimorbidity (≥2 comorbidities)	241 (60.3)
Complex multimorbidity (≥3 comorbidities)	132 (33.0)

Table 11. Relationship Between Smoking Burden and Multimorbidity

Pack-Year Category	Total (n)	Multimorbidity n (%)
<20	44	12 (27.27)
20–39.9	171	84 (49.1)
40–59.9	143	82 (57.3)
≥60	42	35 (83.3)

Result:

- $\chi^2 = 29.33$
- $df = 3$
- $p < 0.001$

DISCUSSION

The present study demonstrates a substantial burden of systemic multimorbidity among current tobacco smokers, highlighting that the adverse effects of tobacco extend far beyond the respiratory system. The study population had a mean age of 57.2 ± 12.3 years and a mean smoking exposure of 37.6 ± 17.7 pack-years, reflecting long-term tobacco use.

Hypertension was the most prevalent comorbidity (38.8%), followed by COPD (34.3%), cardiovascular disease (32.5%), chronic kidney disease (23.5%), and diabetes mellitus (19.3%). These findings indicate that smoking-related disease predominantly affects cardiovascular, renal, metabolic, and respiratory systems simultaneously. COPD was the most common isolated comorbidity, whereas hypertension frequently appeared in major multimorbidity clusters, suggesting its central role in the disease network.

The most common dual-comorbidity cluster was chronic kidney disease with cardiovascular disease, while chronic kidney disease, hypertension, and pneumonia formed the leading triple-comorbidity

cluster. More advanced four-, five-, and six-comorbidity clusters were largely dominated by combinations of hypertension, cardiovascular disease, chronic kidney disease, and diabetes mellitus, reflecting the cumulative systemic impact of tobacco exposure.

Multimorbidity was highly prevalent, affecting 60.3% of participants, while complex multimorbidity was observed in 33.0%. Furthermore, the prevalence of multimorbidity increased significantly with smoking burden, rising from 27.3% among smokers with <20 pack-years to 83.3% among those with ≥60 pack-years ($p < 0.001$). This finding demonstrates a clear dose-response relationship between cumulative tobacco exposure and the development of multiple chronic diseases.

Overall, the study supports the concept that smoking is a multisystem disorder rather than an isolated respiratory risk factor. Comprehensive screening for cardiovascular, renal, metabolic, and respiratory diseases, along with early smoking cessation interventions, is essential to reduce the growing burden of tobacco-related multimorbidity.

Study Limitations

This single-center, hospital-based cross-sectional study may limit the generalizability of the findings. Important confounding factors such as socioeconomic status, environmental exposures, and lifestyle variables were not assessed.

CONCLUSION

Our study on Current tobacco smokers show considerable burden of systemic multimorbidity that extends well beyond pulmonary disease. Hypertension, chronic kidney disease, cardiovascular disease, and diabetes mellitus formed the predominant multimorbidity network, with hypertension acting as the principal connecting condition.

These findings reinforce the concept that tobacco smoking is a multisystem disorder affecting multiple organs simultaneously rather than an isolated respiratory risk factor. Comprehensive screening for cardiovascular, renal, metabolic, and respiratory conditions should therefore be considered in smokers.

Smoking cessation at any age can provide significant benefits in preventing the development and progression of tobacco-related multimorbidity.

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