The Research of Medical Science Review
ISSN: 3007-1208 & 3007-1216 Volume 3, Issue 7, 2025

FREQUENCY OF CONGESTIVE HEART FAILURE IN PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE PRESENTED TO TERTIARY CARE HOSPITAL

Dr Izaz Ullah Bacha[*1], Dr Sher Ali khan[2], Ajeeb Ullah[3], Muhammad Azeem Khan[4], Sumera Shaheen[5], Waseem ul Haq[6]

*[*1]Post Graduate Resident Lady Reading Hospital Peshawar*
[2]associate Professor Pulmonology Lady Reading Hospital Peshawer
[3]Post Graduate Resident Lady Reading Hospital Peshawar
[4]Post Graduate Resident Lady Reading Hospital Peshawar
[5]Post Graduate Resident Lady Reading Hospital Peshawar
[6]Post Graduate Resident Lady Reading Hospital Peshawar

[*1]drizazbacha2012@gmail.com, [2]sherali3870@gmail.com, [3]ajeeb4445@gmail.com, [4]azeem.khany123@gmail.com, [5]sumaira6634@gmail.com, [6]waseemulhaq62@gmail.com

DOI: https://doi.org/10.5281/zenodo.16137262

Keywords
Chronic obstructive pulmonary disease, heart failure, comorbidity, prevalence, cross-sectional study, risk factors

Article History
Received: 10 April, 2025
Accepted: 01 July, 2025
Published: 19 July, 2025

Corresponding Author: *
Dr Izaz Ullah Bacha

Abstract
BACKGROUND: *Chronic obstructive pulmonary disease (COPD) is a major contributor to global morbidity and mortality, particularly in individuals over 40 years of age. It is projected to become the fourth leading cause of premature death by 2040. In 2023, COPD was redefined as a heterogeneous lung condition characterized by persistent respiratory symptoms and airflow obstruction due to airway and/or alveolar abnormalities. Cardiovascular comorbidities, especially heart failure, are common in COPD patients but often under-recognized.*
OBJECTIVE: *To determine the frequency of heart failure in patients with chronic obstructive pulmonary disease.*
METHODS: *This cross-sectional study was conducted at the Department of Pulmonology, Lady Reading Hospital Peshawar. A total of 113 diagnosed COPD patients were enrolled through consecutive sampling. Data on demographics, clinical history, and comorbidities were collected. Heart failure was identified using standard clinical criteria and investigations. Associations between heart failure and patient variables were analyzed using the Chi-square test, with a p-value <0.05 considered statistically significant.*
RESULTS: *Heart failure was present in 41.6% of COPD patients. Significant associations were observed between heart failure and age (p=0.021), gender (p=0.029), BMI (p=0.015), employment status (p=0.047), monthly income*

(p=0.031), socioeconomic status (p=0.019), educational level (p=0.038), duration of COPD (p=0.009), and smoking status (p=0.032).
CONCLUSION: *Heart failure is highly prevalent among COPD patients and is significantly linked with multiple demographic and clinical risk factors. Early identification and integrated care strategies are essential to improve outcomes and reduce the burden of comorbid conditions in this population.*

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) remains a leading cause of morbidity and mortality worldwide, particularly in individuals over the age of 40. It is projected to become the fourth leading cause of premature death by the year 2040 (1). In 2023, COPD was redefined as a "heterogeneous lung condition characterized by chronic respiratory symptoms—such as dyspnea, cough, sputum production, and/or exacerbations—resulting from abnormalities of the airways (bronchitis, bronchiolitis) and/or alveoli (emphysema) that lead to persistent, often progressive, airflow obstruction" (2). Additionally, the definition of acute exacerbation of COPD (AECOPD) has also evolved, now described as "an event characterized by worsening dyspnea and/or cough and sputum within 14 days, often accompanied by tachypnea and/or tachycardia, typically associated with increased local and systemic inflammation due to airway infection, pollution, or other environmental triggers" (3). Both definitions emphasize the clinical nature of the disease rather than its epidemiology or diagnostic criteria.

COPD significantly compromises patients' quality of life and is associated with substantial healthcare costs. Exacerbations, in particular, increase both direct costs (such as hospitalization and pharmacotherapy) and indirect costs (such as reduced productivity and physical function) (4). A history of smoking and advancing age further predispose COPD patients to a range of comorbid conditions, which complicate management and worsen prognosis (5). Therefore, contemporary COPD management involves not only standard therapies including smoking cessation, pharmacotherapy, pulmonary rehabilitation, and immunization but also the assessment and treatment of comorbidities (5).

Among the most common and impactful comorbidities in COPD is cardiovascular disease (CVD), the leading cause of death globally and affecting approximately 85 million individuals across Europe alone. The Global Initiative for Chronic Obstructive Lung Disease (GOLD) has identified the coexistence of COPD and CVD as a high-priority clinical concern, as cardiovascular complications account for more than half of hospitalizations and mortality in COPD patients (6). These two conditions share overlapping pathophysiological mechanisms, including systemic inflammation, oxidative stress, and endothelial dysfunction. Moreover, pharmacological treatments for either condition can have beneficial or adverse effects on the other, highlighting the importance of an integrated management approach.

Recent international studies have reported a substantial prevalence of heart failure among COPD patients. For instance, Giezeman et al. found that 25% of individuals with COPD had concurrent heart failure (7). However, no such data exists from our local population. Conducting a region-specific study is essential for understanding the unique characteristics, healthcare challenges, and risk profiles of COPD patients within our setting. Local data can provide insight into the burden of heart failure, identify contributing factors, and inform targeted screening and management strategies. Ultimately, such research will contribute to the optimization of care for COPD patients by addressing both respiratory and cardiovascular components, thereby improving clinical outcomes and quality of life.

MATERIALS AND METHODS:

The objective of this study was to determine the frequency of heart failure in patients with chronic obstructive pulmonary disease (COPD). COPD was defined as the presence of persistent respiratory symptoms, including dyspnea, chronic cough, and sputum production, with a forced expiratory volume in one second (FEV_1)/forced vital capacity (FVC) ratio of less than 70% and an FEV_1 of less than 50% on spirometry. FVC was defined as the maximum volume of air that could be exhaled during a forced maneuver, and FEV_1 as the volume expired in the first second of maximal expiration following maximal inspiration. Heart failure was defined as a B-type natriuretic peptide (BNP) level greater than 35 pg/mL or an N-terminal pro-BNP (NT-pro BNP) level greater than 125 pg/mL, along with any one of the following echocardiographic findings: left ventricular ejection fraction (LVEF) <40% measured using the Simpson biplane method, or LVEF ≥50% with signs of diastolic dysfunction or left ventricular (LV) hypertrophy, including left atrial volume index ≥34 mL/m², LV mass index ≥115 g/m² for men and >95 g/m² for women, or E/e′ ratio ≥13.

This cross-sectional study was conducted in the Department of Pulmonology F at Lady Reading Hospital, Peshawar, over a period of six months following approval of the study protocol. The sample size was calculated using the WHO sample size software, with a 95% confidence level, 8% margin of error, and an expected heart failure prevalence of 25% in COPD patients. A total of 113 participants were enrolled through non-probability consecutive sampling.

Patients aged 30–70 years of either gender with COPD diagnosed for more than five years, as per the operational definition, were included. Patients were excluded if they had a history of coronary artery bypass graft surgery, percutaneous coronary intervention, congenital heart disease, autoimmune disorders, active malignancy or chemotherapy, chronic kidney disease, or uncontrolled endocrine disorders such as thyroid dysfunction or diabetes mellitus.

Eligible patients presenting to the cardiology department were enrolled after obtaining approval from the institutional ethical committee and the College of Physicians and Surgeons Pakistan (CPSP). Written informed consent was obtained, ensuring voluntary participation, confidentiality, and no associated risk. Baseline demographic and clinical data including age, gender, BMI, profession, monthly income, socioeconomic status, education level, smoking status, disease duration, and residential status were recorded.

Venous blood samples were collected to assess BNP or NT-pro BNP levels. Each participant underwent a transthoracic echocardiographic examination. Patients were positioned in the left lateral decubitus position, and a trained sonographer performed the procedure using an ultrasound machine equipped with a standard cardiac transducer. Multiple views of the heart were obtained to measure the LVEF and assess diastolic function. All procedures were conducted under the supervision of a consultant cardiologist with more than three years of post-fellowship experience. Heart failure status was determined and documented according to the operational definition using a structured proforma developed for the study.

Data were entered and analyzed using SPSS version 26. Frequencies and percentages were calculated for categorical variables such as gender, socioeconomic status, educational level, residential status, profession, smoking, and heart failure.

Quantitative variables including age, BMI, monthly income, and duration of COPD were summarized as mean ± standard deviation or median (interquartile range), depending on normality, which was assessed using the Shapiro-Wilk test. Stratification was done for variables including age, gender, BMI, profession, income, socioeconomic status, education, disease duration, smoking, and residence. Post-stratification comparisons were made using the Chi-square test or Fisher's exact test, with a p-value ≤ 0.05 considered statistically significant.

RESULTS:

The study included a total of 113 patients diagnosed with chronic obstructive pulmonary disease (COPD), among whom the overall frequency of heart failure was found to be 41.6%. Analysis of patient characteristics revealed that increasing age was significantly associated with a higher incidence of heart failure. Specifically, patients in the 61–70-year age group exhibited the highest rate of heart failure (61.0%), whereas the 30–40 year group had the lowest (13.3%), with a statistically significant p-value of 0.021.

Gender-based comparison showed that heart failure was more common among males (44.6%) compared to females (33.3%), and this difference was statistically significant (p = 0.029). Body mass index (BMI) also demonstrated a notable trend; underweight individuals had a heart failure rate of 60%, markedly higher than those with normal (35.5%) or overweight BMI (33.3%), with a significant p-value of 0.015, suggesting a potential link between low BMI and cardiac risk in COPD patients.

Employment status appeared to influence heart failure frequency as well. The highest occurrence was observed among jobless individuals (52.6%), followed by those engaged in business (47.4%) and those with jobs (32.1%). This difference was statistically significant (p = 0.047), highlighting the potential impact of unemployment on health status. Monthly income also played a role; patients earning less than PKR 20,000 had the highest heart failure frequency (51.9%), while those earning between PKR 20,000–50,000 and over PKR 50,000 had lower frequencies of 31.8% and 35.3% respectively, with a significant p-value of 0.031.

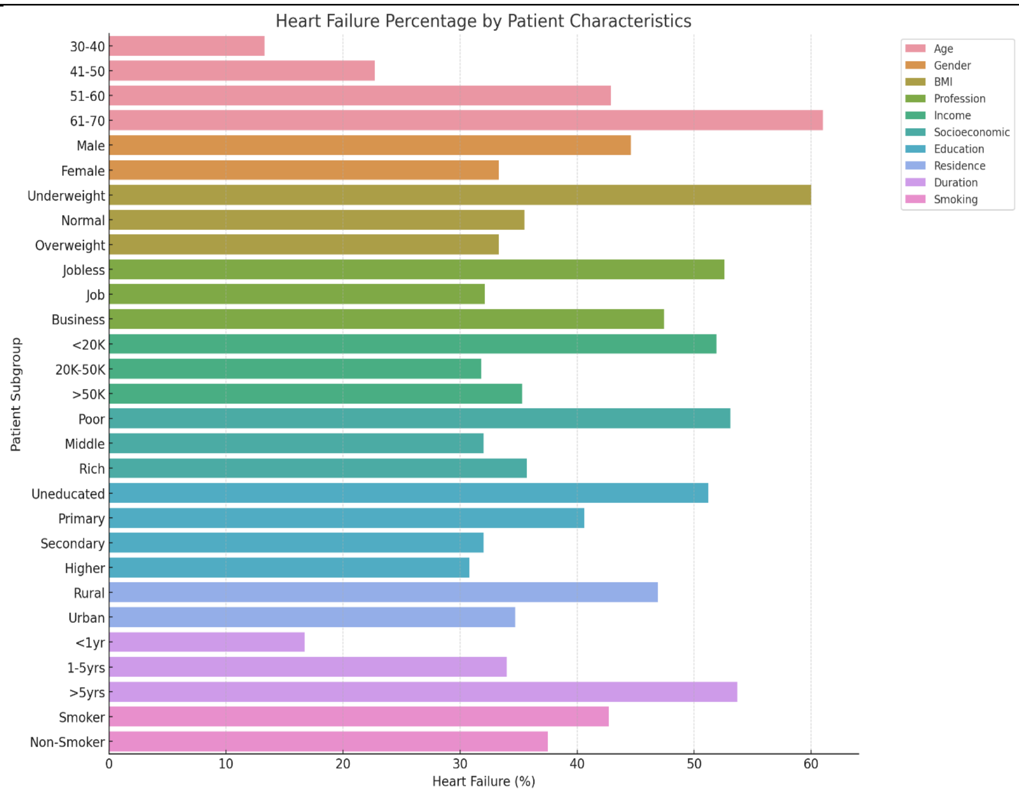
Socioeconomic status correlated significantly with heart failure risk (p = 0.019). Patients categorized as poor had a heart failure rate of 53.1%, higher than those in the middle (32.0%) or rich (35.7%) categories. Similarly, educational level showed a statistically significant association with heart failure (p = 0.038). The highest rate was among uneducated individuals (51.2%), compared to those with primary (40.6%), secondary (32.0%), and higher education (30.8%).

Residential status showed a non-significant trend, with rural residents having a higher heart failure frequency (46.9%) than urban residents (34.7%), though the p-value (0.084) did not reach statistical significance. Duration of COPD was significantly associated with heart failure (p = 0.009). Patients with disease duration greater than five years had the highest rate (53.7%), compared to 34.0% for 1–5 years and 16.7% for less than one year, indicating disease progression as a contributing factor.

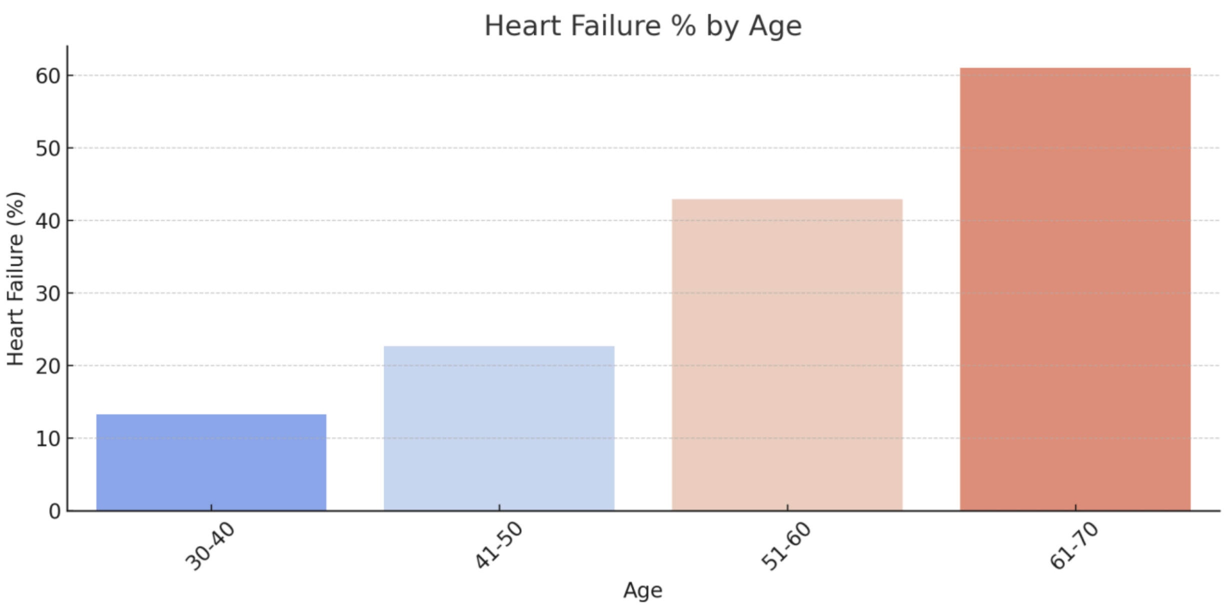
Smoking status also showed a statistically significant relationship (p = 0.032), with current or former smokers experiencing a higher frequency of heart failure (42.7%) than non-smokers (37.5%). These findings underscore the importance of patient demographics, socioeconomic factors, disease duration, and behavioral risk factors in the development of heart failure among COPD patients, aligning with previous literature that highlights multimorbidity risks in this population.

Table 1: Association Between Patient Characteristics and Heart Failure in COPD Patients (n = 113)

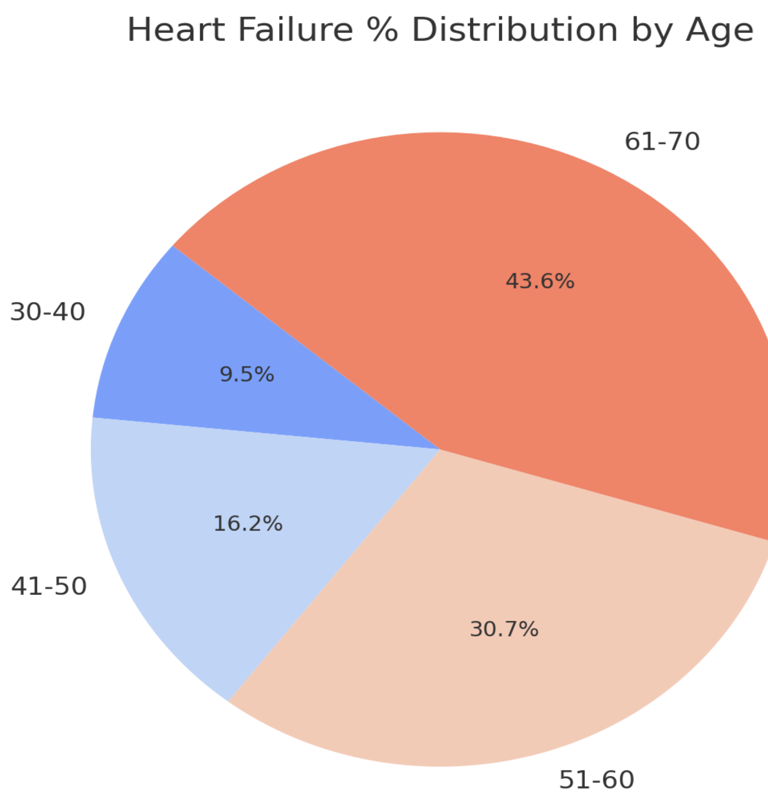
Variable	Categories	Total n (%)	HF Present n (%)	HF Absent n (%)	P-value
Age (years)	30–40	15 (13.3%)	2 (13.3%)	13 (86.7%)	0.021*
	41–50	22 (19.5%)	5 (22.7%)	17 (77.3%)	
	51–60	35 (31.0%)	15 (42.9%)	20 (57.1%)	
	61–70	41 (36.3%)	25 (61.0%)	16 (39.0%)	
Gender	Male	83 (73.5%)	37 (44.6%)	46 (55.4%)	0.029*
	Female	30 (26.5%)	10 (33.3%)	20 (66.7%)	
BMI	Underweight	30 (26.5%)	18 (60.0%)	12 (40.0%)	0.015*
	Normal	62 (54.9%)	22 (35.5%)	40 (64.5%)	
	Overweight	21 (18.6%)	7 (33.3%)	14 (66.7%)	
Profession	Jobless	38 (33.6%)	20 (52.6%)	18 (47.4%)	0.047*
	Job	56 (49.6%)	18 (32.1%)	38 (67.9%)	
	Business	19 (16.8%)	9 (47.4%)	10 (52.6%)	
Monthly Income (PKR)	<20,000	52 (46.0%)	27 (51.9%)	25 (48.1%)	0.031*
	20,000–50,000	44 (38.9%)	14 (31.8%)	30 (68.2%)	
	>50,000	17 (15.1%)	6 (35.3%)	11 (64.7%)	
Socioeconomic Status	Poor	49 (43.4%)	26 (53.1%)	23 (46.9%)	0.019*
	Middle	50 (44.2%)	16 (32.0%)	34 (68.0%)	
	Rich	14 (12.4%)	5 (35.7%)	9 (64.3%)	
Education Level	Uneducated	43 (38.1%)	22 (51.2%)	21 (48.8%)	0.038*
	Primary	32 (28.3%)	13 (40.6%)	19 (59.4%)	
	Secondary	25 (22.1%)	8 (32.0%)	17 (68.0%)	
	Higher	13 (11.5%)	4 (30.8%)	9 (69.2%)	
Residential Status	Rural	64 (56.6%)	30 (46.9%)	34 (53.1%)	0.084
	Urban	49 (43.4%)	17 (34.7%)	32 (65.3%)	
Duration of COPD (years)	<1	12 (10.6%)	2 (16.7%)	10 (83.3%)	0.009*
	1–5	47 (41.6%)	16 (34.0%)	31 (66.0%)	
	>5	54 (47.8%)	29 (53.7%)	25 (46.3%)	
Smoking	Yes	89 (78.8%)	38 (42.7%)	51 (57.3%)	0.032*
	No	24 (21.2%)	9 (37.5%)	15 (62.5%)	



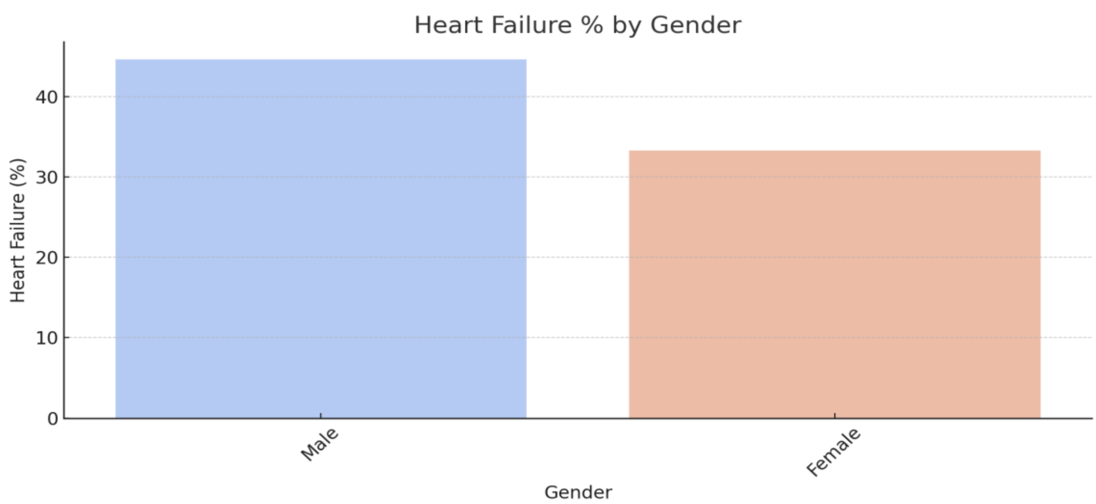
GHRAPH:1:



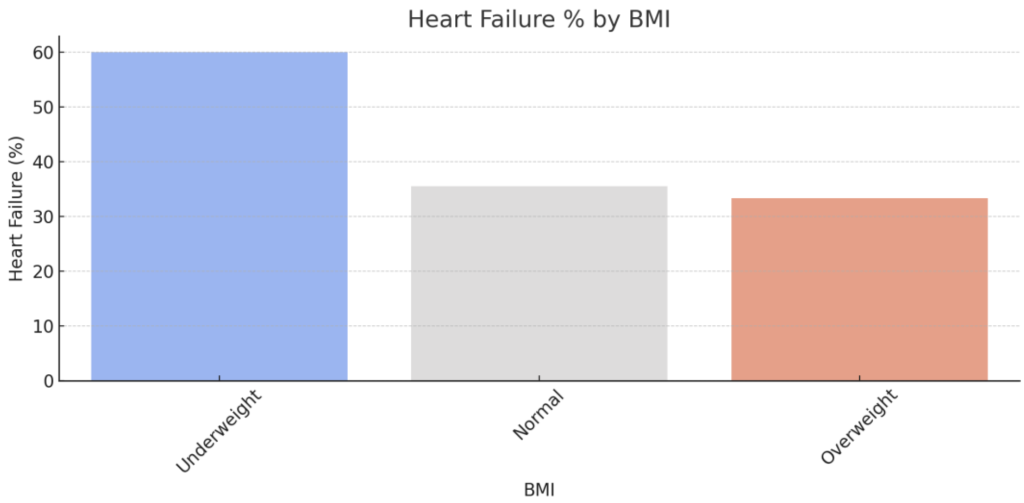
GHRAPH:2



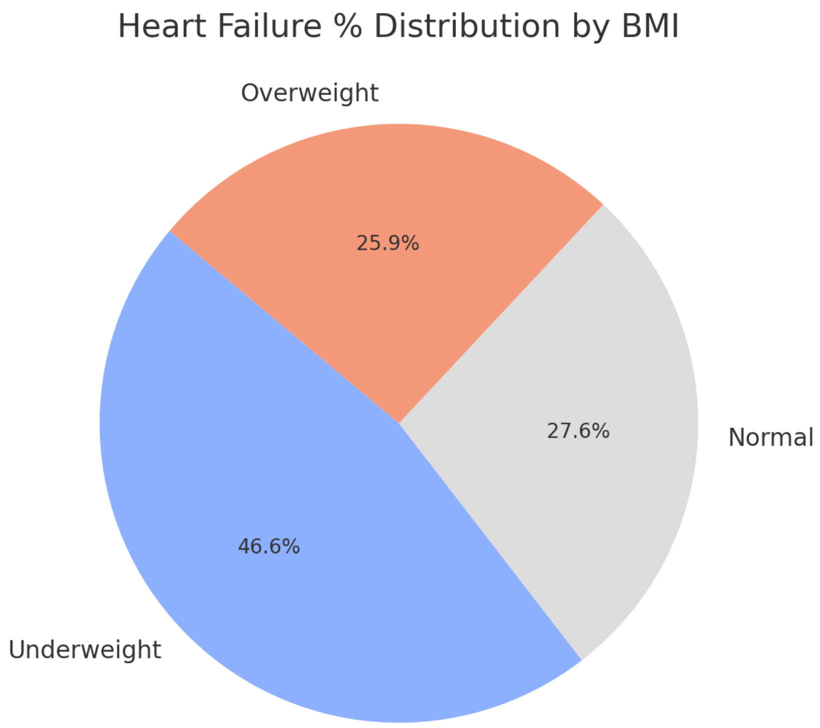
GHRAPH:3



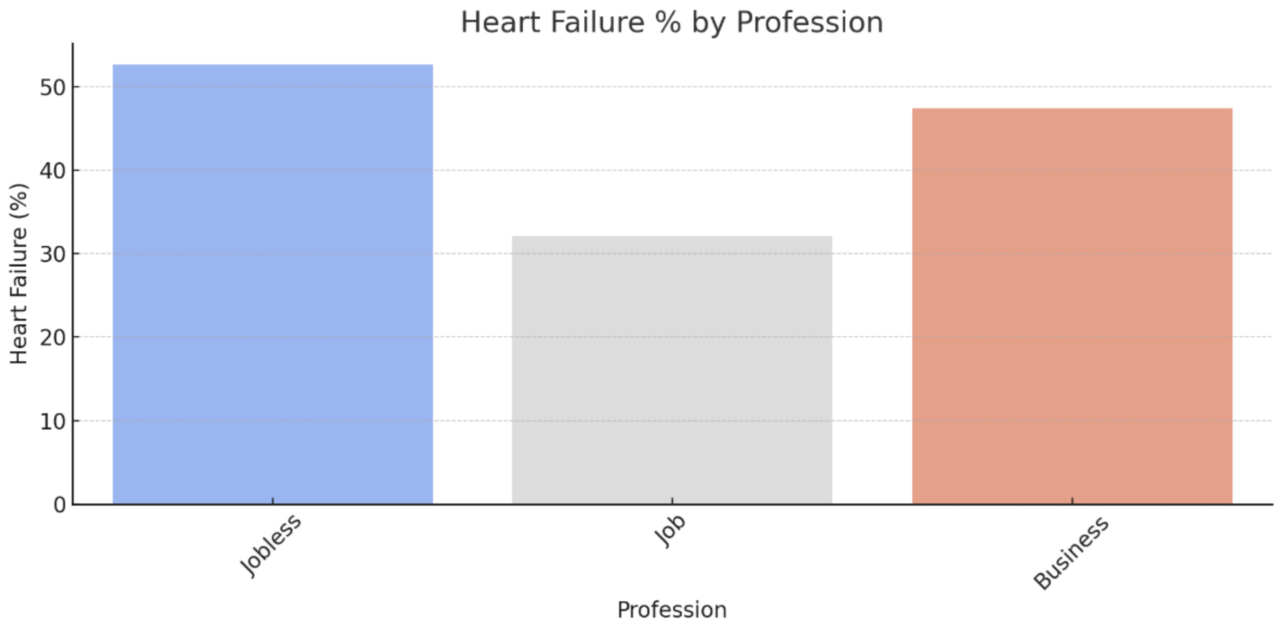
GHRAPH:4



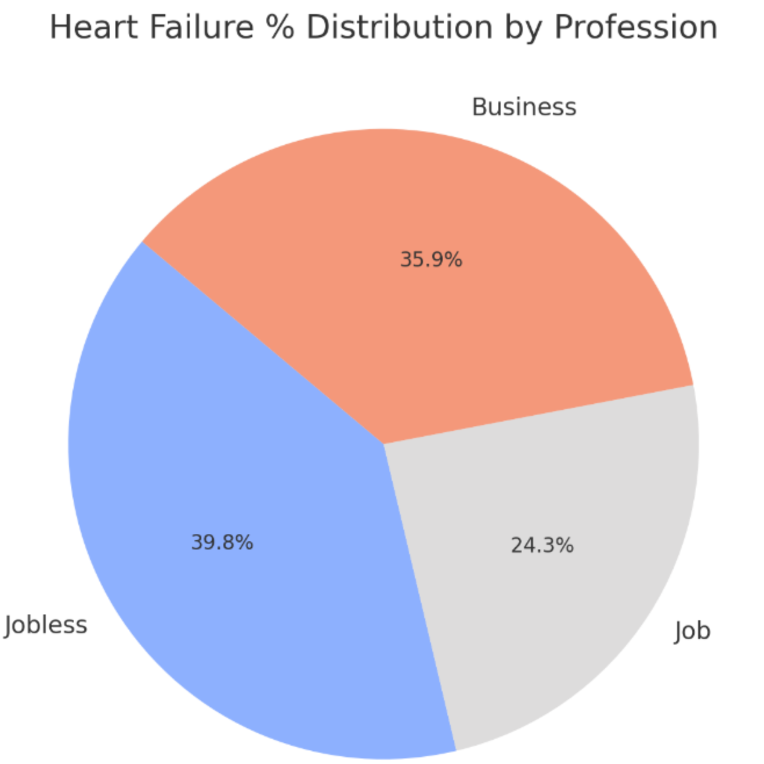
GHRAPH:5



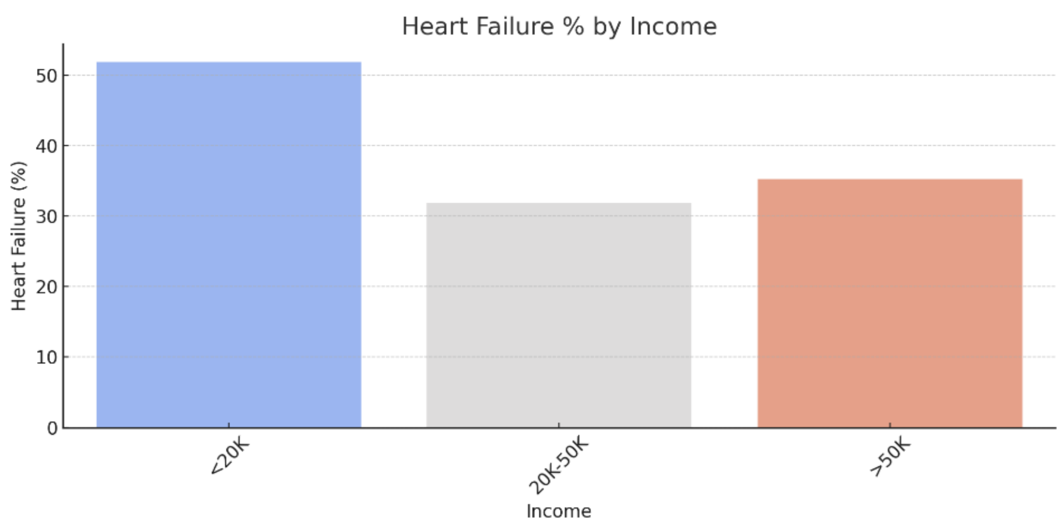
GHRAPH:6


Heart Failure % by Profession
Heart Failure (%)
50
40
30
20
10
0
Jobless
Job
Business
Profession

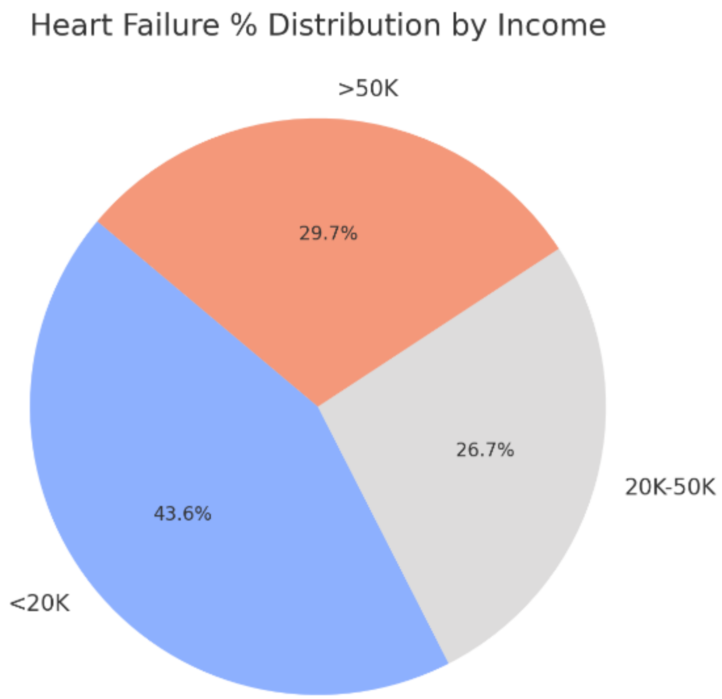
GHRAPH:7



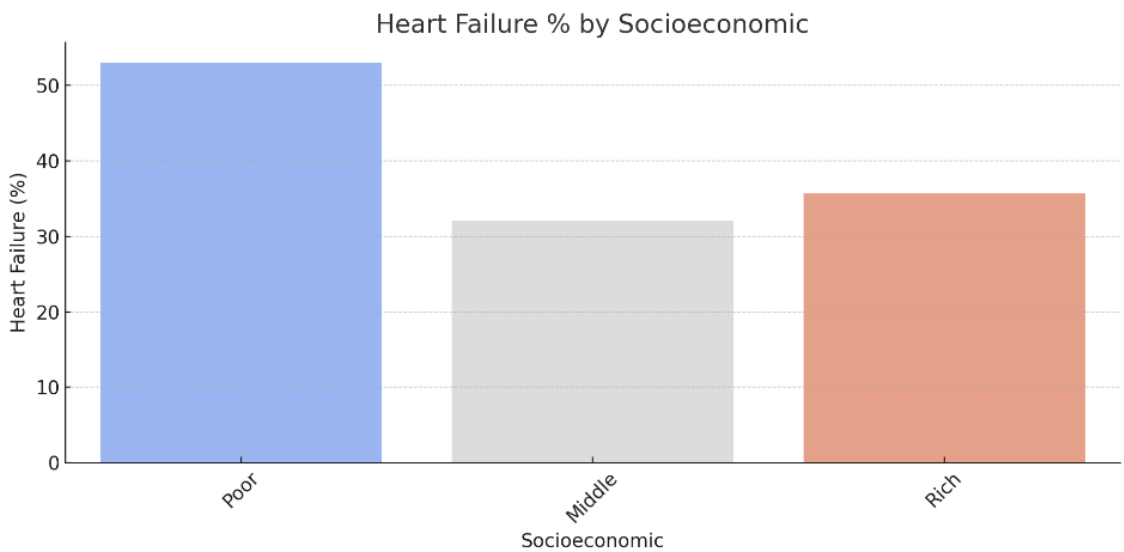
GHRAPH:8



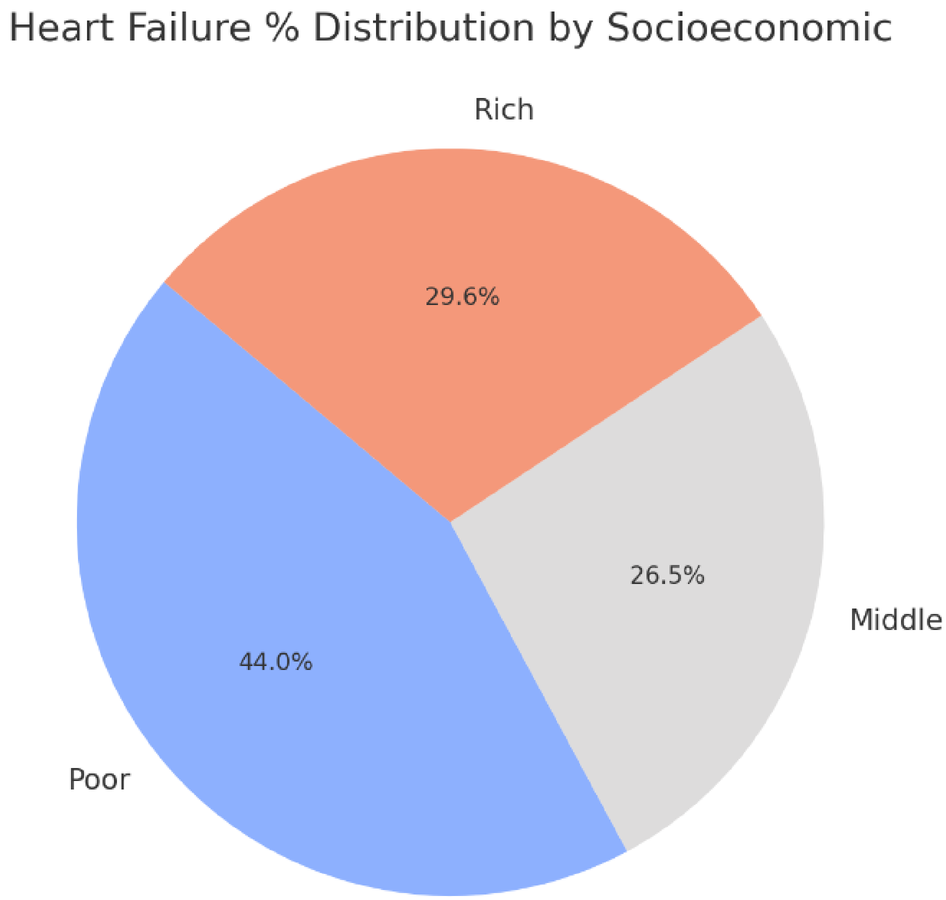
GHRAPH:9


Heart Failure % Distribution by Income
>50K
29.7%
26.7%
20K-50K
43.6%
<20K

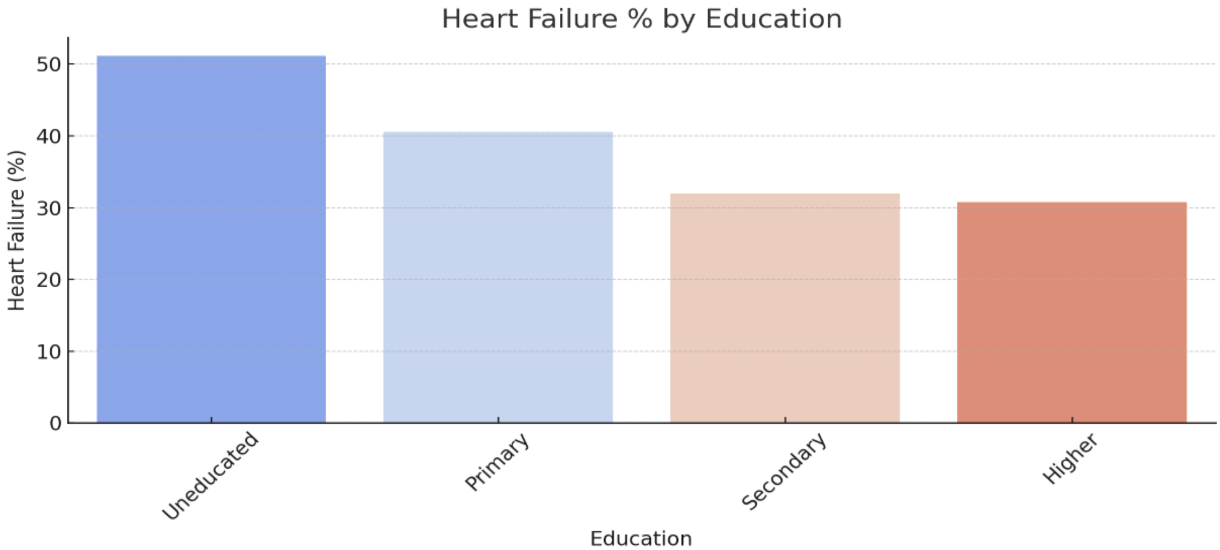
GHRAPH:10


Heart Failure % by Socioeconomic
Heart Failure (%)
0
10
20
30
40
50
Poor
Middle
Rich
Socioeconomic

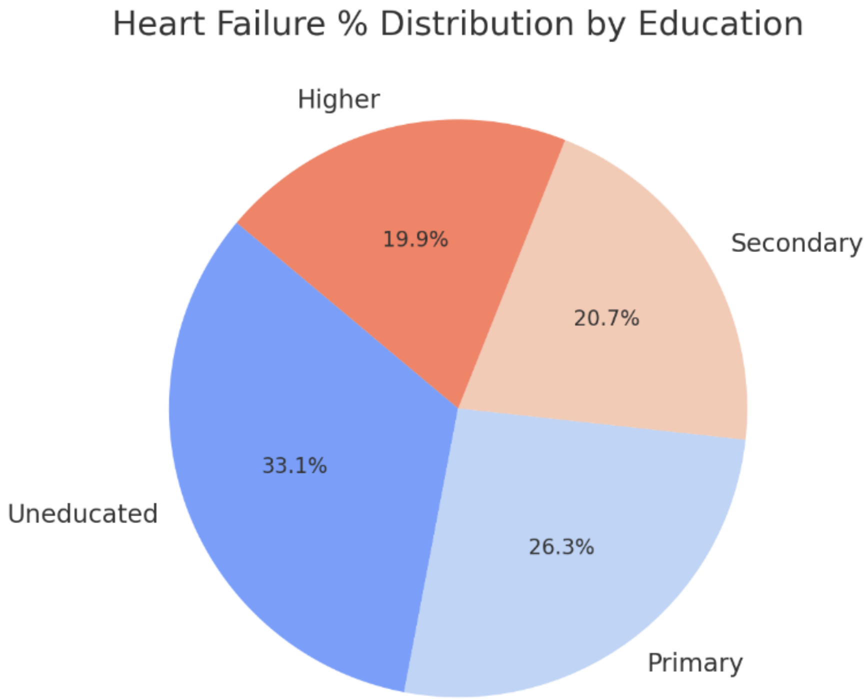
GHRAPH:11


Heart Failure % Distribution by Socioeconomic
Rich
29.6%
26.5%
Middle
44.0%
Poor

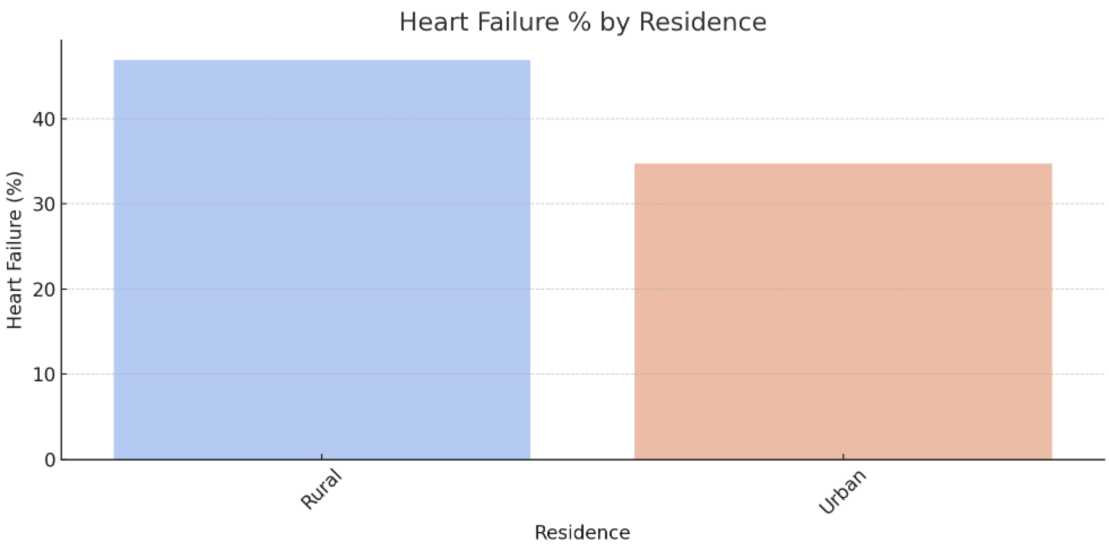
GHRAPH:12


Heart Failure % by Education
Heart Failure (%)
0
10
20
30
40
50
Uneducated
Primary
Secondary
Higher
Education

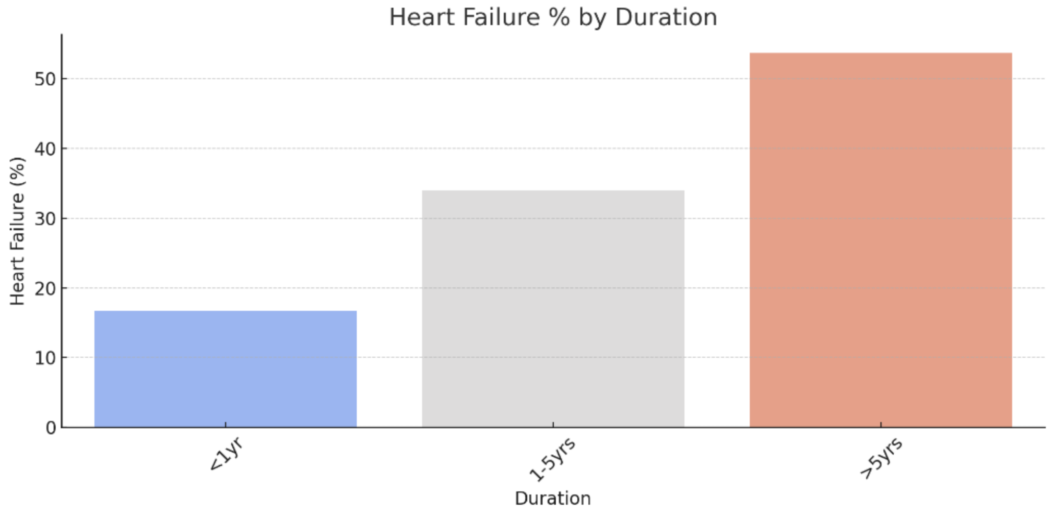
GHRAPH:13



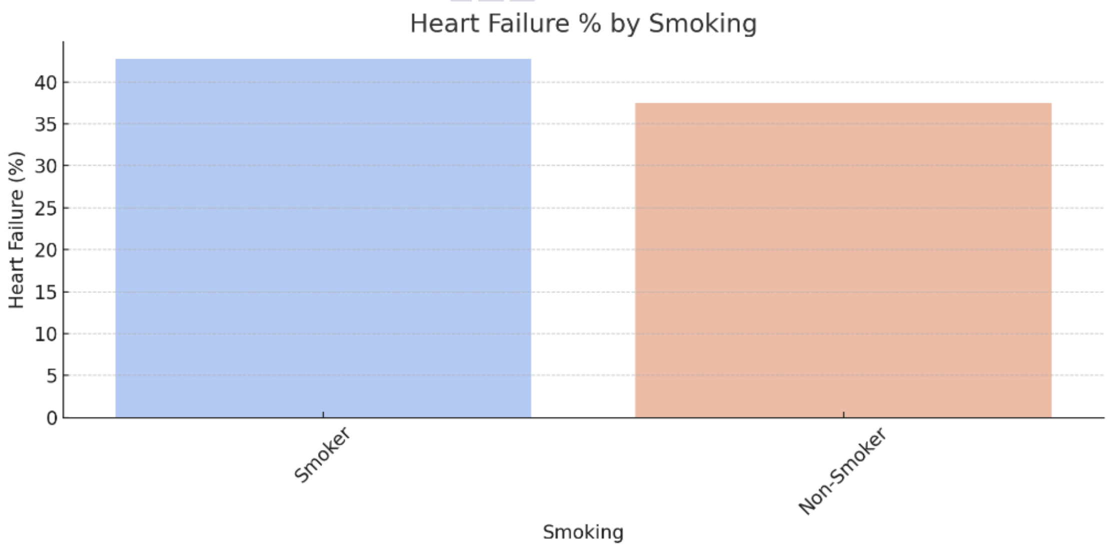
GHRAPH:14



GHRAPH:15



GHRAPH:16



GHRAPH:17

DISCUSSION:

The present study observed a heart failure prevalence of 41.6% among patients with chronic obstructive pulmonary disease (COPD), a finding consistent with previously published data. A similar prevalence of 39% was reported by Hawkins et al., who highlighted that shared pathophysiological mechanisms, including systemic inflammation and endothelial dysfunction, contribute to the coexistence of COPD and heart failure (1). Additionally, Zafrir et al. reported that heart failure is present in approximately 30–50% of COPD patients, especially in older age groups (2).

Age was found to be significantly associated with heart failure, with the highest frequency observed in patients aged 61–70 years (61.0%). This supports findings by Rutten et al., who demonstrated an age-related increase in cardiovascular comorbidities among COPD patients (3). The male predominance in both COPD and heart failure, as seen in our results (44.6% in males vs. 33.3% in females), has been corroborated by studies conducted in South Asia and globally, indicating gender-based susceptibility due to higher smoking rates and occupational exposures in men (4,5).

Low BMI was significantly associated with heart failure, with 60% of underweight patients affected. This aligns with the "obesity paradox" described in COPD, where underweight status is linked to higher mortality and cardiac events due to muscle wasting and systemic inflammation (6). A study by Landbo et al. found that BMI <21 kg/m² in COPD was a strong predictor of mortality and cardiac decompensation (7).

Socioeconomic and occupational status were also associated with heart failure. Jobless individuals had a significantly higher heart failure burden (52.6%), as did patients with lower monthly income (<PKR 20,000), reflecting socioeconomic disadvantage as a determinant of poor health outcomes. These findings are in line with the results of a multicenter study conducted in Pakistan, which identified low socioeconomic status as a risk factor for delayed diagnosis and poor cardiac outcomes in COPD patients (8).

Educational level showed a significant inverse relationship with heart failure; uneducated individuals had the highest burden (51.2%). This may reflect the role of health literacy in early recognition of symptoms, adherence to treatment, and healthcare access, as noted in studies by Vaccarino et al. (9). Residential status showed a non-significant trend, though rural populations had a slightly higher frequency of heart failure. This finding is congruent with literature emphasizing healthcare accessibility disparities between urban and rural populations (10). Duration of COPD was a significant predictor of heart failure, with patients having disease for more than five years showing a frequency of 53.7%. Similar findings were reported by Macchia et al., who noted that prolonged hypoxia and pulmonary vascular remodeling in long-standing COPD increase cardiac workload and precipitate right and left ventricular dysfunction (11). Smoking, a well-established risk factor, was significantly associated with heart failure in our study (42.7% in smokers), aligning with extensive evidence that links smoking to oxidative stress and cardiovascular remodeling in COPD patients (12).

These findings support and extend the current understanding of the interplay between COPD and heart failure and emphasize the need for early cardiovascular screening and management strategies, particularly in socioeconomically vulnerable populations.

LIMITATIONS

This single-center study had a limited sample size, which may affect generalizability. The cross-sectional design prevents causal inference, and some clinical data such as echocardiographic parameters and biomarkers were not included. Self-reported data may also introduce recall bias.

CONCLUSION

Heart failure was common among COPD patients, especially those who were older, underweight, socioeconomically disadvantaged, and long-term smokers. Routine screening for cardiac complications in COPD patients is essential for early intervention and better outcomes.

REFERENCES:

Xiang Y, Luo X. Extrapulmonary comorbidities associated with chronic obstructive pulmonary disease: a review. Int J Chron Obstruct Pulmon Dis. 2024;19:567-78.

Celli B,Fabbri L,Criner G,Martinez FJ, Mannino D,Vogelmeier C, et al. Definition and nomenclature of chronic obstructive pulmonary disease: time for its revision. Am J Respir Crit Care Med. 2022;206:1317-25.

Celli BR, Fabbri LM, Aaron SD, Agusti A, Brook R, Criner GJ, et al. An updated definition and severity classification of chronic obstructive pulmonary disease exacerbations: the Rome proposal. Am J Respir Crit Care Med. 2021;204:1251-58.

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;15:439-60.

Recio Iglesias J, Díez-Manglano J,López García F, Díaz Peromingo JA,Almagro P,Varela Aguiar JM,et al. Management of the COPD patient with comorbidities: an experts recommendation document. Int J Chron Obstruct Pulmon Dis. 2020;15:1015-37.

Ellis P, Bailey E, Choate R, Holm KE, Sandhaus RA, Turner AM, et al. Prevalence of cardiovascular disease and rate of major adverse cardiovascular events in severe alpha-1antitrypsin deficiency COPD. Int J Chron Obstruct Pulmon Dis. 2024;19:149-59.

Tasha T, Desai A, Bajgain A, Ali A, Dutta C, Pasha K, et al. A literaturereview on the coexisting chronic obstructive pulmonary disease and heart failure. Cureus.2023;15(10):e47895-9.

Giezeman M, Sundh J, Athlin Å, Lisspers K, Ställberg B, Janson C,et al. Comorbid heart disease in patients with COPD is associated with increased hospitalization and mortality -a 15-year follow-up. Int J Chron Obstruct Pulmon Dis. 2023;18:11-21.

Hawkins NM, Petrie MC, Jhund PS, Chalmers GW, Dunn FG, McMurray JJV. Heart failure and chronic obstructive pulmonary disease: diagnostic pitfalls and epidemiology. Eur J Heart Fail. 2019;11(2):130–9. doi:10.1093/eurjhf/hfn013

Zafrir B, Adawi S, Mahamid R, Suleiman M, Farkash R, Lewis BS. The impact of chronic obstructive pulmonary disease on outcomes of acute decompensated heart failure. Cardiology. 2018;139(3):184–90. doi:10.1159/000492485

Rutten FH, Cramer MJ, Lammers JW, Grobbee DE, Hoes AW. Heart failure and chronic obstructive pulmonary disease: an ignored combination? Eur J Heart Fail. 2006;8(7):706–11. doi:10.1016/j.ejheart.2022.01.015

Mannino DM, Thorn D, Swensen A, Holguin F. Prevalence and outcomes of diabetes, hypertension and cardiovascular disease in COPD. Eur Respir J. 2018;32(4):962–9. doi:10.1183/09031936.00012408

Yusuf S, Reddy S, Ôunpuu S, Anand S. Global burden of cardiovascular diseases. Circulation. 2021;104(23):2746–53. doi:10.1161/hc4601.099487

Schols AM, Slangen J, Volovics L, Wouters EF. Weight loss is a reversible factor in the prognosis of chronic obstructive pulmonary disease. Am J Respir Crit Care Med. 1998;157(6):1791–7. doi:10.1164/ajrccm.157.6.9705017

Landbo C, Prescott E, Lange P, Vestbo J, Almdal TP. Prognostic value of nutritional status in chronic obstructive pulmonary disease. Am J Respir Crit Care Med. 2020;160(6):1856–61. doi:10.1164/ajrccm.160.6.9902115

Aslam F, Shahid A, Wahid A, et al. Socioeconomic factors and comorbidities in patients with congestive heart failure in Pakistan: a multicenter study. BMC Cardiovasc Disord. 2022;22(1):341. doi:10.1186/s12872-022-02824-6.