

## STUDY OF PREVALENCE OF SEVERE COMMUNITY-ACQUIRED PNEUMONIA IN PATIENTS HAVING DIABETES MORE THAN 1 YEAR ADMITTED TO A TERTIARY CARE HOSPITAL IN EASTERN INDIA: A RETROSPECTIVE COHORT STUDY.

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### Abstract

#### Aim

This study aims to assess the prevalence of CAP among diabetic patients receiving treatment at a tertiary care hospital in Bhubaneswar.

#### Methods

This retrospective study was conducted at KIMS and PBMH, Bhubaneswar, analyzing hospital records of 100 diabetic patients with CAP over one year (April 1, 2023, to April 1, 2024). Data were collected on demographics, clinical history, and laboratory findings, and analyzed using SPSS version 25.

#### Results

The majority of participants were aged over 60 years, with a higher prevalence of CAP in uncontrolled diabetes (48%) than in controlled diabetes (45%). Urban residents were predominant in both groups, though low-income individuals had poorer diabetes control. Uncontrolled diabetic patients exhibited more severe symptoms, higher RBS and ESR levels, increased pleural effusion, and longer hospital stays.

#### Conclusion

Uncontrolled diabetes is associated with a marginally higher prevalence of CAP and increased disease severity. Socioeconomic factors, and glycemic control play a crucial role in patient outcomes.

#### Recommendation

It is recommended that improving glycemic control and addressing socioeconomic factors be prioritized in managing diabetic patients to reduce the prevalence and severity of CAP.

**Keywords:** Community-acquired pneumonia, diabetes mellitus, glycemic control, hospitalization, prevalence.

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### Introduction

Pneumonia has been acknowledged for an extensive period as a common and potentially fatal illness, with its clinical importance recorded for almost two hundred years [1]. Community-acquired pneumonia (CAP) refers to an infection of the lower respiratory tract that arises in environments outside of hospitals or long-term healthcare facilities. Diagnosis occurs either in outpatient environments or within the initial 48 hours of hospitalization [2]. Persons who have pre-existing medical conditions face a heightened risk of developing Community-Acquired Pneumonia (CAP) [3]. Specific comorbidities not only render individuals more susceptible to infections but also shape the range of causative pathogens, possibly aiding in the emergence of uncommon and more virulent microorganisms. Furthermore, prevalent pathogens can demonstrate distinct patterns of antibiotic resistance when underlying

diseases are present [4–6]. A thorough grasp of these microbiological traits is crucial for formulating effective empirical treatment approaches. Moreover, research has highlighted significant comorbid conditions as critical factors influencing the severity of pneumonia [4–8]. CAP is mainly spread via droplet infection, resulting in an inflammatory response when pathogens colonize the alveoli. The traditional pathological progression encompasses congestion, and red and grey hepatization, followed by resolution, frequently resulting in little to no residual scarring. The mortality rates observed in hospitalized patients fluctuate between 5% and 10%, yet in instances of severe cases, the fatality rates can escalate to as much as 50% [9].

Diabetes mellitus (DM) encompasses a collection of metabolic disorders marked by persistent hyperglycemia, which arises from either inadequate insulin secretion, diminished insulin action, or a combination of both

factors. The rising global incidence of diabetes mellitus presents a considerable challenge to public health [10]. The enduring complications of diabetes mellitus are chiefly linked to microangiopathy and the non-enzymatic glycosylation of tissue proteins. Furthermore, the dysfunction of the immune system is a thoroughly documented outcome of diabetes mellitus, characterized by impairments in the activity of neutrophils and macrophages. This includes notable deficiencies in chemotaxis, adhesion, phagocytosis, and the elimination of pathogens. The respiratory burst, crucial for the intracellular elimination of bacteria via the generation of free radicals, superoxides, and hydrogen peroxide, is notably impaired in individuals with diabetes [10]. In developed nations, Community-Acquired Pneumonia (CAP) stands out as a prevalent infectious disease that often requires hospitalization. Hospital admission is often advised for individuals suffering from both diabetes mellitus and community-acquired pneumonia; nonetheless, the available data regarding the interplay of these conditions, especially concerning hospitalization and mortality risks, is still scarce [11].

The American Diabetes Association categorizes diabetic patients as either controlled or uncontrolled based on glycosylated hemoglobin (HbA1c) levels. Patients with HbA1c levels below 7% are classified as having controlled diabetes, whereas those with levels exceeding 7% are considered to have uncontrolled diabetes [12]. This study aims to assess the prevalence of CAP among diabetic patients receiving treatment at a tertiary care hospital in Bhubaneswar.

## Methods

### Study Design and Setting

This retrospective cohort study was conducted at Kalinga Institute of Medical Sciences (KIMS) and Pradyumna Bal Memorial Hospital (PBMH) in Bhubaneswar. KIMS is a well-established tertiary care hospital with a wide range of specialties and a large outpatient and inpatient population, while PBMH is a prominent hospital serving both urban and rural communities. The research aimed to evaluate the prevalence of community-acquired pneumonia (CAP) among diabetic patients. Data were collected from hospital records over one year, spanning from April 1, 2023, to April 1, 2024.

### Study Population and Sample Size

A total of 100 diabetic patients were included in the study, with 60 classified as having controlled diabetes and 40 as having uncontrolled diabetes, based on glycosylated hemoglobin (HbA1c) levels. Patients with a confirmed diagnosis of diabetes mellitus and presenting with symptoms of CAP were included. Only those who were physically active and mentally stable were considered eligible for inclusion. The exclusion criteria included:

- Patients with a history of chronic obstructive pulmonary disease (COPD) or asthma
- Patients who had received treatment for CAP within the last 30 days
- Patients with other severe comorbid conditions that could influence the results
- Pregnant women
- Those with incomplete or missing medical records

### Data Collection Procedure

Patient medical records were reviewed to extract relevant data, including demographic details, clinical history, laboratory findings, and CAP diagnosis. A structured data extraction form was used to ensure systematic collection. The study adhered to institutional protocols for accessing and managing patient records, with strict measures in place to maintain confidentiality.

### Data Processing and Analysis

The collected data were thoroughly reviewed, cleaned, and validated for accuracy and completeness. The dataset was then categorized according to the study objectives and relevant variables. Statistical analysis was performed using IBM Statistical Package for the Social Sciences (SPSS) version 25, with results presented in both descriptive and inferential formats.

### Bias

To minimize potential biases, the study used a retrospective design, relying on existing medical records. The inclusion of both controlled and uncontrolled diabetic groups ensured a balanced comparison. Selection bias was addressed by using well-defined inclusion and exclusion criteria. Additionally, efforts were made to minimize recall bias by relying solely on medical record data. Statistical controls were applied to account for confounding variables such as age and gender.

### Ethical Considerations

Ethical approval was obtained from the Institutional Review Board (IRB) of KIMS and PBMH, Bhubaneswar (Approval number: XXX). Since this was a retrospective study, individual patient consent was not required. However, all patient information was handled with strict confidentiality following institutional and ethical guidelines.

### Results

The age distribution of the study participants revealed that the majority of both controlled and uncontrolled diabetic patients were above 60 years of age, accounting for 50.00% and 47.50% of their respective groups. The 51–60 age group had nearly equal representation among

controlled (30.00%) and uncontrolled (30.00%) diabetic patients, while a smaller proportion of patients belonged to the 41–50 age range (20.00% vs. 22.50%). This

indicates a higher prevalence of diabetes, particularly uncontrolled cases, among older individuals (Table 1).

**Table 1: Age Distribution of the Respondents**

Age Group (Years)	Controlled Diabetes (n=60)	Uncontrolled Diabetes (n=40)	% (Controlled)	% (Uncontrolled)	P-value
41-50	12	9	20.00%	22.50%	0.001
51-60	18	12	30.00%	30.00%	
More than 60	30	19	50.00%	47.50%	

Regarding the residential distribution, a significantly higher proportion of controlled diabetic patients resided in urban areas (83.33%) compared to those in rural settings (16.67%). Similarly, among uncontrolled diabetic patients, the majority (75.00%) lived in urban

regions, whereas 25.00% were from rural areas. These findings suggest a higher representation of urban residents in both groups, though the proportion of rural participants was slightly higher in the uncontrolled diabetes group (Table 2).

**Table 2: Distribution of Respondents by Residence**

Residence Type	Controlled Diabetes (n=60)	Uncontrolled Diabetes (n=40)	% (Controlled)	% (Uncontrolled)	P-value
Urban	50	30	83.33%	75.00%	0.001
Rural	10	10	16.67%	25.00%	

The analysis of monthly family income indicated that a substantial proportion of uncontrolled diabetic patients (35.00%) belonged to the lowest income category (₹10,000–20,000), whereas only 10.00% of controlled diabetic patients fell into this group. A higher percentage

of controlled diabetic patients (45.00%) had a family income within the ₹40,000–80,000 range compared to only 10.00% in the uncontrolled group. This suggests a possible correlation between lower socioeconomic status and poor diabetes control (Table 3).

**Table 3: Distribution of Respondents by Monthly Family Income**

Monthly Income (INR)	Controlled Diabetes (n=60)	Uncontrolled Diabetes (n=40)	% (Controlled)	% (Uncontrolled)	P-value
10,000-20,000	6	14	10.00%	35.00%	0.001
20,000-40,000	22	20	36.67%	50.00%	
40,000-80,000	27	4	45.00%	10.00%	
>80,000	5	2	8.33%	5.00%	

Assessment of clinical factors showed that fever, respiratory distress, and chest pain were significantly more pronounced in uncontrolled diabetic patients compared to their controlled counterparts. The mean random blood sugar (RBS) level was notably higher in the uncontrolled diabetes group ( $86.47 \pm 12.54$ )

compared to the controlled group ( $23.25 \pm 10.49$ ), reflecting poor glycemic management. Similarly, erythrocyte sedimentation rate (ESR), pleural effusion, and hospitalization days were significantly elevated among uncontrolled diabetic patients, indicating more severe clinical complications (Table 4).

**Table 4: Distribution of Respondents by Clinical Factors**

Clinical Factor	Mean $\pm$ SD (Controlled)	Mean $\pm$ SD (Uncontrolled)	P-value
Cough	28 $\pm$ 2.0	32 $\pm$ 1.15	0.210
Fever	37.97 $\pm$ 0.72	40.06 $\pm$ 1.17	0.050
Respiratory Distress	31.71 $\pm$ 8.35	34.57 $\pm$ 7.92	0.015
Chest Pain	10 $\pm$ 3.0	12.0 $\pm$ 8.1	0.010
Pulse Rate	13.21 $\pm$ 3.87	18.48 $\pm$ 3.65	0.062
Random Blood Sugar (RBS)	23.25 $\pm$ 10.49	86.47 $\pm$ 12.54	0.001
Erythrocyte Sedimentation Rate (ESR)	30.5 $\pm$ 9.3	40.5 $\pm$ 14.3	0.000
Pleural Effusion	9 $\pm$ 15.6	26 $\pm$ 2.3	0.001
Hospitalization Days	5.50 $\pm$ 6.20	10.53 $\pm$ 8.10	0.001

The prevalence of community-acquired pneumonia (CAP) was found to be slightly higher in uncontrolled diabetic patients (48.00%) compared to controlled diabetic patients (45.00%). This suggests a marginally

increased susceptibility to CAP among those with poor glycemic control, although the difference is not substantial (Table 5).

**Table 5: Prevalence of CAP among Diabetic Patients**

Diabetes Type	Sample Size (n)	Prevalence (%)	Number of Cases
Controlled Diabetes	60	45.00%	27
Uncontrolled Diabetes	40	48.00%	19

The overall prevalence of community-acquired pneumonia (CAP) among diabetic patients in this study was found to be 46%, with 45% of controlled diabetic patients and 48% of uncontrolled diabetic patients affected. This indicates a slightly higher prevalence of CAP among those with poor glycemic control, although the difference between the two groups is marginal.

## Discussion

This retrospective analysis aimed to assess the prevalence of community-acquired pneumonia (CAP) within a cohort of diabetic patients at a tertiary care hospital located in Bhubaneswar. Although a variety of studies have explored CAP in individuals with diabetes [13,14,15], our investigation focused on a comparative analysis of both controlled and uncontrolled diabetic patients.

In this investigation involving 60 controlled diabetic patients, the demographic distribution revealed that 45% were male while 55% were female. Conversely, the cohort of 40 uncontrolled diabetic patients consisted of 57% males and 43% females. An analysis of age distribution indicated that 52% of patients with controlled diabetes were over the age of 60, while 50% of those with uncontrolled diabetes fell within the same age category. The results of this investigation correspond with earlier research indicating that 65.7% of 108 patients with community-acquired pneumonia were male,

with an average age of 51.2  $\pm$  17.79 years and an age spectrum of 18 to 80 years [2].

The occurrence of CAP in uncontrolled diabetic patients was noted to be 48%, in contrast to 45% of those with controlled diabetes who exhibited CAP. The observed prevalence significantly exceeds the documented prevalence of type 2 diabetes mellitus (T2DM) in cases of community-acquired pneumonia (CAP), which stands at around 15.6% among adults aged 20 to 79 years. The higher prevalence of CAP in diabetic patients (48% in uncontrolled and 45% in controlled) compared to the general prevalence of 15.6% among adults suggests that diabetes, particularly uncontrolled, may increase the susceptibility to CAP. This underscores the importance of monitoring and managing diabetes to reduce the risk of respiratory infections like CAP. The present findings, however, align with and present an inverse relationship to the research conducted by another group, which indicated that 40.1% of CAP patients within the Egyptian population were diagnosed with diabetes mellitus [16,17].

Additionally, this research revealed no notable distinctions between patients with controlled diabetes and those with uncontrolled diabetes regarding symptoms including cough, respiratory distress, chest pain, and pulse rate. The lack of significant differences in symptoms such as cough, respiratory distress, chest pain, and pulse rate between controlled and uncontrolled diabetic patients suggests that these clinical

manifestations may not be strongly influenced by glycemic control. However, further investigation is needed to understand the full spectrum of symptoms in this population. However, individuals with poorly controlled T2DM who were diagnosed with CAP experienced longer hospital stays and a higher rate of complications, particularly pleural effusion. An earlier study conducted in 2012 by a different group has also yielded comparable results, further substantiating the link between inadequate glycaemic control and a rise in complications associated with CAP [18].

### Conclusion

The study highlights a slightly higher prevalence of community-acquired pneumonia (CAP) among uncontrolled diabetic patients compared to those with controlled diabetes. Uncontrolled diabetes was associated with more severe clinical manifestations, including elevated random blood sugar and erythrocyte sedimentation rate levels, higher rates of pleural effusion, and longer hospital stays. Socioeconomic factors, particularly lower-income, appeared to correlate with poorer diabetes control. These findings emphasize the importance of effective glycemic management and targeted interventions to reduce the risk and severity of CAP in diabetic individuals.

### Generalizability

The findings of this study are primarily based on diabetic patients attending Kalinga Institute of Medical Sciences (KIMS) and Pradyumna Bal Memorial Hospital (PBMH), Bhubaneswar, and may therefore be more relevant to this population. Generalizability to broader populations should be cautious, as regional and healthcare system differences may affect outcomes.

### Limitations

The study's retrospective design limits the ability to establish causal relationships. The sample size, although adequate, may not fully represent the broader diabetic population, particularly those with more severe or advanced disease stages. Additionally, the lack of data on long-term outcomes and the potential for incomplete or biased records further limits the study's comprehensiveness.

### Recommendations

Future prospective studies should investigate the long-term outcomes of community-acquired pneumonia (CAP) in diabetic patients, with a particular focus on the impact of glycemic control over extended periods. It is also recommended to explore the role of other comorbidities in the severity of CAP among diabetic patients.

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This study was not funded by any external sources.

### Conflict of Interest

The authors declare no conflict of interest regarding this study.

### List of Abbreviations

- CAP: Community-Acquired Pneumonia
- T2DM: Type 2 Diabetes Mellitus
- HbA1c: Glycosylated Hemoglobin
- RBS: Random Blood Sugar
- ESR: Erythrocyte Sedimentation Rate

### Author Contributions:

All authors contributed equally to this study.

### Data Availability

The data supporting the findings of this study are available upon request from the corresponding author.

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