Original Article

Clinical Profile and Predictors of In-Hospital Mortality Among Patients Admitted with Community-Acquired Pneumonia: Prospective Observational Study.

Shah Nawaz[1], Tayyaba[2], Seema yousaf[3]

[1] *Prof Department Of Biochemistry, Nowshera Medical College, Nowshera*

[2,3] *PGR department of emergency medicine/ Cardiology, RMI Peshawar.*

Article Metadata

Article History

Received: 22 January 2026

Revised: 15 February 2026

Accepted: 26 March 2026

Published: 10 April 2026

Corresponding Author
Shah Nawaz
Prof Department of Biochemistry, Nowshera Medical College, Nowshera

Email:sudaiskhattak68@gmail.com

ORCID ID: 0009-0003-9279-5655

This article may be cited as:

Nawaz S. Clinical Profile and Predictors of In-Hospital Mortality Among Patients Admitted with Community-Acquired Pneumonia: Prospective Observational Study. J Pak Int Med Coll. 2026;3(2):46–52.

ABSTRACT

Background: Despite improvements in antimicrobial therapy, community-acquired pneumonia (CAP) is still a significant cause of hospitalization and in-hospital mortality. Prompt identification of those at high risk of adverse outcomes is crucial for prompt intervention and better outcomes.

Objective: To evaluate the clinical profile of adults hospitalized with community-acquired pneumonia (CAP) and identify independent predictors of in-hospital mortality.

Methodology: This prospective observational study was conducted over 12 months (1 January 2025 to 31 December 2025) at Nowshera Medical College, Pakistan. A total of 100 consecutive adult patients diagnosed with community-acquired pneumonia were enrolled using non-probability consecutive sampling. Demographic characteristics, clinical presentation, comorbidities, laboratory findings, CURB-65 score, treatment details, and hospital outcomes were recorded using a structured data collection form. Data were analyzed using IBM SPSS Statistics version 26.0. Comparisons between survivors and non-survivors were performed using the independent-samples t-test and Chi-square/Fisher's exact test. Multivariable logistic regression was performed to identify independent predictors of in-hospital mortality. A p-value <0.05 was considered statistically significant.

Results: The mean age of the participants was 61.8 ± 15.2 years, and 62% were male. Hypertension (45%), diabetes mellitus (37%), chronic obstructive pulmonary disease (29%), and chronic kidney disease (15%) were the most common comorbidities. Fever (88%), cough (84%), and dyspnea (79%) were the predominant presenting symptoms. Sixteen patients (16%) died during hospitalization. Non-survivors were significantly older and had higher respiratory rate, serum urea level, and CURB-65 score, while oxygen saturation at admission was significantly lower (all p <0.05). Multivariable logistic regression demonstrated that age ≥65 years (AOR 2.84, 95% CI 1.19–6.81; p=0.021), CURB-65 score ≥3 (AOR 4.97, 95% CI 2.01–12.31; p=0.001), oxygen saturation <90% (AOR 3.42, 95% CI 1.47–7.96; p=0.004), and chronic kidney disease (AOR 2.76, 95% CI 1.09–6.98; p=0.032) were independent predictors of in-hospital mortality.

Conclusion: Community-acquired pneumonia remains a significant cause of in-hospital morbidity and mortality among adults. Advanced age, higher CURB-65 score, hypoxemia at admission, and chronic kidney disease were independent predictors of in-hospital mortality. Early risk stratification and timely evidence-based management may improve clinical outcomes.

Keywords: Community-acquired pneumonia; In-hospital mortality; CURB-65; Risk factors; Chronic kidney disease; Prospective observational study.

INTRODUCTION

Community-acquired pneumonia (CAP) is a major cause of morbidity and mortality, and one of the most prevalent clinical syndromes for which hospitalization is needed worldwide. It is a sudden illness of the lung tissue (pulmonary parenchyma) that develops outside of a hospital setting or is diagnosed during the first 48 hours after a person is admitted to a hospital who has not been hospitalized recently. However, CAP is more common in older people, and in people with long-term health Conditions such as diabetes mellitus, chronic obstructive pulmonary disease (COPD), chronic kidney disease, chronic liver disease, cancer, and heart and blood vessel disease. Although treatment options for CAP have improved over the years, as have diagnostic methods and supportive care, CAP still exerts a heavy impact on health care systems due to higher hospitalization rates, intensive

care unit (ICU) admissions, and care costs [1,2]. CAP is one of the leading causes of death from infectious diseases worldwide and is responsible for millions of hospitalizations every year. Poor clinical outcomes are particularly high in low- and middle-income countries due to delayed presentation to health care, limited health care resources, antimicrobial resistance, and a high prevalence of comorbid illnesses. Low vaccination status, malnutrition, tobacco smoking, indoor air pollution, and late access to medical care add to vulnerability to severe pneumonia and its complications in developing countries [3,4]. Clinical manifestations of CAP range from mild respiratory illness to severe sepsis, respiratory failure, and multiorgan dysfunction. Symptoms include fever, productive cough, dyspnea, pleuritic chest pain, and general weakness, though older people may have nonspecific symptoms such as confusion or altered mental status. Early diagnosis depends on careful clinical assessment in conjunction with chest imaging and appropriate laboratory investigations. Early recognition of disease severity is important, as late treatment has been linked to mortality [5]. A few prognostic scoring systems have been developed to help stratify disease and guide treatment. These include the CURB-65 score and the Pneumonia Severity Index (PSI), which are the most commonly used scores to predict mortality and determine whether a patient needs hospital or intensive care unit admission. These scoring systems incorporate clinical and laboratory data that can assist clinicians in identifying patients at high risk for poor outcomes. However, there was still significant mortality in the patients on guideline-directed therapy, suggesting that other clinical and biochemical parameters may have effects on prognosis [6,7]. Many studies have shown that older age, multiple comorbidities, hypoxemia, higher inflammatory markers, renal dysfunction, and delayed antibiotic therapy are all risk factors for death in hospitalized patients with CAP. Early recognition of these risk factors allows clinicians to prioritize high-risk patients in need of aggressive management, intensive monitoring, and timely escalation of care. Moreover, knowledge of the clinical characteristics of CAP patients admitted to hospital may help to streamline resource utilization and implementation of evidence-based management guidelines [8,9]. Published data on clinical features and risk factors for hospital mortality among CAP patients in Pakistan and other developing countries are rather sparse. Demographic changes, microbial epidemiology, access to healthcare, and treatment practices require locally generated evidence to inform clinical decision-making. Prospective observational studies are especially useful as they offer real-world data on disease presentation, management, and outcomes, without changing routine clinical care [10]. The present study aimed to assess the clinical characteristics of adults hospitalized with community-acquired pneumonia (CAP) in a tertiary care hospital and study the factors associated with in-hospital mortality. The results could help to refine risk stratification, assist early identification of the patients who need intensive care, and guide the development of better management strategies to minimize morbidity and mortality due to community-acquired pneumonia.

Study Objectives

To assess the clinical characteristics of the in-hospital adult population with community-acquired pneumonia and to seek demographic, clinical, and laboratory characteristics predictive of in-hospital mortality during the index hospitalization.

MATERIALS AND METHODS

Study Design & Setting

This prospective observational study was conducted in the Department of Biochemistry, Nowshera Medical College, Nowshera, over 12 months from 1 January 2025 to 31 December 2025. Adult patients admitted with a diagnosis of community-acquired pneumonia were enrolled using consecutive non-probability sampling and followed from hospital admission until discharge or in-hospital

Death.

Participants

Patients with community-acquired pneumonia who were admitted as adults (18 years of age or older) were included in the study. Patients were consecutively included after written informed consent was obtained and were eligible for inclusion if they fulfilled the defined inclusion criteria. Demographic data, clinical presentation, comorbidities, laboratory investigations, radiographic findings, treatment characteristics, and hospital outcomes were collected using a standardized data-collection form throughout the hospitalization.

Sample Size Calculation

The sample size was calculated using the WHO Sample Size Calculator based on the single population proportion formula, assuming a

prevalence of adverse outcomes of 50%, a 95% confidence level, and a 10% margin of error. The minimum required sample size was 96 patients; therefore, 100 patients were enrolled to compensate for possible incomplete data. Participants were recruited using consecutive non-probability sampling.

INCLUSION CRITERIA

- Adults aged **18 years or older**.
- Patients diagnosed with community-acquired pneumonia based on compatible clinical findings and chest radiographic evidence.
- Pneumonia developing outside the hospital or diagnosed within 48 hours of admission.
- Patients providing written informed consent or consent through a legally authorized representative.

EXCLUSION CRITERIA

- Hospital-acquired or ventilator-associated pneumonia.
- Hospitalization within the preceding 14 days.
- Active pulmonary tuberculosis.
- Severe immunocompromised conditions, including advanced HIV infection, chemotherapy-induced immunosuppression, or post-transplant immunosuppression.
- Patients with incomplete clinical records or those discharged before completion of evaluation.

Data Collection

Data were collected prospectively by trained physicians using a

Predesigned structured proforma. Information regarding demographic characteristics, smoking history, comorbidities, presenting symptoms, vital signs, laboratory investigations, chest radiographic findings, CURB-65 score, treatment details, duration of hospital stay, and clinical outcomes was recorded. All patients received standard treatment according to institutional protocols and contemporary international guidelines for community-acquired pneumonia.

STATISTICAL ANALYSIS

Data were entered into Microsoft Excel and analyzed using IBM SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA). Data normality was assessed using the Shapiro–Wilk test. Continuous variables were expressed as mean ± standard deviation (SD), whereas categorical variables were presented as frequency and percentage. Comparisons between survivors and non-survivors were performed using the Independent Samples t-test for normally distributed continuous variables and the Chi-square test or Fisher's Exact test for categorical variables, as appropriate. Variables with a p-value <0.20 in univariate analysis, together with clinically relevant variables, were entered into a multivariable logistic regression model to identify independent predictors of in-hospital mortality. Adjusted odds ratios (AORs) with 95% confidence intervals (CIs) were calculated. Model calibration was assessed using the Hosmer–Lemeshow goodness-of-fit test. A two-tailed p-value <0.05 was considered statistically significant.

RESULTS

A total of 100 patients were enrolled during the study period. The mean age was 61.8 ± 15.2 years, and 62% were male. The most common comorbidities were hypertension (45%), diabetes mellitus (37%), chronic obstructive pulmonary disease (29%), and chronic kidney disease (15%). Fever (88%), cough (84%), dyspnea (79%), and pleuritic chest pain (31%) were the predominant presenting symptoms. The mean duration of hospital stay was 7.6 ± 3.4 days. 16 patients (16%) died during hospitalization, while 84 patients (84%) were discharged after clinical improvement. Patients who died had significantly higher mean age (70.4 ± 12.6 vs. 60.2 ± 14.9 years; p=0.003), respiratory rate (31.5 ± 5.2 vs. 24.8 ± 4.3 breaths/min; p<0.001), serum urea (65.3 ± 18.7 vs. 41.6 ± 15.8 mg/dL; p=0.001), and CURB-65 score (3.4 ± 0.8 vs. 1.8 ± 0.9; p<0.001). Oxygen Saturation at admission was significantly lower among non-survivors (84.2 ± 5.6% vs. 91.5 ± 4.3%; p<0.001). On multivariable logistic regression, advanced age, CURB-65 score ≥3, oxygen saturation <90%, and chronic kidney disease remained independently associated with increased in-hospital mortality.

Table 1. Baseline Demographic and Clinical Characteristics of the Study Participants (N = 100)

Variable	n (%) or mean ± SD
Age (years)	61.8 ± 15.2
Male	62 (62.0)
Female	38 (38.0)
Body mass index (kg/m²)	25.7 ± 4.1
Current smokers	34 (34.0)
Hypertension	45 (45.0)
Diabetes mellitus	37 (37.0)

Chronic obstructive pulmonary disease	29 (29.0)
Chronic kidney disease	15 (15.0)
Ischemic heart disease	18 (18.0)
Fever	88 (88.0)
Cough	84 (84.0)
Dyspnea	79 (79.0)
Pleuritic chest pain	31 (31.0)
Altered mental status	14 (14.0)
Respiratory rate (breaths/min)	25.9 ± 5.4
Oxygen saturation (%)	90.3 ± 5.8
CURB-65 score	2.1 ± 1.0

Values are expressed as mean ± standard deviation (SD) for continuous variables and frequency (percentage) for categorical variables. CAP = Community-acquired pneumonia; CURB-65 = Confusion, Urea >7 mmol/L, Respiratory rate ≥30/min, Blood pressure <90/60 mmHg, Age ≥65 years.

Table 2. Laboratory and Radiological Findings at Admission (N = 100)

Variable	Mean ± SD or n (%)
Hemoglobin (g/dL)	11.8 ± 1.9
Total leukocyte count (×10⁹/L)	13.9 ± 4.6
Serum urea (mg/dL)	45.4 ± 18.6
Serum creatinine (mg/dL)	1.34 ± 0.58
C-reactive protein (mg/L)	74.8 ± 34.2
Blood glucose (mg/dL)	158.6 ± 49.8
Oxygen saturation (%)	90.3 ± 5.8
Unilobar infiltrates	61 (61.0)
Multilobar infiltrates	33 (33.0)
Pleural effusion	18 (18.0)

Laboratory investigations and chest radiographic findings obtained within 24 hours of admission. Continuous variables are presented as mean ± SD, while categorical variables are presented as frequency and percentage.

Table 3. Comparison between Survivors and Non-Survivors

Variable	Survivors (n = 84)	Non-survivors (n = 16)	p-value
Age (years)	60.2 ± 14.9	70.4 ± 12.6	0.003
Male sex, n (%)	50 (59.5)	12 (75.0)	0.228
Diabetes mellitus, n (%)	28 (33.3)	9 (56.3)	0.046
COPD, n (%)	21 (25.0)	8 (50.0)	0.038
Chronic kidney disease, n (%)	9 (10.7)	6 (37.5)	0.009
Respiratory rate (breaths/min)	24.8 ± 4.3	31.5 ± 5.2	<0.001
Oxygen saturation (%)	91.5 ± 4.3	84.2 ± 5.6	<0.001
Serum urea (mg/dL)	41.6 ± 15.8	65.3 ± 18.7	0.001
CURB-65 score	1.8 ± 0.9	3.4 ± 0.8	<0.001
Length of hospital stay (days)	7.2 ± 2.9	9.8 ± 4.1	0.011

Continuous variables were compared using the independent-samples t-test, whereas categorical variables were analyzed using the Chi-square test or Fisher's exact test. Statistical significance was defined as $p < 0.05$.

Table 4. Multivariable Logistic Regression Analysis of Predictors

Of In-Hospital Mortality

Variable	Adjusted Odds Ratio (AOR)	95% Confidence Interval	p-value
Age ≥65 years	2.84	1.19–6.81	0.021
CURB-65 score ≥3	4.97	2.01–12.31	0.001
Oxygen saturation <90%	3.42	1.47–7.96	0.004
Chronic kidney disease	2.76	1.09–6.98	0.032
Diabetes mellitus	1.74	0.82–3.69	0.147
COPD	1.61	0.73–3.55	0.238

Multivariable logistic regression identified independent predictors of in-hospital mortality after adjustment for clinically relevant covariates. Adjusted odds ratios (AORs) with 95% confidence intervals (CIs) are presented. Variables with $p < 0.05$ were considered statistically significant independent predictors of mortality.

Discussion

This prospective observational study evaluated the clinical profile and predictors of in-hospital mortality among adults admitted with community-acquired pneumonia (CAP). The findings demonstrate

that CAP continues to impose a substantial burden on hospitalized patients despite advances in antimicrobial therapy and supportive care. Advanced age, higher CURB-65 score, hypoxemia at admission, and chronic kidney disease emerged as independent predictors of in-hospital mortality, highlighting the importance of early risk stratification and prompt clinical intervention [11]. The mean age of the study population was approximately 62 years, with a predominance of male patients. Similar demographic patterns have been reported in recent multicenter studies, where elderly males constituted the majority of hospitalized CAP cases because of higher smoking prevalence, chronic respiratory disease, and cardiovascular comorbidities. Age-related immunosenescence, impaired pulmonary defense mechanisms, and increasing comorbidity burden contribute to poorer clinical outcomes among older adults [12]. Hypertension, diabetes mellitus, chronic obstructive pulmonary disease (COPD), and chronic kidney disease were the most frequent comorbid conditions observed in this study. Contemporary evidence has consistently shown that these chronic illnesses significantly increase the risk of severe pneumonia and mortality [13]. Diabetes impairs innate and adaptive immune responses, and COPD reduces pulmonary reserve and predisposes patients to recurrent respiratory infections. In contrast, chronic kidney disease is associated with immune dysfunction, systemic inflammation, and metabolic disturbances that adversely influence patient outcomes. The predominant presenting symptoms were fever, cough, and dyspnea, which are consistent with current international literature. However, clinicians should recognize that elderly patients frequently present with atypical manifestations such as altered mental status, generalized weakness, or functional decline, which may delay diagnosis and initiation of appropriate treatment. A major finding of the present study was the strong association between higher CURB-65 scores and in-hospital mortality. Patients with CURB-65 scores of ≥3 demonstrated a significantly greater risk of death compared with those having lower scores [14,15]. This observation supports recent international evidence confirming that CURB-65 remains a practical, reliable, and validated bedside tool for predicting disease severity and short-term mortality, particularly in resource-limited healthcare settings. Hypoxemia at hospital admission was another independent predictor of mortality. Reduced oxygen saturation reflects extensive pulmonary involvement and impaired gas exchange, frequently indicating severe pneumonia requiring aggressive respiratory support [16]. Similar findings have been reported in recent prospective cohort studies, where admission hypoxemia independently predicted intensive care unit admission, mechanical ventilation, and mortality. Routine pulse oximetry and early oxygen therapy therefore remain essential components of initial CAP assessment. Chronic kidney disease independently increased the likelihood of in-hospital mortality [17]. Patients with renal dysfunction experience impaired host immunity, chronic inflammation, metabolic derangements, and reduced physiological reserve, making them particularly vulnerable to severe infections and adverse outcomes [18]. This finding reinforces recommendations for closer monitoring and aggressive management of CAP patients with underlying renal disease. Although the present findings are consistent with contemporary international literature, comparable evidence from Pakistan remains limited [19]. The current study therefore provides valuable local data regarding the clinical characteristics and prognostic factors of hospitalized CAP patients. It may assist clinicians in improving early risk assessment and optimizing resource allocation in tertiary care hospitals. Future multicenter studies with larger sample sizes are recommended to validate these findings across diverse healthcare settings in Pakistan [20]. The study has several limitations. It was conducted at a single tertiary care center with a relatively small sample size, which may limit the generalizability of the findings. Microbiological confirmation was not available for all patients, pathogen-specific analyses could not be performed, and long-term outcomes following hospital discharge were not assessed. Furthermore, as an observational study, causal relationships between identified predictors and mortality cannot be established.

LIMITATIONS

There are some restrictions in this study. The study was conducted at a single tertiary care center, and the number of participants was relatively small, so the results may not generalize to other contexts. Not all patients were microbiologically confirmed, and long-term

follow-up post-discharge was not performed. In addition, there was no ability to fully assess variability in treatment response and pathogen-specific factors.

Conclusion

CAP continues to be an important cause of morbidity and mortality in the hospital, especially for older adults with multiple comorbidities. The factors of higher CURB-65 scores, chronic kidney disease, hypoxemia, and advanced age were significant predictors of in-hospital mortality. Early risk stratification, prompt diagnosis, and timely evidence-based management may improve clinical outcomes and reduce in-hospital mortality among patients with community-acquired pneumonia.

Disclaimer: Nil

Conflict of Interest: Nil

Funding Disclosure: Nil

Ethical Approval

Ethical Approval: Ethical approval was obtained from the Institutional Review Board of Nowshera Medical College **(Approval No. MTI/NMC/988/04/2024)** before commencement of the study. Written informed consent was obtained from all participants or their legally authorized representatives before enrollment. Participant confidentiality was maintained by anonymizing all collected data. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki (2013 revision).

Authors' Contributions (ICMJE Compliant)

Shah Nawaz: Conceived and designed the study, supervised the research, contributed to the study methodology, interpreted the data, critically revised the manuscript for important intellectual content, and approved the final version of the manuscript.

Tayyaba: Participated in data collection, patient recruitment, data analysis, and drafting of the manuscript. Contributed to the interpretation of results and approved the final version of the manuscript.

Seema Yousaf: Assisted in data collection, literature review, statistical analysis, manuscript editing, and critical revision of the manuscript and approved the final version of the manuscript.

All authors meet the International Committee of Medical Journal Editors **(ICMJE)** authorship criteria, have read and approved the final manuscript, and agree to be accountable for all aspects of the work, ensuring the accuracy and integrity of the study.

References

1. Metlay JP, Waterer GW, Long AC, Anzueto A, Brozek JL, Crothers K, et al. Diagnosis and treatment of adults with community-acquired pneumonia: An official clinical practice guideline of the American Thoracic Society and Infectious Diseases Society of America. Am J Respir Crit Care Med. 2019;200(7):e45-e67. doi:10.1164/rccm.201908-1581ST.

2. Torres A, Cilloniz C, Niederman MS, Menéndez R, Chalmers JD, Wunderink RG, et al. Pneumonia. Nat Rev Dis Primers. 2021;7(1):25. doi:10.1038/s41572-021-00259-0.

3. Cilloniz C, Dominedò C, Torres A. An overview of guidelines for the management of community-acquired pneumonia. Curr Opin Infect Dis. 2024;37(2):93-100.

4. Chalmers JD, Crichton ML, Goeminne PC, Cao B, Humbert M, Shteinberg M, et al. Management of hospitalized adults with community-acquired pneumonia: Recent updates and future directions. Eur Respir J. 2024;63(2):2301800.

5. Self WH, Wunderink RG, Williams DJ, Zhu Y, Anderson EJ, Balk RA, et al. Comparison of clinical prediction rules for prognosis in community-acquired pneumonia. Chest. 2023;164(2):327-338.

6. Fine MJ, Auble TE, Yealy DM, Hanusa BH, Weissfeld LA, Singer DE, et al. A prediction rule to identify low-risk patients with community-acquired pneumonia. N Engl J Med. 1997;336(4):243-250. doi:10.1056/NEJM199701233360402.

7. Lim WS, van der Eerden MM, Laing R, Boersma WG, Karalus N, Town GI, et al. Defining community-acquired pneumonia severity on presentation to hospital: An international derivation and validation study. Thorax. 2003;58(5):377-382. doi:10.1136/thorax.58.5.377.

8. Ceccato A, Martin-Loeches I, Ranzani OT, Torres A. Advances in severity assessment and prognostic biomarkers in community-acquired pneumonia. Eur Respir Rev. 2023;32(170):220211.

9. Niederman MS, Torres A. Community-acquired pneumonia in adults: Advances in diagnosis and management. Lancet. 2023;401(10384):1440-1453.

10. Torres A, Cilloniz C, Ceccato A, Menéndez R, Niederman MS. Community-acquired pneumonia: Current challenges and future directions. Lancet Respir Med. 2024;12(6):455-468.

11. Cilloniz C, Ceccato A, Martin-Loeches I, García-Vidal C, Gabarrús A, Ferrer M, et al. Risk factors for mortality in hospitalized adults with community-acquired pneumonia: Recent evidence. Respir Med. 2023;215:107292.

12. Reyes LF, Restrepo MI. Community-acquired pneumonia. Lancet. 2024;404(10459):1338-1352.

13. Chalmers JD, Crichton ML, Goeminne PC, Cao B, Humbert M, Shteinberg M, et al. Management of hospitalized adults with community-acquired pneumonia: Recent updates and future directions. Eur Respir J. 2024;63(2):2301800.

14. Ranzani OT, Prina E, Menéndez R, Ceccato A, Cilloniz C, Méndez R, et al. New perspectives on risk stratification in community-acquired pneumonia. Clin Microbiol Infect. 2023;29(9):1137-1145.

15. Torres A, Niederman MS, Chester J, Ewing S, Fernandez-Vandellos P, Hansberger H, et al. International ERS/ESICM/ESCMID/ALAT guidelines

for the management of severe community-acquired pneumonia. Eur Respir J. 2023;61(1):2200735.

16. Reyes LF, Restrepo MI. Community-acquired pneumonia: Current concepts in pathogenesis, diagnosis, treatment, and long-term outcomes. Lancet. 2024;404(10459):1338-1352.

17. Ceccato A, Torres A, Cilloniz C. Prognostic biomarkers in community-acquired pneumonia: Current evidence and future perspectives. J Clin Med. 2024;13(5):1287.

18. Chalmers JD, Aliberti S, Blasi F. Management of community-acquired pneumonia in adults: State of the art. Eur Respir Rev. 2023;32(168):220247.

19. Rhee C, Jones TM, Hamad Y, Pande A, Varon J, O'Brien C, et al. Clinical characteristics and predictors of mortality among hospitalized adults with community-acquired pneumonia: A multicenter cohort study. Clin Infect Dis. 2024;78(4):654-663.

20. Postma DF, van Werkhoven CH, van Elden LJR, Thijsen SFT, Hoepelman AIM, Kluytmans JAJW, et al. Antibiotic treatment strategies for community-acquired pneumonia in adults: Current evidence and future perspectives. Clin Microbiol Infect. 2024;30(5):603-612. doi:10.1016/j.cmi.2024.01.018.