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LOWER RESPIRATORY TRACT INFECTIONS: CLINICAL-MICROBIOLOGICAL PROFILE AND THERAPEUTIC IMPLICATIONS

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ABSTRACT

Hospitalized lower respiratory tract infections present clinical and antimicrobial-management challenges, particularly when acquired during hospitalization. This retrospective study examined 47 patient records from the Pneumology I Department of Leamna Pulmonology Hospital (2022-2025). Forty cases were community-acquired (85.1 %) and seven hospital-acquired (14.9 %). Sputum cultures were negative in 20 cases (42.6 %). Recorded agents included Streptococcus pneumoniae, Pseudomonas aeruginosa, Haemophilus influenzae and Staphylococcus aureus. Mean antibiotic duration was longer in hospital-acquired than community-acquired cases (11.3 versus 7.8 days; p = 0.016), while length of stay did not differ significantly (15.7 versus 10.9 days; p = 0.079). Severe cases had longer hospital stays (19.4 versus 10.3 days; p = 0.002) and a lower frequency of favorable clinical response. The findings underline the importance of severity assessment, microbiological testing and susceptibility-guided antibiotic reassessment, while the small hospital-acquired subgroup limits generalization.

INTRODUCTION

Lower respiratory tract infections, particularly pneumonia, remain an important cause of hospitalization and infectious-disease mortality. Clinical presentations range from localized infection to respiratory failure and sepsis, with the greatest burden among older adults and people with chronic or immunosuppressive conditions (GBD 2016 Lower Respiratory Infections Collaborators 2018; Torres et al. 2021).

A practical distinction is made between community-acquired pneumonia (CAP) and hospital-acquired pneumonia (HAP). The acquisition setting shapes likely microbial etiology and the probability of antimicrobial resistance. While *Streptococcus pneumoniae* and *Haemophilus influenzae* are common pathogens in CAP, Gram-negative bacilli and methicillin-resistant *Staphylococcus aureus* (MRSA) are of particular concern in selected HAP cases (Metlay et al. 2019; Kalil et al. 2016). However, specific resistance phenotypes must be confirmed by susceptibility testing, not inferred from species identification alone.

Microbiological diagnosis is often incomplete because respiratory cultures can be negative, samples may be collected after treatment begins, and atypical

microorganisms require additional investigations. Consequently, empirical treatment is frequently necessary, but should be reassessed when microbiological results become available (Jain et al. 2015; Cilloniz et al. 2016). Antimicrobial stewardship balances adequate initial coverage against the adverse effects and selection pressure associated with unnecessary broad-spectrum therapy (Murray et al. 2022).

The aim of the present study was to describe the clinical and microbiological profile of hospitalized lower respiratory tract infections, compare the treatment and hospitalization burden associated with CAP and HAP, and examine the relationship of severity with clinical outcomes. The analysis is based on retrospective hospital records, with particular attention to the limits of the small HAP subgroup.

MATERIAL AND METHODS

Study design and setting. A retrospective descriptive and comparative study included 47 hospitalized cases recorded between 2022 and 2025 in the Pneumology I Department of Leamna Pulmonology Hospital, Romania. Eligible records concerned a lower respiratory tract infection requiring hospital care. Diagnostic categories comprised community-acquired or hospital-acquired pneumonia, pneumonia associated with an infectious exacerbation of chronic obstructive pulmonary disease (COPD), aspiration pneumonia and post-viral bronchopneumonia.

Clinical definitions. Pneumonia was classified as community-acquired (CAP) when documented before admission or within the first 48 hours; hospital-acquired pneumonia (HAP) was defined by onset more than 48 hours after admission, with no pneumonia documented at admission. Clinical severity was categorized as mild, moderate or severe according to recorded assessments. CURB-65 scores were calculated or estimated retrospectively from available clinical records; these were used as supportive severity indicators rather than prospectively established measurements.

Data sources and microbiology. Demographic and clinical variables comprised age, sex, body mass index, smoking status, comorbidities, acquisition setting, time of infection onset, severity, length of hospital stay, antibiotic regimens and treatment duration, complications, intensive care transfers and clinical response. Microbiological findings were extracted from laboratory reports and antibiograms, including sputum culture, blood culture and reported antimicrobial susceptibility. *Mycoplasma pneumoniae* was detected by polymerase chain reaction (PCR); this result is not a routine bacterial culture isolate.

Statistical analysis. Counts and percentages were used for categorical variables and descriptive summary statistics for continuous variables. In the analysis accompanying the original clinical dataset, CAP and HAP groups and severe versus non-severe cases were compared using independent-samples t tests or Mann-Whitney U tests for continuous outcomes; chi-square comparisons were reported for categorical variables. A threshold of $p < 0.05$ was used for interpretation. Because the HAP subgroup contained only seven cases and multiple outcomes were considered, all reported p values were interpreted as exploratory and unadjusted; sparse categorical comparisons should not be used as confirmatory evidence.

Institutional approval. Leamna Pulmonology Hospital authorized the retrospective review of hospital records and the inclusion of records dated after

approval during the 2022-2025 study period (institutional approval no. 6189, dated 13 October 2022).

RESULTS AND DISCUSSIONS

Clinical profile. Of 47 cases, 40 (85.1 %) were classified as CAP and 7 (14.9 %) as HAP (Fig. 1). The mean age was 62.1 years, with a median of 65 years; 30 cases involved men and 17 involved women. Hypertension, COPD and type 2 diabetes were frequently recorded comorbidities. Disease severity was classified as mild in 14 cases, moderate in 26 and severe in 7. These figures describe the composition of the reviewed records, not the hospital-wide incidence of respiratory infections.

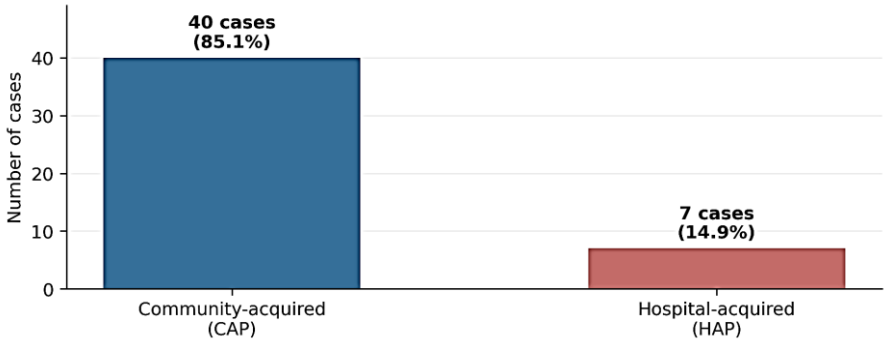


Figure 1. Distribution of community-acquired and hospital-acquired cases (n = 47).

Microbiological findings. Negative sputum cultures were reported for 20 of 47 cases (42.6 %). Across the available microbiology results, *Streptococcus pneumoniae* was recorded in 7 cases, *Pseudomonas aeruginosa* in 5, *Haemophilus influenzae* in 4, *Staphylococcus aureus* in 4 (2 MRSA and 2 methicillin-susceptible isolates), and *Klebsiella pneumoniae* in 3. *Acinetobacter baumannii*, *Moraxella catarrhalis* and an additional *Klebsiella pneumoniae* report with suspected extended-spectrum beta-lactamase (ESBL) production were each listed once. *Mycoplasma pneumoniae* was detected by PCR in one case, rather than by routine culture (Fig. 2). One blood culture was positive for *Klebsiella pneumoniae*. Because these figures encompass distinct diagnostic assays, the organism counts should not be interpreted as a verified count of positive sputum cultures.

All seven HAP cases were reported to have a positive culture involving an organism of potential antimicrobial-resistance concern, while two CAP cases had *Pseudomonas aeruginosa*. This finding is descriptive and should not be treated as a validated predictor of multidrug resistance. MRSA was identified in the laboratory results, whereas ESBL production remained reported as suspected; isolation of Pseudomonas or Acinetobacter alone does not establish a multidrug-resistant phenotype. Antimicrobial decisions should be interpreted in conjunction with the individual antibiogram and clinical context (Kalil et al. 2016; Restrepo et al. 2018).

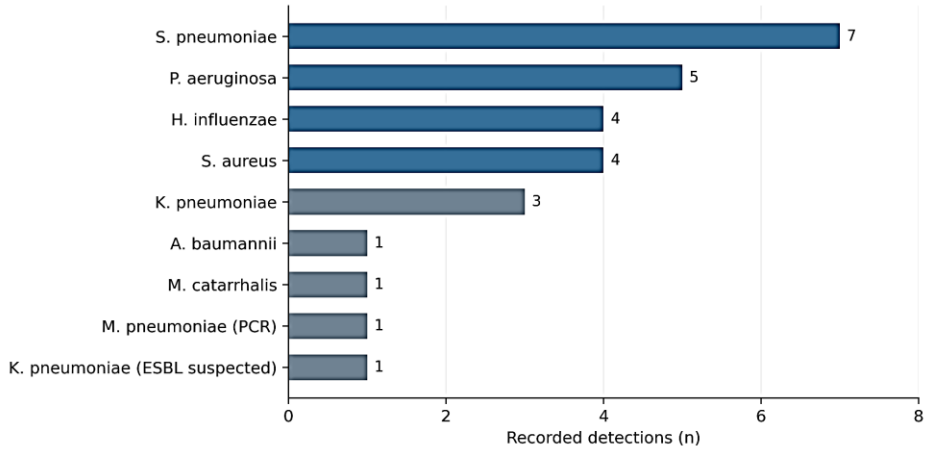


Figure 2. Reported microbiological detections; *Mycoplasma pneumoniae* was identified by PCR. The figures combine different laboratory methods and should not be interpreted as positive sputum cultures alone.

Therapy and hospital stay. The mean duration of antibiotic treatment was 11.3 days for HAP and 7.8 days for CAP (p = 0.016). Mean hospitalization was also numerically longer in HAP (15.7 versus 10.9 days), but the difference was not statistically significant at the conventional 0.05 threshold (p = 0.079; Table 1 and Fig. 3). Since HAP occurs after admission by definition, the between-group difference in hospital stay should not be interpreted as hospital days attributable to the infection.

Table 1

Comparison of mean treatment duration and hospitalization by acquisition setting.

Indicator	CAP (n=40)	HAP (n=7)	p value
Antibiotic duration (days)	7.8	11.3	0.016
Hospital stay (days)	10.9	15.7	0.079

Values and p values are from the retrospective analysis; comparisons were not adjusted for potential confounders.

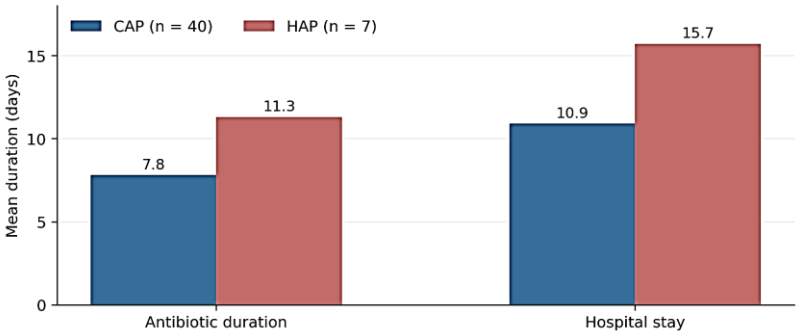


Figure 3. Mean antibiotic-treatment duration and length of hospital stay in CAP and HAP.

Antibiotic management. Empirical therapies included ceftriaxone plus azithromycin (15 cases), amoxicillin/clavulanate (10 cases), and levofloxacin (5 cases). Broader-spectrum regimens, including piperacillin/tazobactam and meropenem, were recorded in cases considered at risk for resistant organisms, with anti-MRSA coverage when indicated. Susceptibility results supported reassessment and narrowing of treatment where feasible. These descriptive treatment patterns do not demonstrate that a particular regimen caused a better outcome (Metlay et al. 2019; Kalil et al. 2016).

Disease severity and outcomes. In the seven severe cases, mean hospitalization was 19.4 days, compared with 10.3 days in non-severe cases ($p = 0.002$), and antibiotic duration was 11.4 versus 7.8 days ($p = 0.008$). Favorable clinical response was reported in 13/14 mild cases (92.9%), 20/26 moderate cases (76.9%) and 4/7 severe cases (57.1%). Six cases required transfer to intensive care and one patient died. These observations align with the clinical importance of early severity assessment, although CURB-65 was reconstructed retrospectively and was developed principally for evaluating CAP (Lim et al. 2003).

Clinical interpretation. The distinct pathogen distributions between CAP and HAP are consistent with established differences in acquisition setting and resistance risk. Nevertheless, the study is not designed to estimate regional pathogen prevalence or compare the effectiveness of antibiotic strategies. The observation of Pseudomonas in community-acquired cases also reinforces the importance of patient-level risk assessment, rather than automatically equating acquisition setting with a particular organism (Restrepo et al. 2018; Self et al. 2016).

Study limitations. The retrospective, single-center design, small total cohort and particularly small HAP subgroup ($n = 7$) limit external validity and statistical precision. Statistical comparisons are unadjusted and exploratory, with no reported confidence intervals or adjustment for multiple testing. Detailed susceptibility distributions and patient-level confounder information are not presented here, so associations must not be interpreted causally. In addition, CURB-65 was reconstructed retrospectively, and a substantial fraction of sputum cultures was negative. The findings warrant confirmation in a larger, clearly specified cohort.

CONCLUSIONS

Community-acquired cases predominated in this retrospective 47-case cohort (85.1 %), whereas hospital-acquired cases accounted for 14.9 % and had longer recorded antibiotic courses.

The microbiological findings included organisms associated with antimicrobial-resistance risk, particularly among the seven HAP cases. Species identification and suspected resistance must be distinguished from microbiologically confirmed multidrug resistance.

Greater recorded clinical severity was associated with longer hospital stay, longer antibiotic treatment and lower proportions of favorable clinical response. Because of the small subgroups and unadjusted analyses, these findings should not be considered causal estimates.

Assessment of severity, appropriately selected microbiological tests and susceptibility-guided reassessment of empirical therapy remain important principles for respiratory-infection management and antimicrobial stewardship.

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