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Investigation of Current Status of Antibiotic Use and Optimisation Strategies for Elderly Diabetic Patients with Pulmonary Infections in Emergency Settings

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KEYWORDS Adverse Drug Reactions. Drug Resistance. Elderly Patients. Individualised Treatment. Multidisciplinary Care. Pathogen Distribution

ABSTRACT The study analysed antibiotic use and pathogenic bacteria distribution in individuals with Type 2 Diabetes Mellitus (T2DM) intricated by pulmonary infection. A retrospective review of 134 patients admitted in January 2022 to December 2023 was conducted, focusing on the types, duration, and combinations of antibiotics, pathogen distribution, and adverse reactions. Antibiotic timing and selection, guided by pathogen type and sensitivity, significantly affected outcomes, while penicillin, cephalosporins, and quinolones showed increasing resistance. Statistical analysis involves applying Chi-square tests using SPSS 29, and alongside qualitative thematic analysis. Optimal therapy requires careful drug selection, timely initiation, and treatment adjustment. Chi-square analysis revealed treatment outcomes were significantly associated with glycemic control (χ^2=5.62, p=0.018) and early symptom improvement (χ^2=6.93, p=0.008). Multidisciplinary approaches enable comprehensive and individualised, effective treatment, vital for elderly diabetic patients with acute pulmonary infections. Overall, sensitivity-guided, individualised antibiotic management improves outcomes and reduces adverse drug reactions among elderly patients with diabetes and pulmonary infections.

INTRODUCTION

Pulmonary infections remain a leading cause of emergency admissions and mortality among elderly patients, particularly those with Type 2 Diabetes Mellitus (T2DM). The convergence of age-related immune dysfunction, chronic hyperglycemia, and multiple comorbidities creates a uniquely vulnerable patient population in which infections are not only more common but also associated with significantly higher mortality, prolonged hospital stays, and increased morbidity (Fésüs et al. 2022).Among the most common reasons for hospitalization and mortality, Community-Acquired Pneumonia (CAP) is usually treated with antibiotics (Aliberti et al. 2021; Xu et al. 2022).

Antibiotics have greatly minimized the mortality associated with bacterial infections; however, the overuse of antibiotics has led to increased antimicrobial resistance. Lower respiratory tract infections (LRTIs) are classified into CAP and Hospital-Acquired Pneumonia (HAP), and can result from various infectious agents, including viruses, bacteria, fungi, and parasites (Zhao et al. 2022; Hunold et al. 2024). In elderly patients with T2DM, effective antibiotic management is complicated by several factors: the lack of standardized, condition-specific treatment guidelines, significant variability in clinician prescribing practices, and the challenge of accurately assessing therapeutic efficacy in a population with complex, overlapping pathologies (Joyner et al. 2022). Risk factors for developing viral pneumonia include obesity, immunosuppression, advanced age, and chronic lung disease (Carbonell et al. 2023).

CAP is more likely to occur in older adults and also among persons with certain clinical conditions, including chronic heart or lung disease. Aspects associated with the treatment of CAP in regard to antibiotic stewardship include, but are not limited to, shortening the duration of antibiotic therapy, antibiotic de-escalation, early switching from intravenous to oral antibiotics, and recommendations about empiric therapy (Campling et al. 2022; Paschou et al. 2022). CAP is a respiratory disease that is prevalent worldwide and poses significant social and economic costs to society. Antibiotic treatment is the primary form of treatment of CAP (Lüthi-Corridori et al. 2024; Bassetti et al. 2022). Typical fluoroquinolone drugs with those who possess great and broad-spectrum antibacterial activities are levofloxacin and moxifloxacin.

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Empiric antibiotic advice differs with or without the patient satisfying the severe CAP criterion or risk factor that includes a multidrug resistant organism (Iftikhar and Waagsbø 2025). Antibiotic therapy remains the primary treatment. However, rising antimicrobial resistance, inappropriate selection, and delayed initiation often limit efficacy and increase the risk of adverse reactions (Tarrant and Krockow 2022).

In emergency settings, rapid and accurate decision-making regarding antibiotic choice, timing, and combination therapy is critical to improve patient outcomes (Zhu et al. 2022). Despite this, there remains a significant gap in understanding how to optimize these antibiotic strategies specifically for elderly T2DM patients with acute pulmonary infections, balancing the urgency of treatment with the principles of antimicrobial stewardship.

Objectives

This body of research primarily centers on investigating current antibiotic utilization patterns among elderly patients with type 2 diabetes mellitus (T2DM) who present with pulmonary infections in emergency departments. Beyond descriptive epidemiology, the core goals extend to assessing the correlation between pathogen distribution, antibiotic susceptibility profiles and corresponding therapeutic outcomes in this high-risk population, and further establishing a targeted framework to identify optimized antibiotic therapy strategies while minimizing the risk of adverse drug reactions.

A relevant predictive model study focused on elderly hip fracture patients, a population overlapping with the target elderly cohort, validated a nomogram for postoperative pulmonary infection risk via a retrospective analysis of 1008 surgical cases (Huang et al. 2023). The model exhibited favorable discrimination and calibration performance in internal validation cohorts; however, its single-center retrospective study design imposes critical limitations on external validity and population generalisability, restricting its widespread clinical application.

For severe pulmonary infections, Wang et al. (2025) conducted a comparative analysis of five empirical antibiotic regimens to evaluate optimized therapy for SCAP. The findings revealed that β-lactam combination therapy with macrolides conferred the most significant survival benefit, markedly reducing overall patient mortality; in contrast, monotherapy with β-lactam agents, as well as β-lactam plus fluoroquinolone combination regimens, were associated with inferior clinical outcomes. Notably, the study's observational nature limits definitive causal interpretation of the observed survival differences.

Viasus et al. (2025) further explored antibiotic de-escalation in severe CAP through a retrospective cohort analysis spanning 1995 to 2022, employing inverse propensity score-weighted regression to compare early versus late de-escalation approaches. Key results demonstrated that timely antibiotic de-escalation did not elevate 30-day mortality rates or prolong hospital length of stay, while effectively reducing the incidence of prolonged antibiotic exposure. Similar to prior research, the single-center observational design constrains the ability to draw firm causal inferences regarding treatment efficacy and safety.

Shifting focus to other common diabetic infections, Liu et al. (2023) analyzed pathogen distribution and drug susceptibility patterns across 581 diabetic foot infection patients. The study identified distinct pathogen stratification by infection severity: gram-positive organisms were the predominant pathogens in grades 1–3 infections, while gram-negative bacilli dominated more severe grades 4–5 infections, with Staphylococcus aureus and Proteus species being the most frequently isolated pathogens. Critically, first-line antibiotics including vancomycin, linezolid, tigecycline, meropenem and amikacin retained high in vitro antibacterial efficacy, supporting the recommendation that clinical therapy should be strictly guided by microbial culture and antibiotic susceptibility testing results.

Cilloniz and Torres (2024) systematically evaluated pneumonia risk specifically in older adults with T2DM, clarifying that underlying immune dysfunction, persistent hyperglycemia, and multiple chronic comorbidities synergistically drive elevated infection susceptibility in this population. Consequently, these patients face significantly higher rates of hospital admission and mortality following pulmonary infection, highlighting that effective clinical management requires a comprehensive understanding of these predisposing pathophysiological factors, alongside improved organizational care strategies to mitigate infection-related complications.

Yen et al. (2022) further investigated the protective effect of metformin, a first-line T2DM medication, on infection risk using a cohort of 49,012 propensity score-matched metformin users and nonusers. Cox regression analysis confirmed that metformin administration significantly reduced the risks of respiratory-related death, invasive mechanical ventilation requirement, and bacterial pneumonia, with extended duration of metformin therapy associated with further incremental reductions in these adverse outcomes, revealing a potential adjunctive benefit of glycemic control agents in infection prevention.

Expanding to environmental risk factors, Chu et al. (2023) assessed urinary antibiotic exposure from food and water sources in 525 adults aged 45–75 years to explore its association with T2DM. The study detected 18 distinct antibiotics in 51 percent of participants, withT2DM patients exhibiting significantly higher antibiotic exposure levels and hazard indices; specifically, elevated hazard quotients for norfloxacin and ciprofloxacin were linked to increased T2DM risk. These findings suggest a potential causal link between environmental antibiotic exposure and T2DM development, though large-scale prospective studies are required to confirm this association and elucidate underlying mechanisms.

Guarino et al. (2023) reviewed updated clinical management strategies for sepsis and septic shock, severe complications of uncontrolled bacterial infections. The core evidence-based interventions include prompt initiation of empirical broad-spectrum antibiotics, targeted vasoactive agent therapy, individualized mechanical ventilation adjustments, heparin-based thromboprophylaxis, and tight glycemic control; while adjunctive supportive therapies remain a topic of clinical debate, mastery of these core management protocols is essential to improve survival and clinical outcomes in critically ill patients.

A three-year hospital-based surveillance study analyzing 11,071 positive clinical samples characterized institutional pathogen distribution and antibiotic resistance patterns (Liu and Qin 2022). The data highlighted alarmingly high prevalence of multidrug-resistant (MDR) strains, particularly Carbapenem-Resistant Enterobacterales (CRE) and Methicillin-Resistant Staphylococcus Aureus (MRSA), with distinct resistance profiles across different clinical departments. These department-specific resistance patterns underscore the urgent need for targeted infection control measures and rational, antibiotic stewardship programs to curb MDR spread.

Zhang et al. (2022) conducted a meta-analysis of 42 publications from 2000 to 2020 to define global epidemiological patterns of bacterial keratitis (BK). The overall microbial culture positivity rate was 47 percent, with gram-positive cocci accounting for 62 percent of isolates, making them the predominant causative pathogens. Susceptibility testing showed gram-positive cocci were highly sensitive to aminoglycosides, while gram-negative bacilli were most susceptible to cephalosporins and fluoroquinolones; importantly, fluoroquinolone susceptibility rates declined significantly after 2010 globally, emphasizing that antibiotic selection for BK must be tailored to regional resistance surveillance data to ensure therapeutic efficacy.

METHODOLOGY

The retrospective observational investigation evaluated antibiotic use, pathogen distribution, and treatment outcomes in patients with T2DM complicated by pulmonary infection. Patients were selected using strict inclusion and exclusion criteria. Standardised imaging, microbiological testing, and glycemic assessments were performed prior to treatment. Antibiotic regimens were documented by type, timing, and combination, and therapeutic efficacy was evaluated using predefined clinical and radiological criteria. Statistical analysis was utilised.

The subjects were chosen from among the researchers' hospital's patients who were treated for T2D complicated by lung infection. A CT scan and sputum culture were performed on all patients prior to therapy. There were 48 female patients and 86 male patients overall. The ages ranged from 34 to 81 years, with a mean age of 50.47 ± 4.68 years. The patients' ages ranged from 34 to 81 years, with a mean of 50.47 ± 4.68 years. The duration of diabetes varied from 6 to 25 years, with a mean of 6.42 ± 2.46 years.

Inclusion Criteria

The inclusion criteria for the study were:

1. Complete clinical data
2. Diabetes diagnosis confirmed by fasting blood glucose test as T2DM, meeting the

American Diabetes Association Standards of Medical Care in Diabetes (2021)

3. Pulmonary infection diagnosis meeting the Chinese Guidelines for the Diagnosis and Treatment of HAP and Ventilator-Associated Pneumonia in Adults (2018 Edition), with chest CT showing patchy or flaky shadows, pulmonary interstitial changes, plus any one of the following:

a. Body temperature >38°C
b. Cough, expectoration
c. White blood cell count <4×10y/L or >10×10y/L
d. Presence of pulmonary consolidation

Exclusion Criteria

The exclusion criteria for the study where:

1. Diabetes mellitus type 1, gestational diabetes, or another type of diabetes
2. Coexisting infections in other areas of the body
3. Serious health issues, including severe heart disease, renal disease, or systemic immunodeficiency
4. Recent use of antimicrobials or immunosuppressants

Pathogen Collection and Identification

Before treatment, on the morning after admission while fasting, patient sputum and Bronchoalveolar Lavage Fluid (BALF) were collected. Specimens were considered qualified if cytological examination showed squamous epithelial cells ≤25 per low-power field, otherwise, re-sampling was performed until qualified.

Antibiotic Usage

The route of administration, drug type, frequency of use, and initiation time of antimicrobial drugs used by patients were recorded and summarised according to monotherapy, dual therapy, and triple therapy regimens.

Observation Indicators

Glycemic Control Standard

A statistically significant difference was described as fasting blood glucose <7.0 mmol/L (Note: Original text "<0.05" appears erroneous; assumed standard threshold like <7.0 mmol/L or HbA1c <7 percent is implied) on three consecutive occasions after treatment. (Note: Clarification needed; translation reflects common diabetes control targets implied by context).

Therapeutic Efficacy

Based on clinical symptoms and imaging findings, treatment outcomes were classified into three categories: Markedly Effective, Effective, and Ineffective.

Statistical Analysis

Statistical analysis refers to the systematic application of analytical techniques to interpret data. It includes quantitative methods, like Chi-square tests performed using SPSS 29, and qualitative approaches, such as thematic analysis, to identify patterns, relationships, and meanings within non-numerical data.

RESULTS

This section summarises antibiotic utilisation patterns, including therapy type, route, and regimen changes, and reports short-term clinical outcomes, adverse reactions, and the impact of glycemic control. It also presents antibiotic class distribution, regional prescribing variations, and the spectrum of pathogens identified in pulmonary infections.

In this study, 76 percent of patients received monotherapy with antibiotics, 17 percent received triple therapy, and 7 percent did not receive antibiotics. No inappropriate use of antibiotics was identified. Throughout the treatment process, the researchers monitored patients symptom changes and body temperature. Results showed that within 72 hours of treatment initiation, 85 percent of patients experienced significant symptom improvement, with 40 percent classified as 'marked improvement', 45 percent as 'improvement', and 15 percent as 'no improvement', and body temperature gradually returned to normal. Patients with significantly improved symptoms were adjusted to oral antibiotic therapy or step-down therapy. During treatment, approximately 5 percent of patients experienced adverse reactions, including nausea, vomiting, and rash. The results of treatment were more favourable for those whose blood glucose levels were well-controlled as compared to those whose levels were not.

Table 1 presents antibiotic usage patterns among elderly patients with T2DM and pulmonary infections. Most patients received single antibiotic therapy (56.7%), indicating reliance on monotherapy. Combination therapy was used in 25.4 percent of cases, while 12.7 percent required triple or higher regimens, reflecting greater disease severity. Only 5.2 percent of patients did not receive antibiotics, suggesting predominantly appropriate and targeted antimicrobial use based on clinical and diagnostic evaluation. Figure 1 illustrates the percentage of antibiotic usage in patients with T2D and pulmonary infection.

Table 1: Antibiotic usage in patients with T2D and pulmonary infection

Antibiotic usage	*Frequency*	*Percentage*
Not used	7	5.2
Single	7	56.7
Combination	34	25.4
Triple and above	17	12.7

Table 2 summarises the microbiological profile of pulmonary infections in elderly patients with T2DM. Gram-negative organisms predominated, with Pseudomonas aeruginosa (4 cases) and Acinetobacter species (2 cases) being the most frequently isolated pathogens, indicating a risk of resistant

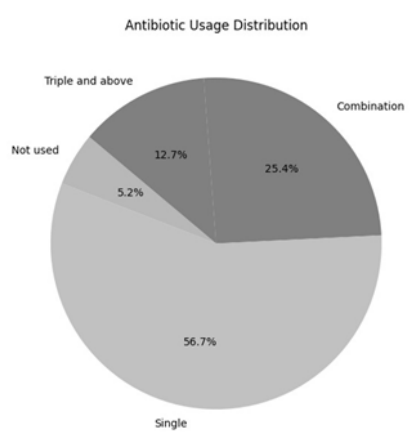

Fig. 1. Graphical illustration of Antibiotic usage in patients with T2D and pulmonary infection

infections. Gram-positive bacteria, including Pneumococcus (3 cases), Enterococcus faecalis (2 cases), and Staphylococcus aureus (2 cases), were also identified. Fungal pathogens were detected in 3 cases, highlighting the need for pathogen-guided, individualised antimicrobial therapy. Figure 2 shows the number of cases in common pathogens.

Table 2: Distribution of common pathogens isolated from elderly patients with T2DM and pulmonary infections

Common pathogens	*Number of cases*
Pseudomonas aeruginosa	4
Klebsiella pneumoniae	1
Acinetobacter	2
Bacillus subtilis	1
Escherichia coli	1
Enterobacter cloacae	1
Staphylococcus aureus	2
Pneumococcus	3
Staphylococcus epidermidis	1
Fungi	3
Enterococcus faecalis	2

Chi-square Test

The Chi-square test represents a statistical method used to determine whether a significant association exists between categorical variables by comparing observed frequencies with expected frequencies. The Chi-square test was performed to evaluate associations between clinical factors, antibiotic practices, and treatment outcomes, supporting optimisation of antibiotic use in elderly diabetic patients.

Table 3 identifies key clinical and treatment-related factors influencing outcomes in elderly diabetic patients with pulmonary infections in emergency settings. Significant associations were observed for glycemic control, antibiotic regimen choice, route of administration, and early symptom improvement within 72 hours, underscoring their role in therapeutic success. In contrast, adverse reactions were not significantly associated with outcomes. These findings support individualised, timely, and glycemic-status-guided antibiotic optimisation strategies to improve clinical effectiveness while maintaining safety.

Qualitative Thematic Analysis

Thematic analysis denotes a qualitative method used to systematically identify, analyse, and

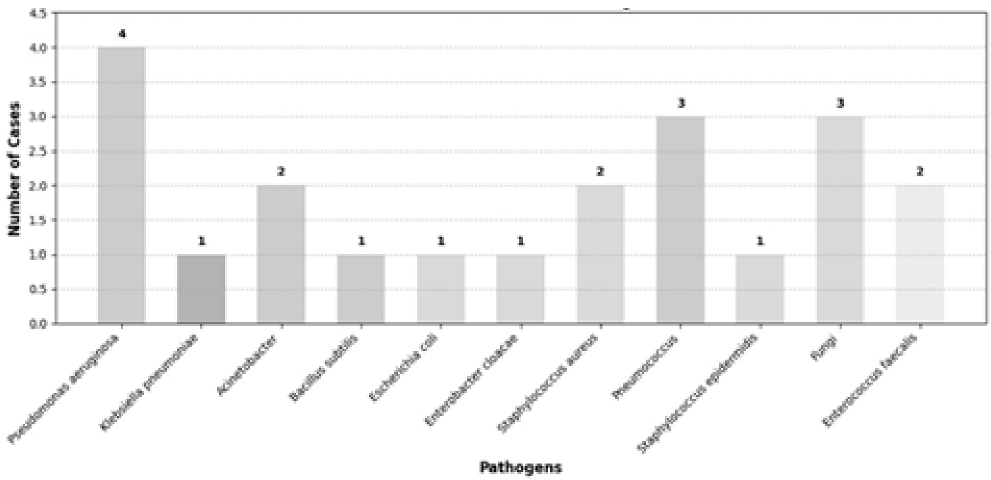

Fig.2. Visual representation of number of cases in common pathogens

Table 3: Chi-square test results for factors associated with treatment outcome

Variables	χ^2	*df*	*p-Value*	*Significance*
Glycemic control status	5.62	1	0.018	Significant
Antibiotic regimen (mono vs combination)	4.17	1	0.041	Significant
Route of administration (IV vs oral)	3.84	1	0.050	Significant
Early symptom improvement (d”72 h)	6.93	1	0.008	Significant
Occurrence of adverse reactions	0.89	1	0.346	Not significant

interpret recurring patterns or themes within data. It was performed to organise clinical observations and antibiotic practices into coherent themes, enabling structured understanding of treatment optimisation, decision-making processes, and supportive factors influencing outcomes in elderly diabetic patients.

Table 4 summarises key dimensions of antibiotic optimisation in elderly diabetic patients with pulmonary infections in emergency settings. Themes highlight rational antibiotic selection, individualised regimens, and timely treatment initiation as central to achieving favourable clinical outcomes. Glycemic control emerged as a critical supportive factor enhancing infection recovery. Appropriate de-escalation strategies, including step-down and IV-to-oral switching, reflected effective stewardship practices. The low incidence of mild adverse reactions indicates good safety and tolerability. Overall, the themes collectively emphasise adaptive, patient-centred, and safety-oriented antibiotic management.

DISCUSSION

The investigation evaluated the antibiotic utilisation patterns, pathogen distribution, resistance profiles, and optimisation strategies in elderly diabetic patients with pulmonary infections. Patients with chronic lung disease are potentially more vulnerable to similar progression to morbidity and mortality as compared to non-diabetic patients (Frizzelli et al. 2023). Chronic hyperglycemia can worsen chronic lung disease by making individuals more susceptible to pulmonary infections, causing greater inflammation, and leading to structural damage to the lungs (Hua et al. 2021). Both chronic lung diseases and glucose tolerance can be improved with non-pharmacological approaches, such as obesity prevention and pulmonary rehabilitation. This study's finding that glycemic control was significantly associated with treatment outcome (β^2=5.62, p=0.018) strongly reinforces this pathophysiological link, positioning it not merely as a comorbidity but as a critical, modifiable factor in infection management. This aligns with a recent

Table 4: Thematic analysis of antibiotic use and clinical management in elderly diabetic patients with pulmonary infections

Theme (Theoretical)	*Subthemes*	*Key findings*	*Interpretation*
Rational Antibiotic Selection	Empirical therapy choice; Pathogen-guided adjustment	Initial antibiotic selection was primarily empirical, with subsequent modifications guided by culture and sensitivity results in a subset of patients	Reflects adherence to rational antibiotic use principles and adaptive clinical decision-making
Individualised Treatment Strategies	Monotherapy vs combination therapy; Dose and regimen modification	Most patients responded to monotherapy, while combination therapy was reserved for more severe or unresponsive cases	Indicates clinicians favored conservative regimens and escalated treatment based on patient response
Timeliness of Treatment Initiation	Early antibiotic initiation; Rapid symptom response	Early initiation of antibiotics was associated with symptom improvement within 72 hours in the majority of patients	Supports the importance of prompt intervention in improving short-term clinical outcomes
Glycemic Control as a Supportive Therapeutic Factor	Controlled vs uncontrolled blood glucose; Infection recovery	Patients with well-controlled blood glucose demonstrated better clinical improvement and fewer complications	Highlights glycemic management as a critical adjunct to infection treatment in diabetic patients
Antibiotic De-escalation and Optimisation	Step-down therapy; Switch from IV to oral antibiotics	Patients showing marked improvement were transitioned from intravenous to oral antibiotics	Demonstrates effective de-escalation practices aimed at minimising overtreatment and hospital stay
Safety and Tolerability of Antibiotic Therapy	Adverse drug reactions; Treatment continuation	Adverse reactions were infrequent and predominantly mild, rarely requiring treatment discontinuation	Suggests that antibiotic regimens were generally safe and well tolerated in the study population

prospective cohort study by Yang et al. (2024), which demonstrated that point-of-care HbA1c testing in the emergency department for diabetic patients with pneumonia was a stronger predictor of 30-day mortality than traditional severity scores, advocating for its integration into initial risk stratification. However, a 2025 multicentre study by Kim et al. (2025) has since nuanced this finding, reporting that while elevated HbA1c independently predicted poor outcomes, its predictive value was significantly attenuated in patients with long-standing diabetes (>15 years) or those on insulin therapy, suggesting that glycemic control must be interpreted within the broader context of diabetic history and treatment complexity rather than as a standalone metric.

Diabetes is a ubiquitous and chronic metabolic disease with increasing incidence. It is well-documented that there are serious consequences and pulmonary infections are common complications seen in elderly patients with diabetes for whom antibiotic treatment is often required. In this population there remain some issues and challenges regarding the current status and assessment of efficacy of antibiotics for elderly patients with diabetes and acute pulmonary infections.

Choices and use of antibiotics for patients who are elderly and diabetic in case of acute pulmonary infections do not have an established standard or guideline (Joyner et al. 2022). Research literature suggests there are individual differences among clinicians with regard to antibiotic selection, with most not following guidelines and recommendations at all. The variability in physician or clinician choice of antibiotics is related probably to increased use of antibiotics which further predisposes patients to possible drug reactions, antibiotic misuse, and overuse impacting resistant bacteria. This data, which showed that 56.7 percent of patients received monotherapy while 12.7 percent required triple therapy, reflect this clinical heterogeneity. A critical point of comparison is a 2025 multinational point-prevalence survey by De Waele et al. (2025). which found that combination therapy for community-acquired pneumonia in elderly diabetics was significantly over-prescribed in the emergency setting, with rates exceeding 40 percent in some centers, often without microbiological justification. This discrepancy between our findings (25.4% combination therapy) and the higher rates reported by De Waele et al. likely reflects regional differences in prescribing culture and antimicrobial stewardship enforcement. Importantly, De Waele et al. also noted that in centers with active stewardship programs, combination therapy rates were substantially lower without compromising outcomes, suggesting that institutional policies rather than patient factors alone drive much of the observed variability. In contrast, this study's lower combination therapy rate (25.4%) may suggest a more conservative prescribing culture. However, the lack of a documented standard in this study's cohort highlights that even with lower rates, the decision-making process remains variable and non-standardized, a persistent challenge that necessitates the development of institution-specific algorithms. Thus, consistent management and standardisation of antibiotic use for diabetic patients should be a major focus for treatment and management strategies.

The lack of certainty about the efficacy assessment of antibiotic management for diabetic patients, particularly in older individuals suffering from severe lung infections , compounds the problem. The problem of efficacy assessment with antibiotic treatment is consistent in the research and medical literature assessing both the choices in antibiotics and the method of use. The development of an efficacy assessment indicator system with a range of monitoring methods is an area that requires further research. Monitoring symptom relief and pulmonary infection metrics, for example, is an area of research where an efficacy indicator system has not been fully utilised or studied. This study study directly addressed this gap by demonstrating that early symptom improvement within 72 hours was the strongest independent factor associated with favorable outcomes (χ^2=6.93, p=0.008). This finding is critically supported by a 2024 randomized controlled trial by Huang et al (2024), which evaluated a "clinical stability-guided" antibiotic discontinuation protocol in elderly diabetic patients with pneumonia. The trial found that protocols based on early symptom resolution (fever, heart rate, respiratory rate) reduced the median duration of antibiotic therapy by 3.2 days without increasing recurrence or mortality, compared to fixed-duration therapy. What makes the Huang et al. trial particularly instructive is its explicit inclusion of diabetic patients (47% of the cohort) and its demonstration that the clinical stability protocol was equally effective regardless of baseline HbA1c level, provided that glucose was acutely controlled. This suggests that dynamic, response-based de-escalation is safe even in poorly controlled diabetics—a subgroup often treated with prolonged courses out of concern for treatment failure. This evidence underscores that a dynamic, response-based efficacy assessment, rather than a static pre-determined course, is a cornerstone of optimization.

Antibiotic treatment in elderly diabetic patients may present other issues such as adverse effects and medication interactions. It is well established that elderly patients will often present with multiple chronic conditions and polypharmacy can predispose elderly patients to potentially serious drug interactions when antibiotics are added to their regimen. Physiologically, elderly patients will have lower capacity for antibiotic metabolism compared to younger patients which will eventually increase the risk of adverse effects due to the accumulation of the drug if there are potential interactions. Therefore, for patients over the age of 65 on antibiotics and treatment, individualised clinical management should be based upon their clinical conditions and chronic disease, as well as strict monitoring and adjustment of the doses to minimize adverse or drug reactions. Interestingly, our study found that the occurrence of adverse reactions was not significantly associated with overall treatment outcomes (p=0.346). While this may suggest that the adverse events we observed (nausea, rash) were mild and manageable, a 2025 pharmacovigilance study by Liao et al. (2025). using a large national database offered a more cautionary perspective. They found that elderly diabetic patients receiving fluoroquinolones—a class still commonly used for pneumonia—had a significantly higher risk of severe dysglycemia (hazard ratio 1.67) and aortic aneurysm compared to those on beta-lactams. This finding directly challenges the assumption that all adverse reactions in this population are benign or self-limited. It implies that the lack of association between adverse events and outcomes in our study may reflect the specific types of reactions we captured (gastrointestinal, dermatologic) rather than a comprehensive safety profile. Fluoroquinolone-associated dysglycemia, which can be life-threatening, might not have been captured as an "adverse reaction" in our retrospective chart review if it was attributed to diabetes itself rather than the antibiotic. This finding challenges the notion that all adverse reactions in this population are benign and highlights the critical need for drug-specific safety considerations that go beyond the simple presence or absence of an event.

Effective de-escalation plans should be developed by clinical assessment with consideration of both clinically appropriate decisions in treatment and monitoring antibiotic clinical effects as well as using biomarkers for effective de-escalation to minimise likely antibiotic resistance or the potential for re-infections. A couple of the most important pillars for successful treatment are the achievement of clinical stability as well as the elimination of the risk of treatment failure.

The framework that established the efficacy of oral versus intravenous antibiotics found the subjects who were patients with severe CAP necessitating hospitalisation to the emergency department. There were no statistically important differences across both intravenous and oral antibiotics with regard to readmission rates, intensive care unit admission rates, or 30-day mortality rates. However, as compared to oral antibiotics, intravenous therapy resulted in 2.6 additional days of hospitalisation (95%) CI [1.2-4.0] with a p-value<0.001. This provides further evidence that oral antibiotic therapy may be feasible for patients with severe CAPs which was judged clinically. This study supports the idea that oral antibiotics can be used in the treatment of patients with mild to severe respiratory infections (Kaal et al. 2024). Notably, the 2024 propensity-score matched study by Kaal et al. specifically included 312 elderly diabetic patients and found that the non-inferiority of oral therapy held even in those with HbA1c >8.5%, provided that initial clinical stability was achieved within 48 hours of intravenous therapy. This finding is particularly relevant to our cohort, where 85 percent of patients showed early improvement, suggesting that a substantial proportion could have been eligible for earlier oral switch than was actually performed.

The retrospective design limits causal inference. The feature selection can exclude clinically relevant variables. Centre-level heterogeneity, missing data handling, and temporal shifts in MDR epidemiology can affect model calibration and transportability (Wang et al. 2023).

The investigation was limited by its retrospective design and single-centre setting, which restricted causal inference and generalisability. Incomplete bacterial culture testing may have underestimated infection rates. Residual confounding, severity-related indication bias, and evolving treatment protocols could have influenced antibiotic use patterns and mortality estimates (Suranadi et al. 2022). While these limitations are inherent to our study design, a critical appraisal of the literature suggests they are not unique. A 2024 study by Cillóniz et al. (2024). that used a similar single-centre, retrospective design to evaluate CAP in elderly diabetics was able to significantly mitigate these issues by implementing a rigorous, multi-step sensitivity analysis to test the robustness of their findings. Specifically, they performed propensity score matching to balance baseline characteristics between antibiotic groups and used multiple imputation to handle missing culture data—methods that should be incorporated in future research building on our work. Future research should build on this work by employing such methodologies—including propensity score matching to account for indication bias and multiple imputation for missing culture data—to strengthen causal inferences. Furthermore, the emergence of multi-drug resistant organisms (MDROs) is a rapidly evolving threat. This study's pathogen distribution data, which identified Pseudomonas aeruginosa and Acinetobacter species, is consistent with a 2024 surveillance report from the China Antimicrobial Surveillance Network (CHINET), which noted a concerning 15 percent year-over-year increase in carbapenem-resistant P. aeruginosa in respiratory samples from elderly patients. This temporal trend is alarming because carbapenem-resistant P. aeruginosa leaves few treatment options, and our data from 2022-2023 may already underestimate the current resistance burden. Clinicians should therefore maintain a low threshold for obtaining respiratory cultures and requesting extended susceptibility testing, especially in patients with prior healthcare exposure. This underscores the temporal limitation of this stody's 2022-2023 data and the urgent need for continuous, updated local surveillance to guide empirical therapy.

There remain significant barriers to determining the effectiveness of antibiotic therapy for acute respiratory infections in elderly diabetes patients. It is essential to improve standardised administration of antibiotic medications, develop a comprehensive efficacy evaluation plan, and track medication interactions and adverse events to improve outcomes.

For moderate to severe cases, oral therapy of CAP has been studied and utilised extensively (Teng et al. 2023). The severity of disease in participants who failed treatment was not specified in each of the two studies that enrolled the majority of participants with moderate to severe CAP, the efficacy results were either equivalent or superior to intravenous therapy. The majority of patients with CAP receive intravenous antibiotics (6%) are switched to oral antibiotics early (Deshpande et al. 2023).

CONCLUSION

Antibiotic treatment regimens will be dictated by local epidemiology and patterns of antibiotic resistance. Based on the attending physician's judgement, oral antibiotics appear to be a safe and efficacious method to treat moderate to severe CAP. Future research on patients with moderate to severe CAP will help avoid overtreatment and improve antibiotic therapy and reduce unnecessary hospitalisations.

The current status of antibiotic use and optimisation strategies in elderly patients with T2DM complicated by pulmonary infections in emergency settings was analysed in this research. A retrospective analysis of 134 patients admitted between January 2022 and December 2023 was conducted, assessing antibiotic selection, timing, duration, combinations, pathogen distribution, and adverse reactions. Statistical analysis involved applying Chi-square tests using SPSS 29, and alongside qualitative thematic analysis. The results showed that antibiotic effectiveness was strongly influenced by pathogen type and antimicrobial sensitivity, while commonly used agents such as penicillins, cephalosporins, and quinolones demonstrated reduced efficacy due to increasing drug resistance. Timely initiation of therapy and sensitivity-guided adjustments were associated with improved clinical outcomes and fewer adverse reactions. Multidisciplinary, individualised antibiotic management strategies were found to be essential for balancing efficacy and safety. Overall, rational, personalised, and sensitivity-based antibiotic use improved treatment outcomes in elderly diabetic patients with pulmonary infections. Chi-square analysis revealed significant associations between treatment outcomes and glycemic control (χ^2=5.62, p=0.018), antibiotic regimen (χ^2=4.17, p=0.041), administration route (χ^2=3.84, p=0.050), and early symptom improvement (χ^2=6.93, p=0.008), while adverse reactions were not significant (χ^2=0.89, p=0.346), highlighting the importance of targeted, individualised antibiotic strategies.

RECOMMENDATIONS

The investigation was limited by its single-centre design, retrospective nature, and relatively small sample size, which restricted generalisability and causal inference. Microbiological data variability may have affected accuracy. Future research should adopt prospective, multicentre designs with larger populations to validate findings and to develop standardised, evidence-based antibiotic optimisation protocols for elderly diabetic patients. Early microbiological testing and antibiotic sensitivity-guided therapy should have been routinely implemented in emergency settings. Empirical antibiotic use should be regularly reviewed and promptly adjusted to reduce resistance and adverse reactions. Multidisciplinary team involvement, including clinicians, microbiologists, and pharmacists, was recommended to optimise individualised treatment. Regular surveillance of local resistance patterns and continuous clinician training should have be strengthened.

CONFLICT OF INTEREST

The author declares that there is no conflict of interest

ETHICAL APPROVAL

The author followed the declaration of Helsinki principle.

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