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The Role of Nurses and Pharmacists in Managing Antimicrobial Practices in Patients with Hospital-Acquired Pneumonia.

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Abstract

Background: Hospital-acquired pneumonia (HAP) and ventilator-associated pneumonia (VAP) are major healthcare-associated infections that contribute to morbidity, mortality, prolonged hospitalization, and increased healthcare costs. Their management is complicated by multidrug-resistant pathogens, diagnostic limitations, and the clinical complexity of hospitalized patients.

Aim: This review examines the epidemiology, etiology, clinical presentation, diagnostic evaluation, treatment, and prognosis of HAP and VAP, with particular emphasis on the complementary roles of nursing and pharmacy professionals in prevention and management.

Methods: The review discusses current evidence concerning common bacterial pathogens, risk factors for antimicrobial resistance, clinical and microbiological diagnostic approaches, empirical antimicrobial selection, treatment modification, and infection prevention strategies. It also examines nursing surveillance, medication optimization, antimicrobial stewardship, and multidisciplinary collaboration.

Results: HAP and VAP are commonly associated with gram-negative organisms, including Pseudomonas aeruginosa, Klebsiella pneumoniae, and Acinetobacter species, as well as Staphylococcus aureus. Previous intravenous antibiotic exposure and prolonged hospitalization increase the risk of resistant infections. Diagnosis requires integration of clinical findings, radiological evidence, and respiratory cultures, while molecular assays may accelerate pathogen identification. Empirical treatment should reflect local resistance patterns and individual risk factors, followed by culture-guided de-escalation. A seven-day antibiotic course is generally sufficient for uncomplicated cases. Nursing interventions support early detection and infection prevention, whereas pharmacists optimize antimicrobial selection, dosing, safety, and treatment duration.

Conclusion: Effective HAP and VAP management requires early diagnosis, appropriate antimicrobial therapy, infection prevention, and coordinated interprofessional care.

Keywords: Hospital-acquired pneumonia; ventilator-associated pneumonia; nursing; clinical pharmacy; antimicrobial stewardship; multidrug resistance.

Introduction

Hospital-acquired pneumonia (HAP) is a major healthcare-associated infection and an important cause of morbidity, mortality, prolonged hospitalization, and increased healthcare costs. It is defined as pneumonia that develops 48 hours or more after hospital admission in patients who did not have evidence of pneumonia at the time of admission. Ventilator-associated pneumonia (VAP) is a distinct subtype of HAP that develops in patients receiving invasive mechanical ventilation. It is generally defined as pneumonia occurring more than 48–72 hours after endotracheal intubation. VAP represents a major complication among critically ill patients and is estimated to affect approximately 10%–20% of individuals who receive mechanical ventilation for more than 48 hours [1,2]. The development of HAP and VAP involves interactions between patient-

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related factors, microbial exposure, and healthcare practices. Hospitalized patients may have impaired immune responses, underlying diseases, reduced mobility, and exposure to invasive procedures. In mechanically ventilated patients, endotracheal intubation disrupts normal airway defense mechanisms and facilitates the entry of microorganisms into the lower respiratory tract. Aspiration of colonized oropharyngeal and gastric secretions is also an important mechanism contributing to infection. The management of HAP and VAP presents challenges because these infections frequently involve resistant bacterial pathogens. Delayed recognition, inappropriate empirical antibiotic selection, and inadequate treatment can contribute to treatment failure and adverse outcomes. Early clinical assessment, microbiological investigation, and appropriate antimicrobial therapy are therefore essential. Nurses and pharmacists have complementary responsibilities in preventing infection, identifying clinical deterioration, ensuring appropriate medication administration, monitoring treatment response, and promoting antimicrobial stewardship. Nursing interventions include adherence to infection prevention measures, oral hygiene, appropriate positioning, respiratory assessment, and surveillance for clinical signs of pneumonia. Pharmacists contribute through antimicrobial selection, dose adjustment, assessment of drug interactions, therapeutic monitoring, and evaluation of treatment duration. Collaboration between these professionals can improve medication safety, support appropriate antibiotic use, and reduce the risk of antimicrobial resistance. Understanding the epidemiology, causative organisms, risk factors, and clinical presentation of HAP and VAP provides a foundation for effective prevention and management [1][2].

Etiology:

Hospital-acquired pneumonia (HAP) and ventilator-associated pneumonia (VAP) are caused by a range of bacterial pathogens, with aerobic gram-negative bacilli and gram-positive cocci representing the most frequently identified groups. Common gram-negative organisms include Pseudomonas aeruginosa, Escherichia coli, Klebsiella pneumoniae, Enterobacter species, and Acinetobacter species. Among gram-positive bacteria, Staphylococcus aureus is an important pathogen, including methicillin-resistant Staphylococcus aureus (MRSA), while Streptococcus species may also contribute to infection. The distribution of causative organisms varies between healthcare facilities and depends on local antimicrobial resistance patterns, patient characteristics, previous antibiotic exposure, and institutional infection prevention practices [2]. The development of HAP and VAP is often associated with colonization of the upper respiratory tract by hospital microorganisms, followed by aspiration of contaminated secretions into the lower respiratory system. Endotracheal intubation increases this risk by bypassing normal airway defenses and providing a surface for microbial adherence and biofilm formation. Mechanical ventilation, prolonged hospitalization, and exposure to broad-spectrum antibiotics further increase the likelihood of colonization with multidrug-resistant (MDR) organisms. Several clinical factors help identify patients at increased risk of infection caused by resistant pathogens. In VAP, recognized risk factors for MDR organisms include septic shock at the time of pneumonia onset, acute respiratory distress syndrome (ARDS) before VAP develops, intravenous antibiotic exposure within the preceding 90 days, hospitalization exceeding five days before infection, and acute renal replacement therapy before VAP onset. For HAP, previous intravenous antibiotic administration within 90 days is an important risk factor for MDR pathogens. The same exposure is associated with an increased likelihood of MRSA and MDR Pseudomonas aeruginosa in both HAP and VAP [1–3]. Identifying these risk factors is important when selecting empirical antimicrobial therapy. Patients with previous antibiotic exposure or prolonged hospitalization may require broader initial coverage, depending on local microbiological data and the severity of illness. However, unnecessary broad-spectrum treatment should be avoided because it increases the risk of adverse drug reactions, antimicrobial resistance, and secondary infections. Pharmacists can support treatment decisions by reviewing previous antimicrobial exposure, assessing resistance risks, and recommending appropriate empirical regimens. Nurses contribute by monitoring clinical changes, obtaining respiratory specimens correctly, and ensuring timely administration of prescribed antibiotics. Microbiological results should guide subsequent treatment modification, including narrowing or discontinuing antibiotics when appropriate.

Epidemiology:

Hospital-acquired pneumonia (HAP) is among the most frequent healthcare-associated infections and represents a substantial burden on hospital services. Its reported incidence is approximately 5–10 cases per 1,000 hospital admissions. HAP is considered one of the most common hospital-acquired infections in Europe and the United States, contributing to increased healthcare utilization, prolonged hospital stays, and higher treatment costs [1,3]. Its epidemiological burden varies according to patient populations, hospital characteristics, infection prevention practices, and the prevalence of antimicrobial-resistant microorganisms. Ventilator-associated pneumonia (VAP) accounts for a considerable proportion of pneumonia cases occurring in intensive care units (ICUs). More than 90% of pneumonia

episodes developing in ICUs occur among patients who are intubated and receiving mechanical ventilation. This association reflects the increased susceptibility of critically ill patients to respiratory infections and the disruption of normal airway defense mechanisms following endotracheal intubation [1,3]. The risk of HAP and VAP is influenced by several factors, including the severity of underlying illness, duration of hospitalization, mechanical ventilation, exposure to invasive devices, and previous antimicrobial treatment. Patients with severe systemic infections, respiratory failure, impaired consciousness, or multiple comorbidities may have a greater risk of developing pneumonia. Longer periods of mechanical ventilation also increase opportunities for airway colonization and aspiration of contaminated secretions. The epidemiology of these infections is further complicated by differences in bacterial distribution and antimicrobial susceptibility between hospitals. Some institutions report a high prevalence of gram-negative organisms, particularly Pseudomonas aeruginosa and Acinetobacter species, whereas others may identify a greater proportion of Staphylococcus aureus infections. The emergence of multidrug-resistant organisms has important implications for empirical antibiotic selection and treatment outcomes. Surveillance systems and routine microbiological monitoring are essential for understanding local epidemiological patterns. Hospital infection control teams should evaluate infection rates, identify changes in pathogen distribution, and monitor antimicrobial resistance. Nurses contribute to surveillance through accurate documentation, compliance with infection prevention protocols, and early reporting of suspected infections. Pharmacists support these activities by reviewing antibiotic consumption and resistance trends and participating in antimicrobial stewardship programs. These coordinated efforts can improve the prevention and management of HAP and VAP [2][3].

History and Physical Examination:

The clinical presentation of hospital-acquired pneumonia (HAP) and ventilator-associated pneumonia (VAP) varies according to the causative organism, severity of infection, underlying health status, and ability of the patient to communicate symptoms. Clinical assessment is important because early recognition can support timely diagnostic investigations and antimicrobial treatment. However, diagnosis may be difficult in critically ill patients, particularly those receiving mechanical ventilation or presenting with multiple conditions that produce similar respiratory and systemic findings. Common symptoms include cough, increased sputum production, fever, chest pain, and dyspnea. Patients may report a change in sputum volume, consistency, or color, which can indicate a developing respiratory infection. In mechanically ventilated patients, symptoms such as cough and breathlessness may not be reliably assessed. Therefore, clinical evaluation depends more heavily on changes in respiratory parameters, secretion characteristics, oxygen requirements, and general condition. Physical examination may reveal fever, tachypnea, abnormal breath sounds, pulmonary crackles, and signs of lung consolidation. Increased respiratory effort, reduced oxygen saturation, and worsening oxygenation may indicate progression of pulmonary infection. In severe cases, patients may develop hemodynamic instability, altered mental status, or features of sepsis. These findings require prompt assessment and may indicate the need for escalation of respiratory and critical care support [1–3]. In patients receiving mechanical ventilation, an increase in ventilator requirements, deterioration in oxygenation, increased airway secretions, or changes in secretion appearance may raise suspicion of VAP. Nurses play an important role in identifying these changes through regular respiratory assessment and continuous monitoring. Accurate recording of temperature, respiratory rate, oxygen saturation, ventilator settings, and secretion characteristics helps clinicians evaluate the patient's condition over time.

Clinical findings alone are insufficient to confirm HAP or VAP because fever, leukocytosis, respiratory deterioration, and abnormal chest imaging may also occur in other conditions. These findings should therefore be interpreted alongside radiological assessment and microbiological investigations. Respiratory specimens should be collected appropriately, preferably before starting or changing antibiotic treatment when this can be achieved without delaying necessary therapy. Pharmacists contribute to the clinical management process by reviewing prescribed antimicrobial treatment, checking doses according to renal function and other patient characteristics, and identifying potential adverse effects and drug interactions. They can also support reassessment when microbiological results become available. Effective communication between nurses, pharmacists, physicians, and microbiology teams helps ensure that clinical deterioration is recognized and that treatment remains appropriate throughout the course of infection [1][2][3].



Figure-1: Overview of Hospital-Acquired Pneumonia.

Evaluation

The diagnosis of hospital-acquired pneumonia (HAP) and ventilator-associated pneumonia (VAP) remains challenging because no single diagnostic method provides sufficient accuracy in all clinical situations. Evaluation requires integration of clinical findings, radiological evidence, and microbiological investigations. According to the 2016 Infectious Diseases Society of America and American Thoracic Society guidelines, HAP and VAP are suspected when a new pulmonary infiltrate appears on chest imaging alongside clinical evidence suggesting an infectious cause. Relevant findings include new-onset fever, purulent respiratory secretions, leukocytosis, and deterioration in oxygenation [4,5]. The Clinical Pulmonary Infection Score (CPIS) combines clinical, laboratory, and radiological parameters to estimate the likelihood of pneumonia. Although it may help identify patients with suspected pulmonary infection, its diagnostic value remains controversial. Some studies suggest that CPIS has reasonable sensitivity but limited specificity, potentially resulting in unnecessary antimicrobial treatment. Therefore, it should not replace comprehensive clinical assessment or microbiological confirmation [4,5]. Microbiological evaluation is essential for identifying the causative pathogen and guiding antimicrobial selection. In patients with VAP, lower respiratory tract specimens can be collected using several techniques. Blind tracheobronchial aspiration involves inserting a flexible catheter through the endotracheal tube into the distal trachea. It is relatively noninvasive and can be performed without bronchoscopy. However, the absence of direct visualization may prevent sampling from the specific lung segment affected by pneumonia, increasing the possibility of false-negative results. Contamination during catheter passage through the endotracheal tube and proximal airways may also produce false-positive findings.

Bronchoscopy with bronchoalveolar lavage (BAL) allows clinicians to collect specimens from lung segments suspected of infection. This approach may improve sampling accuracy and reduce false-negative results. However, its effectiveness depends on operator expertise, and contamination of the bronchoscope may influence culture findings. Furthermore, bronchoscopy can worsen hypoxemia, making it unsuitable for some critically ill patients. Another option is the protected specimen brush (PSB), which is advanced through a bronchoscope into the distal airway. Its protective design reduces contamination from upper respiratory secretions [6]. For patients with HAP who are not mechanically ventilated, respiratory specimens can be obtained through spontaneous sputum expectoration, induced sputum collection, or nasotracheal suctioning when patients cannot produce adequate samples independently. All collected respiratory specimens should undergo microscopic examination and microbiological culture. Microscopic evaluation includes Gram staining and assessment of polymorphonuclear leukocytes. The presence of abundant neutrophils supports an inflammatory process, while bacterial morphology may provide preliminary information about the likely pathogen. These findings can help guide initial antibiotic selection while awaiting culture and susceptibility results. Quantitative cultures provide additional evidence of bacterial infection. Common diagnostic thresholds include at least 10^6 colony-forming units (CFU)/mL for endotracheal aspirates, 10^4 CFU/mL for bronchoscopic or mini-BAL specimens, and 10^3 CFU/mL for PSB samples [6,7]. Results should be interpreted alongside clinical findings because colonization and contamination may affect culture results.

Molecular diagnostic methods offer further opportunities to improve the speed of pathogen identification. Multiplex polymerase chain reaction (PCR) assays can detect multiple respiratory bacterial pathogens and selected antimicrobial resistance genes within a shorter period than conventional culture methods. This information can support earlier selection of appropriate antibiotic regimens and help identify patients who may benefit from treatment modification [8]. Nurses contribute to diagnostic evaluation through timely recognition of respiratory deterioration, appropriate specimen collection, and accurate documentation of clinical findings. Pharmacists support interpretation of microbiological results and recommend antimicrobial adjustments based on pathogen identification, susceptibility patterns, renal function, and treatment response. Collaboration between these professionals promotes timely diagnosis, appropriate antimicrobial use, and improved patient safety [5][6].

Treatment and Management

The treatment of hospital-acquired pneumonia (HAP) and ventilator-associated pneumonia (VAP) requires prompt antimicrobial therapy directed against the most likely bacterial pathogens. Initial empirical treatment should provide coverage for Staphylococcus aureus, Pseudomonas aeruginosa, and other gram-negative bacilli. Antibiotic selection should consider the local hospital antibiogram, institutional resistance patterns, previous antimicrobial exposure, patient characteristics, and individual risk factors for multidrug-resistant (MDR) infections [2,9]. For patients with HAP who have an increased risk of methicillin-resistant Staphylococcus aureus (MRSA), empirical treatment should include an agent with specific activity against this organism. Relevant risk factors include intravenous antibiotic exposure within the previous 90 days, treatment in hospital units where more than 20% of S. aureus isolates are methicillin-resistant, or admission to facilities where

the prevalence of MRSA is unknown. MRSA coverage is also recommended for patients at high risk of mortality, particularly those requiring ventilatory support because of HAP or presenting with septic shock. Vancomycin and linezolid are commonly recommended options in these circumstances. In patients without MRSA risk factors or indicators of high mortality risk, treatment should provide coverage for methicillin-susceptible S. aureus (MSSA). Appropriate options include piperacillin-tazobactam, cefepime, levofloxacin, imipenem, and meropenem [2]. Antipseudomonal coverage is another important component of empirical treatment. Patients with risk factors for Pseudomonas infection, other gram-negative resistant pathogens, or high mortality risk may require two antibiotics from different antimicrobial classes with activity against P. aeruginosa. This approach increases the likelihood of providing effective initial coverage when resistance is suspected. For other patients with HAP, a single antipseudomonal agent may be sufficient. Available options include piperacillin-tazobactam, cefepime, ceftazidime, levofloxacin, ciprofloxacin, imipenem, meropenem, amikacin, gentamicin, and aztreonam. The final choice should reflect local susceptibility data and patient-specific considerations [2].

Following initiation of empirical treatment, all patients should undergo regular reassessment based on clinical response and microbiological findings. When the causative organism is identified, antimicrobial therapy should be narrowed according to susceptibility results. This strategy, known as de-escalation, reduces unnecessary broad-spectrum antibiotic exposure and may limit the development of antimicrobial resistance. In patients who demonstrate clinical improvement without an identified pathogen, empirical coverage for MRSA or MDR gram-negative organisms may be discontinued when these pathogens are not detected in high-quality respiratory cultures obtained within 48–72 hours [2]. Patients who fail to improve within 72 hours of starting antimicrobial therapy require further evaluation. Clinicians should investigate possible complications, additional infection sites, inadequate antimicrobial exposure, resistant pathogens, and alternative diagnoses. If pneumonia remains the most likely diagnosis and resistant organisms are suspected, additional respiratory cultures may be required, together with adjustment of empirical treatment to provide appropriate coverage [2]. For most patients with HAP or VAP, a seven-day antibiotic course is generally as effective as longer treatment durations. Shorter courses can reduce antibiotic exposure, adverse drug reactions, and selection pressure for resistant microorganisms. However, treatment duration should be individualized in patients with severe infection, bacteremia, immunocompromised status, delayed clinical response, empyema, or lung abscess [2]. Nurses support treatment effectiveness through timely antibiotic administration, monitoring vital signs, assessing respiratory status, documenting adverse reactions, and maintaining infection prevention practices. Pharmacists contribute by reviewing empirical regimens, adjusting doses according to renal function, identifying drug interactions, monitoring toxicity, and recommending de-escalation when microbiological results become available. This collaboration supports appropriate antimicrobial use and improves the safety and quality of care.

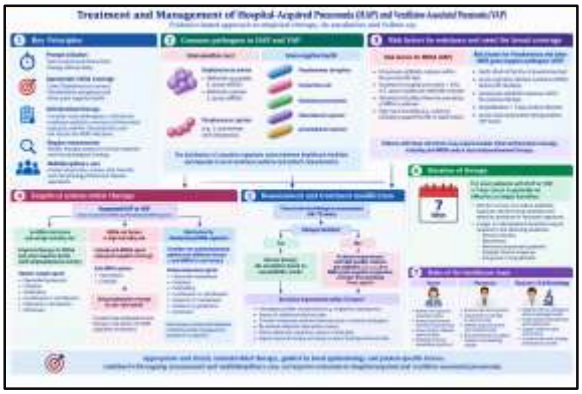


Figure-2: Treatment and Management of Hospital-Acquired Pneumonia.

Differential Diagnosis:

The differential diagnosis of hospital-acquired pneumonia (HAP) and ventilator-associated pneumonia (VAP) is important because several infectious and noninfectious conditions can produce similar clinical manifestations. Fever, respiratory deterioration, increased secretions, leukocytosis, and abnormal chest imaging are not specific to pneumonia. Therefore, clinicians should consider alternative diagnoses before confirming HAP or VAP and initiating or extending antimicrobial treatment. Accurate differentiation helps prevent inappropriate antibiotic exposure, reduces treatment-related complications, and supports the identification of other conditions requiring specific interventions. Several bacterial infections may resemble HAP and VAP, particularly infections caused by Acinetobacter, Enterobacter, Enterococcus, and Escherichia coli. These organisms can cause healthcare-associated infections involving different body systems. Acinetobacter species are particularly relevant in critically ill patients because they can cause respiratory infections and may demonstrate multidrug resistance. Enterobacter and E. coli infections may produce systemic manifestations, including fever and sepsis, while enterococcal infections can arise from urinary, abdominal, or bloodstream sources. Identifying the primary site of infection is essential when interpreting positive microbiological findings [10].

Bacterial sepsis is another important differential diagnosis. Patients with sepsis may develop fever, tachycardia, hypotension, leukocytosis, and respiratory dysfunction without

having pneumonia as the primary source. Blood cultures, clinical examination, laboratory investigations, and evaluation of other potential infection sites can help identify the underlying cause. Burn wound infections should also be considered in hospitalized patients with extensive burns, particularly when systemic inflammatory manifestations or bloodstream infection occur. Viral respiratory infections, including adenovirus infection, may produce fever, cough, respiratory distress, and pulmonary infiltrates. These manifestations can be difficult to distinguish from bacterial pneumonia, especially in immunocompromised patients. Viral testing may therefore be appropriate when the clinical presentation or epidemiological context suggests a viral cause. Other respiratory conditions, such as croup, should be considered when upper airway symptoms, stridor, and characteristic respiratory findings are present. Clostridioides infections and infectious colitis may also complicate the clinical assessment of hospitalized patients. These conditions can cause fever and systemic inflammatory responses, although gastrointestinal manifestations are generally more prominent. In patients receiving antibiotics, Clostridioides difficile infection should be considered when diarrhea or abdominal symptoms develop. The diagnostic process should integrate clinical history, physical examination, imaging, respiratory cultures, blood cultures, and other investigations according to the suspected condition. Nurses contribute by documenting changes in respiratory and gastrointestinal symptoms and reporting clinical deterioration. Pharmacists can help identify medication-related complications, including antibiotic-associated colitis, and review antimicrobial exposure. A systematic differential diagnosis reduces diagnostic errors and supports appropriate treatment decisions [10].

Prognosis:

Hospital-acquired pneumonia (HAP) and ventilator-associated pneumonia (VAP) are associated with substantial morbidity and an increased risk of death among hospitalized patients. Their prognosis depends on several factors, including the severity of infection, the patient's underlying health status, the causative microorganism, antimicrobial susceptibility, and the timeliness of appropriate treatment. Patients who develop pneumonia during hospitalization are often affected by other acute or chronic conditions, which may complicate treatment and delay recovery. The reported all-cause mortality associated with VAP ranges from approximately 20% to 50% across different studies [10]. This variation reflects differences in patient populations, disease severity, diagnostic definitions, causative pathogens, and healthcare settings. Mortality may be particularly high among critically ill patients who develop pneumonia during prolonged mechanical ventilation or experience complications such as septic shock and respiratory failure. The severity of illness at the time of diagnosis is an important prognostic factor. Patients presenting with shock, coma, respiratory failure, or acute respiratory distress syndrome (ARDS) generally have a higher risk of adverse outcomes. These conditions may indicate extensive physiological impairment and reduced capacity to tolerate additional infectious complications. Early recognition of deterioration and timely initiation of appropriate treatment are therefore essential.

Bacteremia is another factor associated with poor prognosis. The presence of bacteria in the bloodstream may indicate systemic dissemination of infection and increase the risk of sepsis and organ dysfunction. Patients with bacteremia may require careful monitoring, targeted antimicrobial treatment, and evaluation for additional infection sources. The identification of resistant pathogens can further complicate management by limiting available treatment options and increasing the possibility of delayed effective therapy. Underlying comorbidities also influence clinical outcomes. Patients with chronic respiratory disease, cardiovascular disorders, renal impairment, diabetes, malignancy, or immunosuppression may have reduced physiological reserves and an increased risk of complications. Advanced age, poor nutritional status, and prolonged hospitalization may further affect recovery, although their prognostic importance varies across patient populations [10]. Several clinical practices can improve the likelihood of favorable outcomes. These include early diagnosis, appropriate empirical antimicrobial therapy, microbiological testing, timely treatment modification, and effective respiratory support. Nurses contribute through continuous assessment of vital signs, oxygenation, respiratory secretions, and neurological status. Pharmacists help optimize antimicrobial selection and dosing while monitoring adverse effects and treatment response. Prognostic assessment should be repeated throughout hospitalization because clinical status can change rapidly. Identifying patients at increased risk allows healthcare teams to prioritize monitoring, adjust treatment strategies, and initiate supportive interventions when needed [10].

Enhancing Healthcare Team Outcomes:

Effective management of hospital-acquired pneumonia (HAP) and ventilator-associated pneumonia (VAP) requires coordinated care involving an interprofessional healthcare team. These infections frequently occur in critically ill patients and may involve complex clinical conditions, resistant microorganisms, respiratory failure, and multiple comorbidities. Their management therefore extends beyond antimicrobial prescribing and requires collaboration among infectious disease specialists, pulmonologists, intensivists, anesthesiologists, nurses, pharmacists,

microbiologists, respiratory therapists, and other healthcare professionals. Without appropriate recognition and management, HAP and VAP can result in substantial morbidity and mortality [10]. Physicians and infectious disease specialists contribute by establishing the diagnosis, assessing disease severity, interpreting microbiological findings, and selecting appropriate antimicrobial regimens. Pulmonologists and critical care specialists manage respiratory complications and determine the need for oxygen therapy, mechanical ventilation, or other supportive interventions. Microbiology teams provide pathogen identification and antimicrobial susceptibility results, allowing treatment to be adjusted according to the causative organism. Nurses have a central role in both prevention and clinical management. Their responsibilities include monitoring temperature, respiratory rate, oxygen saturation, blood pressure, and other indicators of deterioration. They also assess respiratory secretions, support appropriate airway care, collect respiratory specimens, and administer prescribed antibiotics at the scheduled times. In mechanically ventilated patients, nurses contribute to preventive measures through appropriate positioning, oral hygiene, hand hygiene, and adherence to ventilator-associated pneumonia prevention protocols. Accurate documentation and timely communication of clinical changes support early intervention.

Clinical pharmacists improve treatment quality through antimicrobial stewardship and medication optimization. Their responsibilities include reviewing empirical antibiotic selection, assessing the need for MRSA and antipseudomonal coverage, adjusting doses according to renal function, and evaluating potential drug interactions. They also monitor treatment duration, adverse drug reactions, and microbiological results. When cultures identify a susceptible pathogen, pharmacists can recommend narrowing antimicrobial therapy. They may also support discontinuation of unnecessary antibiotics when clinical findings and diagnostic results do not support continued treatment. Respiratory therapists contribute to airway management, ventilator monitoring, secretion clearance, and respiratory support. Their collaboration with nurses and physicians helps maintain appropriate ventilator care and identify changes in respiratory function. Infection prevention specialists monitor institutional infection rates, evaluate compliance with prevention protocols, and develop interventions to reduce healthcare-associated transmission. Regular multidisciplinary communication is essential. Structured clinical reviews allow the team to reassess diagnosis, antimicrobial effectiveness, microbiological findings, respiratory status, and treatment duration. Shared decision-making also helps identify complications and determine when additional investigations or treatment modifications are necessary. Integrating nursing surveillance, pharmacy expertise, medical assessment, and infection prevention strategies can improve antimicrobial use, reduce preventable complications, and strengthen patient safety. Interprofessional collaboration is therefore a fundamental component of high-quality HAP and VAP management [10].

Conclusion:

Hospital-acquired pneumonia and ventilator-associated pneumonia remain significant causes of healthcare-associated morbidity and mortality. Their management is complicated by diverse bacterial pathogens, increasing antimicrobial resistance, and diagnostic challenges. Early recognition through clinical assessment, imaging, and microbiological investigations is essential for initiating appropriate treatment. Empirical antimicrobial therapy should reflect local susceptibility patterns and individual risk factors, followed by culture-guided adjustment and de-escalation. A seven-day treatment course is generally adequate for uncomplicated infections, although duration should be individualized according to clinical response and complications. Nurses contribute through respiratory monitoring, specimen collection, timely medication administration, and infection prevention practices. Pharmacists support treatment optimization through dose adjustment, toxicity monitoring, antimicrobial stewardship, and evaluation of treatment duration. Strengthening collaboration among nurses, pharmacists, physicians, microbiologists, and critical care specialists can improve medication safety, reduce unnecessary antibiotic exposure, and support better clinical outcomes.

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