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The management of community-acquired pneumonia in adults at a rural regional hospital in KwaZulu Natal

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Abstract

Background Pneumonia stands as a significant global contributor to mortality, particularly in South Africa, where it ranks as the second leading cause of death. The country's high prevalence of HIV infection compounds this issue, significantly increasing mortality rates associated with community-acquired pneumonia (CAP).

Objective This study aimed to audit CAP patient management at a regional rural hospital in KwaZulu-Natal.

Method A retrospective review of patient files from September to December 2016 was undertaken. Data extraction from clinical files, conducted according to inclusion criteria, was transferred to a data collection sheet and analyzed using SPSS version 21.

Results The review encompassed 124 patient files over four months, revealing that 117 (94.4%) patients were not managed by the Standard Treatment Guidelines and Essential Medicines List for South Africa. Of the patients admitted with CAP, 54% were HIV positive, and 49 (39.5%) patients succumbed to the illness. Notably, none of the patients underwent assessment using a severity score.

Conclusion The findings underscore a need for more adherence to South African guidelines for managing CAP among staff at the rural regional hospital. This leads to severe consequences, exemplified by the high mortality rate. Urgent intervention is required to incorporate severity assessment scores into pneumonia evaluations, thus enabling appropriate clinical management.

Contribution This study sheds light on the significant impact of CAP within the South African hospital context, delineating critical gaps in clinical care and emphasizing the imperative to address clinical inertia.

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Introduction

Pneumonia is one of the leading causes of mortality, particularly in South Africa, where it ranks as the second leading cause of death. The country's high prevalence of HIV infection compounds this issue, significantly increasing mortality rates associated with community-acquired pneumonia (CAP) [1, 2].

Pneumonia, characterized by lung parenchyma infection, remains a significant global health concern. *Streptococcus pneumoniae*, *atypical pathogens (including Chlamydia pneumoniae*, *Mycoplasma pneumonia*, and *Legionella species)*, and *respiratory viruses* are among the primary causative agents of pneumonia. 1, 23 The classification of pneumonia into community-acquired (CAP) or hospital-acquired depends on the location of infection acquisition. Notably, *Streptococcus pneumoniae* is the most common pathogen associated with CAP, although certain microorganisms exhibit prevalence among specific patient demographics [3]. For instance, elderly patients may present with infections caused by gram-negative bacteria, while individuals with chronic obstructive pulmonary disease (COPD) are more susceptible to *Hemophilus influenza pneumonia.* [4]. Critically ill patients commonly contract infections from *Staphylococcus aureus* or *Klebsiella pneumoniae.*12.

Clinical manifestations of CAP vary and can include malaise, cough, breathlessness, fever, chest pain, haemoptysis, and extrapulmonary features such as pleural effusion [3]. Diagnosis typically relies on clinical presentation and confirmation via chest X-ray examination. However, no specific clinical findings reliably distinguish between different etiological agents [1, 23]. Therefore, all hospitalized CAP patients should undergo chest X-ray, sputum analysis, and blood tests to confirm diagnosis and assess for complications [1–3]. Management of severe CAP necessitating hospitalization includes bed rest, supplemental oxygen, adequate fluid balance, and prompt antimicrobial therapy. Severity assessment often employs the CURB-65 score (C: confusion; U:urea; R:respiratory; R:rate; B:blood pressure) to guide clinical decision-making [2]. One point is allocated to each parameter:0–1:home therapy, 2:hospital therapy, and ≥3: ICU admission. Antibiotic selection varies based on severity and patient demographics, with oral amoxicillin typically prescribed for younger patients without comorbidities and low severity scores. However, patients with two or more severity indicators may require amoxiclav or cephalosporins and hospital admission [1–3].

Given pneumonia's significant global morbidity and mortality rates, accurate diagnosis and appropriate management are imperative. The World Health Organisation estimated that CAP was responsible for 6.1% of deaths globally. In Germany, 17.2% of patients admitted with CAP died, and in the United States of America, 7.7% of inpatients died [5]. In sub-Saharan Africa annual incidence of pneumonia is 4 million cases with 200 000 deaths [3]. In South Africa, influenza and pneumonia were the sixth leading cause of natural death [6]. Numerous evidence-based guidelines developed by international thoracic societies aim to standardize and optimize CAP management. In South Africa, the management of CAP aligns with the Standard Treatment Guidelines (STG), Essential Medicines List (EML), and specific national guidelines [7–10]. This study audited the practice of managing pneumonia at a regional hospital in KwaZulu-Natal, South Africa.

Methods

A retrospective cross-sectional study reviewing clinical charts was conducted over four months, from September to December 2016, in the department of Internal Medicine at a regional hospital in KwaZulu-Natal. The hospital is a public sector hospital that provides care to a catchment population of 800.000, where there is a high burden of tuberculosis (TB) and HIV in the district. The Department of Family Medicine provides outpatient services and covers the Emergency Department at the hospital. All adult medical patients with community-acquired pneumonia who need admission are admitted through the Family Medicine outpatient or Emergency Department. The Internal Medicine Department manages these patients in the ward. The Internal Medicine department services district and regional-level inpatient adult medical patients. Inclusion criteria were admitted patients older than 18 with symptoms (malaise, cough, breathlessness, fever, chest pain, haemoptysis), physical findings and chest X-rays suggestive of CAP were used in this study. Participants admitted for pneumonia and only later found to have TB were excluded from the analysis based on a TB-positive sputum result. The CAP severity assessment tool CURB-65 was used due to its accuracy and simplicity (Confusion, Urea>7mmol/L, Respiratory rate≥30 breaths/minute, Systolic blood pressure less than 90mmHg and age≥65 years). The patients were dichotomized into ≤65 and ≥65 years of age to determine the age impact on the morbidity and mortality of CAP. During the study period, 159 patients were admitted for community-acquired pneumonia. Among those, 35 patients were excluded later due to their TB-positive sputum results. Data were extracted from clinical records used in the Internal Medicine department at the hospital. A data collection form was used to extract information about demographics and the clinical profile of the study population. The management of CAP was assessed according to the standard provided in the National Department of Health's STGs. The authors calculated the CURB-65 scores from available data to determine if the guidelines were adhered to. The data was captured on

an Excel spreadsheet and analyzed using the Statistical Package for Social Sciences (SPSS version 21). Descriptive statistics such as frequencies, percentages, mean and standard deviation were used to summarise the results. The Odds ratio was used to determine the odds of death among patients admitted with HIV and diabetes mellitus. The study was approved by the Research Ethics Committee of the University of KwaZulu Natal (Reference: BE346/13) and authorized by the Chief Executive Officer of Port Shepstone Hospital.

Results

A total of 124 patients were eligible for this study. A total of 159 patients were admitted with CAP but 35 were excluded as they were later diagnosed with TB. Table 1 shows the demographic characteristics of the patients. The majority of patients were younger than 65 years of age. There were more males than females. Black African patients comprised the majority (90%) of patients.

The clinical characteristics of patients are shown in Table 1.

Forty (40/124) patients (32%) were HIV positive on ART ,30/124 (24%) were HIV negative, and 45/124 (36%) had an unknown HIV status. The most common symptoms were cough 25/124 (20.1%) and night sweats 12/124 (9.6%). The common comorbidities found were HIV 49/124 (40%), diabetes mellitus 25/124 (20%) and hypertension 19/124 (15%). Constitutional symptoms commonly found were cough 25/124 (20%) and night sweats 12/124(9.6%). Chest pain 55/124 (52%) and dyspnoea 40/124 (33%) were also found in many patients. Some patients with unknown HIV status tested positive during the admission, which increased the figures from an initial 49/124(40%) to 68/124(55%). The vital signs of patients are recorded in Table 2.

Nineteen (15.3%) patients had a respiratory rate of more than 30 breaths per minute, and 12/124 (9.6%) patients had a low systolic blood pressure of less than 90 mm Hg. New onset confusion was noted in 11/124 (8.8%) patients. Thirty-five patients (29%) had urea greater than 7 and 54/124 (44%) had urea less than 7 mmol/l, whereas urea results were missing in 35/124 (28%) files. The blood culture was done in 9/124 (7.2%) patients, whereas the sputum analysis and culture were done in 101/124 (81.4%) patients and the arterial blood gas in 76/124 (61.2%) patients. Table 3 displays the

Table 1 Demographic and clinical characteristics of patients on admission ($n=124$)

Age	Less than 65 years old	65 years old or older
N(%)	87(70%)	37(30%)
Ethnicity		
African	77(62%)	35(28%)
Indian	10 (8%)	0(0%)
White	00	02(2%)
Gender		
Male	61 (49%)	30(24%)
Female	26 (20%)	7(5%)
Comorbidities		
DM	4 (3%)	21(22%
HPT	3(2%)	16 (17%)
HIV	49 (40%)	0(0%)
COPD	9 (7%)	3(2%)
No comorbidity	19(15%)	0(0%)
HIV status		
Negative	15(12%)	15(12%)
Positive on ART	40 (32%)	0 (0%)
Positive not on ART	09 (7%)	0(0%)
Unknown	23(18%)	22(17%)
Symptoms		
Cough > 2weeks	15(12%)	10(8%)
Night sweats	7(5%)	5(4%)
Loss of weight	4(3%)	2(1%)
Cough and night sweats	5 (4%)	00 (0%)
Chest pain	33(26%)	32(25%)
Fever	19(15%)	00(0%)
Dyspnoea	35(28%)	5(4%)

HIV: Human immunodeficiency virus. DM: Diabetes Mellitus. HPT: Hypertension. TB: Tuberculosis; COPD: Chronic obstructive pulmonary disease; ART: Antiretroviral therapy

Table 2 Vital signs and baseline investigations ($n = 124$)

Age	< 65	≥ 65
Respiratory rate		
RR < 30	68(55%)	37(30%)
RR ≥ 30	19 (15%)	00
Systolic blood pressure		
< 90 mm Hg	12(1%)	00
90–139 mm Hg	57(45%)	37(29%)
> 140 mm Hg	18(14%)	00
New onset confusion		
No confusion	3(2%)	2(1%)
Confusion	11 (8%)	00
Not documented	73(58%)	35(28%)
Urea		
Urea > 7mmol/L	17(14%	18(15%)
Urea < 7 mmol/l	37(30%)	17(14%)
No urea results	33 (27%)	2 (2%)
SPO2		
Not documented	11(8%)	00
ABG	70(56%)	37(29%)
Done	67(54%)	9(7%)
Not done	17(13%)	28(22%)
Not applicable	3 (2%)	00 (0%)
Sputum microscopy and culture		
Done	74(59%)	27(21%)
Not done	13 (10%)	10(8%)
Blood culture		
Not documented	6(4%)	00 (0%)
Done	9(7%)	00(0%)
Not done	72(58%)	37(29%)

RR = respiratory rate, ABG = arterial blood gas, SPO2 = pulse oximetry, mmHg = millimetres of mercury

calculated CURB-65 score, patient admissions, HIV tests and number of deaths.

The CURB-65 score was not documented in any of the 124 medical records. According to the Essential Drug List, antibiotics were prescribed correctly in 7% of cases. The most prescribed antibiotics were amoxiclav (71%) and ceftriaxone (25%). The calculated CURB-65 was done using the available information from the clinical record. Only 75/124 (60%) scores could be confidently calculated because these files contained all the necessary information to calculate the CURB-65 score. Most patients, 54/124 (72%) were admitted to the correct ward, while others, 21/124 (28%), did not meet the admission criteria based on the calculated CURB-65 score. Thirty-five (28%) deaths occurred in patients younger than 65, and 14(11%) were older than 65. Among the deaths younger than 65, 29/124 (83%) were HIV-positive, and those older than 65, eight (16%) had diabetes mellitus. The odds ratio (OR) for patients younger than 65 years old dying if they were HIV positive and had CAP requiring admission was 7.7(95% confidence interval[CI] 2.7; 21.9). The OR for death in the entire cohort if they were HIV positive and had CAP requiring admission was 4.0 (CI: 1.9; 8.6). The OR of death if they were admitted with DM and CAP was 5.6(CI: 2.2;14.9).

Discussion

This study revealed significant deviations from the South African guidelines for pneumonia management and highlighted a high mortality rate among patients admitted with community-acquired pneumonia (CAP). Notably, the absence of a severity scoring tool such as CURB-65 in medical records and inconsistent antibiotic prescriptions were predominant issues. Additionally, the majority of patients were HIV positive, reinforcing the association between HIV infection and increased risk of CAP admission [9]. These findings echo a study at King Edward Hospital in South Africa, which reported poor adherence to national pneumonia management guidelines [11]. In that study, only a small fraction of patients received treatment according to South African guidelines, with many receiving antibiotics inconsistent with CAP South African guidelines. Factors contributing to guideline non-adherence included lack of awareness, knowledge gaps, and physician autonomy [11].

Table 3 Management of patients ($n = 124$ unless otherwise specified)

Age	< 65	≥ 65
CURB-65		
Recorded CURB-65	0	0
Calculated CURB-65 ($n = 75$)	58(77%)	17(23%)
CURB-65 scores > 2	37 (49%)	17 (23%)
CURB 65 scores < 2	21 (28%)	**0**
ANTIBIOTICS		
Antibiotics consistent with STG		
Yes	3(2%)	4(3%)
No	84(67%):	33(26%)
Antibiotics prescribed:		
Amoxiclav	68 (54%)	21(17%)
Ceftriaxone	19 (15%)	16(13%)
Amoxicillin	0	0
Ampicillin	0	0
Antibiotics duration		
< 10 days		
Amoxiclav	59(48%)	17(14%)
Ceftriaxone	14(11%)	13(10%)
>10 days		
Amoxiclav	9(7%)	4(3%)
Ceftriaxone	5(4%)	3(2%)
ADMISSIONS		
Admission indicated (based on calculated CURB-65 ($n = 75$ patients)		
Yes	37(49%)	17(22%)
No	21(28%)	0
Admissions		
General ward	84(67%)	37(22%)
ICU	3(2%)	0
HIV tests		
HIV tests done on patients with unknown status	23(18%)	22(17%)
Tested positive	19(15%)	0
Tested negative	4 (3%)	22 (17%)
Started on ART in hospital	24 (19%)	N/A
ART deferred	4 (3%)	N/A
DURATION OF HOSPITAL STAY		
< 10 days	63(51%)	27(21%)
≥ 10 days	24 (19%)	10(8%)
DEATHS		
Number of deaths	35(71%)	14(28%)
HIV positive	29 (59%)	0
HIV negative	06 (12%)	14 (28%)
Diabetes mellitus	10(20%)	08 (16%)
COPD	0	06(12%)

CURB-65 = severity score based on confusion, high urea, respiratory rate, blood pressure and age; ART = antiretroviral therapy, N/A = not applicable, ICU = Intensive Care Unit. * includes patients diagnosed during this hospital admission

Similar patterns of non-adherence to pneumonia treatment guidelines have been observed in other countries, such as Australia, where antibiotic prescriptions were extensive in spectrum, often including third-generation cephalosporins [12]. Despite the availability of severity scoring tools like CURB-65, documentation of these scores in medical records could have been much higher, compromising the assessment of pneumonia severity and appropriate treatment allocation. International guidelines categorize pneumonia patients based on severity, guiding decisions regarding hospitalization and intensive care unit (ICU) admission [13]. The CURB-65 scoring system, though simple and cost-effective, has limitations, including suboptimal sensitivity and specificity and failure to

recognize certain aspects of disease severity [14]. In one setting in South Africa, guideline adherence did not demonstrate improved outcomes [15]. However, this study recorded only one death and was done in an academic hospital with better resources and possibly more skilled staff. Nevertheless, the CURB-65 standardized application aids in determining appropriate care pathways and enhancing patient safety, particularly among less experienced clinicians [16]. Lui et al [17] found improved outcomes in a prospective study when guidelines were adhered to in Hong Kong. The study team recorded improved survival benefit and a shorter hospital stay in the guideline adherent cohort [17]. However, studies consistently report poor documentation of CURB-65 scores in clinical records, as seen in studies from Ghana, Ethiopia, Australia and South Africa [12, 18–20]. Moreover, adherence to pneumonia management guidelines remains problematic globally, with studies from Venezuela, Sudan, and Argentina reporting poor compliance despite the availability of treatment options [21, 22]. Contributing factors include limited access to diagnostic tools, lack of healthcare infrastructure, and logistic challenges, all hindering guideline implementation efforts [21].

In our study, HIV testing was routinely performed for patients with unknown status upon admission, aligning with national targets for HIV screening and antiretroviral therapy (ART) initiation [23]. The successful implementation of ART initiation protocols in this hospital setting, with many patients starting on ART before discharge, is commendable. However, despite such efforts, the high mortality rate among HIV-positive patients with pneumonia underscores the need for improved management strategies, including appropriate antibiotic selection, use of the severity assessment score CURB-65, timely initiation of ART and closer monitoring of patients with comorbidities (diabetes, COPD, HIV, etc.) [24, 25]. This study has also shown that HIV and diabetes mellitus are significant risk factors for death among inpatients with CAP. The HIV correlation is not dissimilar to that of another study done in KwaZulu-Natal [20]. HIV poses a significant threat to life in South Africa and is the fifth leading cause of natural death in South Africa, as well as being associated with many other significant causes of death such as CAP and TB [3, 6, 20, 26].

Strengths of our study include its focus on guideline adherence and patient outcomes, although limitations such as incomplete records and outdated data collection may affect the generalizability of our findings. Further investigation into the reasons behind guideline non-adherence and strategies for improvement is warranted. A limitation of this study is the fact that this was data from 2016.

In conclusion, this study has shown that there was poor adherence to the CAP South African guidelines at Port Shepstone Hospital. It underscores the critical need for adherence to national pneumonia management guidelines to improve patient outcomes. Implementing severity assessment tools like CURB-65 and enhancing awareness among healthcare providers are crucial steps toward achieving this goal. Regular training, feedback mechanisms, and antimicrobial stewardship programs can facilitate guideline adherence and ultimately improve the quality of pneumonia care.

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Author contributions
All the authors reviewed the manuscript.

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Data availability
Data were extracted from clinical records used in the Internal Medicine department at the hospital. Data is available from the first author upon request.

Declarations

Ethics approval
The study was approved by the Research Ethics Committee of the University of KwaZulu Natal (Reference: BE346/13) and authorized by the Chief Executive Officer of Port Shepstone Hospital.

Consent for publication
Both authors consent for the study publication.

Human ethics and consent to participate
Not applicable.

Conflict of interest
Both authors declare that they do not have conflicts of interest in this study.

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