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Inpatient Treatment outcomes and Associated Factors For Poor Outcome Among Adults Admitted With Pneumonia at Tibebe Ghion Specialized Hospital From January 1st, 2020 To January 31, 2022

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BAHIR DAR UNIVERSITY COLLEGE OF MEDICINE AND HEALTH SCIENCES
SCHOOL OF MEDICINE
DEPARTMENT OF Internal Medicine

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Prepared By- Fikre Desalegn

OCTOBER, 2022

BAHIR DAR

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COLLAGE OF HEALTH SCIENCE

SCHOOL OF MEDICINE

DEPARTMENT OF INTERNAL MEDICINE

INPATIENT TREATMENT OUTCOMES AND ASSOCIATED FACTORS TO POOR OUTCOME AMONG ADULTS ADMITTED WITH PNEUMONIA AT TIBEBE GHION SPECIALIZED HOSPITAL CROSSSECTIONAL STUDY, 2022

By: Dr. Fikre Desalegn

A THESIS TO BE SUBMITTED TO COLLEGE OF MEDICINE AND HEALTH SCIENCES SCHOOL OF MEDICINE DEPARTMENT OF INTERNAL MEDICINE IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE SPECIALITY PROGRAM IN INTERNAL MEDICINE

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October, 2022

Bahir Dar

Declaration

I hereby declare that this thesis submitted in partial fulfillment of the requirements for the degree of Internal medicine. Thesis is my own original work and has not been presented for a degree in any other university, and all sources of references and materials used for this research have been duly acknowledged.

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Approval of thesis for defense

We hereby certify that we have supervised, read, and evaluated this thesis/dissertation titled "To determine inpatient treatment outcomes and associated factors for poor outcome among adults admitted with pneumonia at TGSH in Bahir Dar, Ethiopia" by Fikre Desalegn prepared under our guidance. We recommend the thesis/dissertation to be submitted for final thesis defense.

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Summary

Background: Pneumonia is an acute infection of the pulmonary parenchyma by different pathogen mainly bacteria and virus. It causes of significant morbidity and mortality worldwide.

Objectives: To determine inpatient treatment outcomes and associated factors to poor outcome among adults admitted with pneumonia from Jan. 1st, 2020 to Jan.31, 2022 at TGSH in Bahir Dar, Ethiopia

Methods: Hospital based cross sectional study was conducted. Systematic random sampling was conducted to select study subjects records. Collected data was entered into SPSS version 26 for analysis. To determine the proportion of demographic and other clinical data, descriptive statistics were used. Bi-variable analysis was carried out between the dependent and independent variables with significance level of p-value<0.25.Binary logistic regression was performed with all independent variable which had significant association on bi-Variable analysis to determine how these variables affects poor outcomes of pneumonia with control of other variables constant

Results: A total of 368 study participants' medical records were reviewed, of which 20 (94.6%) of the data were complete. The mortality rate for pneumonia patients who were admitted was 14.4%.

Intubated patients (AOR=28.5, 95% CI: 9.261-87.705), age 65 years and above (AOR=17.242, 95% CI: 4.887-60.836), deranged initial renal function test (AOR=8.941: 95% CI: 3.006-26.590), were significantly associated with the outcome.

Conclusion: The mortality rate of patients with pneumonia who were admitted to the hospital with pneumonia in this study was 14.4%.

There is a significant association between pneumonia mortality and age, an initial abnormal renal function test, and the need for intubation.

Keywords: Pneumonia, Pulmonary parenchyma, Inpatient, Outcome, Morbidity, Mortality

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Acronyms/Abbreviations

CAP……Community Acquired Pneumonia

CDC……Centre for Disease Prevention and Control

CHD……Congenital Heart Disease

CKD……Chronic Kidney Disease

CLD……Chronic Liver Disease

COPD……Chronic Obstructive Pulmonary Disease

COVID-19……Coronavirus Disease 2019

CURB-65……Confusion, Urea, Respiratory rate, Blood pressure and age>65 years

ECDC……European Centre for Disease Prevention and Control

HAP……...Hospital Acquired Pneumonia

HF …….Heart Failure

HIV……Human Immunodeficiency Virus

ICU……Intensive Care Unit

KM…….Kilometer

LRTI…….. Lower Respiratory Tract Infection

PSI…….Pneumonia Severity Index

PORT……..Prospective, Multicenter Observational Pneumonia Patient Outcomes Research Team

TGSH……Tibebe Ghion Specialized Hospital

UNESCO……..United Nations Science and Cultural Organization

VAP……..Ventilator Acquired Pneumonia

VHD…….Valular Heart Disease

WHO……...World Health Organization

1. Introduction

1.1 Background

Pneumonia is an acute infection of the pulmonary parenchyma. It can be classified as Community Acquired Pneumonia (CAP), Hospital-Acquired Pneumonia (HAP), or Ventilator-Associated Pneumonia (VAP) based on the place of acquisition [1].

Based on etiology, Pneumonia has many possible causes that largely determined by the place of acquisition generally can be due to bacteria, viruses, fungi, chemicals and can be also mixed type, but the most common are bacteria and viruses. Other way of classifying pneumonia is based on severity as mild, moderate and severe. Clinical presentation of pneumonia from mild to fatal in severity, common clinical features includes cough, fever, pleuritic chest pain, dyspnea, and sputum production. On physical examination patient commonly might have fever, tachypnea, tachycardia, low saturation (less than 90%), on chest exam crackles, bronchial breath sound, dullness, Palpation may reveal increased or decreased tactile fremitus, and Egophony [2].

The clinical presentation may not be so obvious in the elderly, who may initially display new-onset or worsening confusion and few other manifestations. Severely ill patients may have septic shock and evidence of organ failure[3].

Common laboratory finding is leukocytosis with left shift and leukopenia can also occur. Other laboratory finding gram stain and blood culture can also be done to guide microbiologic identification and treatment. The presence of an infiltrate on plain chest radiograph is considered the gold standard for diagnosing pneumonia while clinical and microbiologic features are supportive. The radiographic appearance of pneumonia may include lobar consolidation, interstitial infiltrates and/or cavitation[1, 4].

According to review of the literature on the causes of adult pneumonia in the majority of European countries published in 2014, Streptococcus pneumoniae was the pathogen that was most frequently isolated pathogen in up to 85% of patients. Legionella pneumophila, Mycoplasma pneumoniae, and Chlamydia pneumoniae were among the atypical bacteria that were frequently found in pneumonia patients. Other pathogens that were isolated included Staphylococcus aureus in up to 20% of cases, Pseudomonas

aeruginosa in 16.8% of cases, and Klebsiella pneumoniae in 5% of cases. 19.9% of patients had mixed-etiology pneumonia, and in nearly 50% of those cases, the cause was unknown. Streptococcus pneumoniae, methicillin-resistant Staphylococcus aureus, Pseudomonas aeruginosa, and Enterobacteriaceae species are more prevalent in immunocompromised patients with pneumonia, in addition to Pneumocystis jirovecii and other fungal and viral causes [5].

Treatment for pneumonia is primarily based on the illness's severity, place of acquisition and etiologic agents. First we need to decide on the appropriate site of care as outpatient or inpatient requires admission to an observation unit, general medical ward or intensive care unit (ICU). To help in choosing the location of care for pneumonia, prediction rules have been established. The most reliable rule currently available is the Pneumonia Severity Index (PSI), which has also been empirically proven to be safe and helpful in assisting clinical decision-making. The CURB-65 score is an alternative that can be used when a less complex scoring system for prognosis is desired. The most frequent bacterial etiologies are targeted with empiric antibiotic therapy prior to etiologic diagnosis. Numerous considerations are taken into consideration when choosing an antibiotic regimen for empiric therapy. The most likely pathogen(s), taking into account the epidemiology of the area, travel history, additional epidemiologic and clinical cues, risk factors for antibiotic resistance, and medical comorbidities[6].

According to the American Thoracic Society's 2019 guideline, the following antibiotics should be used: amoxicillin, doxycycline, or azithromycin in the outpatient setting; third-generation cephalosporins (commonly ceftriaxone) and macrolides (commonly azithromycin) in the hospital setting; and non-severe infections without a risk of methicillin-resistant staph aureus (MRSA) or pseudomonas The treatment of choice and subsequent management for patients at risk for MRSA and pseudomonas infections is vancomycin and piperacillin tazobactum, cefepime ceftazidime, or meropenum [7]. Treatment for CAP is mostly empirical in developing nations like Ethiopia, where the causative agent is infrequently discovered [8].

1.2 Statement of the problem

In high income countries, lower respiratory tract infections kill adults over 70 years of age. Contrarily, in sub-Saharan Africa, children and adults account for 46% of all LRTI

deaths, while people under the age of 70 account for 55% of all deaths.[9]. Although, the etiology and consequences of pneumonia have been extensively studied in well-resource settling like Europe and North America, there is a shortage of data in resource-limited regions like sub-Saharan Africa [5, 10].

Additionally, the COVID-19 pandemic has an impact on pneumonia from other causes in both favorable and negative ways. The use of facemasks, the advice to regular wash one's hands, the isolation of infected individuals and the subsequent careful sanitation of their surroundings all have a favorable impact on reducing interpersonal contact. The negative impact is the overuse of antibiotics to treat COVID-19 patients who have been confirmed or are suspected of having a co-infection. According to a US study, individuals hospitalized with COVID-19 received early empiric antibiotic therapy in 56.6% (965/1705) of cases, while only 3.5% (59/1705) of those patients had proven bacterial co-infection [11-13].

Despite pneumonia has been consistently reported as one of the leading cause of morbidity and mortality in the past years in Ethiopia, there is a paucity of data regarding its outcome and associated factors; limiting the formulation of an appropriate response [14, 15].Therefore the main aim of the study is to determine inpatient treatment outcomes and associated factors of pneumonia at Tibebe Ghion specialized hospital (TGSH).

The study will identify factors which are associated to poor outcome in hospitalized patients with pneumonia, help to act on preventive measures and to address as early as possible if patient having those factors.

It is important to make action plan and to take appropriate measures to decrease morbidity, mortality, associated socioeconomic problems and to give standard of care. After finishing the study it will help us to develop treatment protocols with other studies on pneumonia and the study will help other researcher as background information.

2. Literature review

2.1 Magnitude of pneumonia

In adults globally, lower respiratory infections contributed to 2.4 million deaths in 2016, according to a report by the World Health Organization (WHO). Lower respiratory tract infections alone cause 390,000 deaths of older children and adults each year in sub-Saharan Africa. Lower respiratory tract infections, particularly pneumonia, were the fourth cause of death worldwide in 2019 after ischemic heart disease, stroke, and chronic obstructive pulmonary disease (COPD), but they were the second most common death cause in low-income countries. In high-income countries, pneumonia is the fourth cause of disability-adjusted life years after neonatal conditions, IHD, and stroke[16, 17]. Global pneumonia mortality varies by region (United States/Canada 7.3%; Europe 9.1%; Latin America 13.3%; and Africa 16-23%)[18].The mortality associated with pneumonia in adults was evaluated in a meta-analysis of 127 studies that reported medical outcomes in over 33,000 patients. The mortality rate ranged from 5.1 % for combined ambulatory, 13.6% in hospitalized patients to 36.5% in patients admitted to the intensive care unit (ICU).

From prospective population-based Pneumonia cohort study of adult residents in Louisville, US from 7,449 patients who were hospitalized with pneumonia, out of which 77% of the patients improved, 20% failure rate and 3% non-resolving pneumonia. Mortality at 30-days was 6% for those who improved, 34% for those who failed and 34% for those with non-resolving pneumonia. Mortality at 1-year was 23%, 52% and 51%, respectively. Patients who developed early clinical failure had higher rates of obesity and diabetes mellitus and needed more intensive care management upon admission. Patients with late clinical failure had higher rates of active neoplastic disease [19].

From prospective observational study of adults hospitalized with pneumonia to a teaching hospital in Malawi, of 459 patients 62% was male median age of 34.7 years and 30 days mortality was 14.6%[20]. In a retrospective cross-sectional study conducted at a university hospital in Ethiopia, the male to female ratio was 2.5 to 1, the mean length of hospital stay was 11.49 days, and the total death rate was 20.2%. Poor treatment

outcomes were associated with patient age over 65, admission respiratory rate of above 30 breaths per minute, and concomitant tuberculosis[21]. Other cross-sectional study done in Addis Ababa most common cause of admission was pneumonia, 22.4% and the mortality rate was 31.8% [22]

According to the European Center for Disease Prevention and Control (ECDC), antibiotic resistance poses a severe threat to public health in Europe and is responsible for rising medical expenses, extended hospital stays, failure treatments, and even deaths. In Europe, the percentages of Klebsiella pneumoniae resistant to fluoroquinolones, third-generation cephalosporins, and aminoglycosides, as well as combination resistance to all three antibiotic families, have considerably grown over the last four years (2010 to 2013). The same time frame saw a notable rise in Escherichia coli resistance to third-generation cephalosporins. It is extremely concerning and dangerous for patient safety in Europe when Klebsiella pneumoniae develops carbapenem resistance[23].

According to a systematic evaluation of antimicrobial resistance (AMR) in Africa conducted between the years of 2013 and 2016, 42.6% of the countries lacked AMR data. The final analysis included a total of 144 articles. Thirty-seven different antibiotics were tested against Thirteen Gram negative and Five Gram positive microorganisms. Streptococcus pneumoniae penicillin resistance was found in 14/144 studies (median resistance (MR): 26.7%). Additionally, 18/53 (34.0%) isolates of Haemophilus influenza were amoxicillin resistant. Escherichia coli's respective MRs for amoxicillin, trimethoprim, and gentamicin were 88.1%, 80.7%, and 29.8%[24].

Through an electronic search of PubMed/MEDLINE, a systematic review and meta-analysis were conducted to assess the prevalence of inappropriate antibiotic use and antibiotic resistance in Ethiopia, based on an analysis of 33 articles that qualified, bacteria identification rate was 29% and the prevalence of multi-drug resistance strains was 59.7%. The estimated combined proportion of self-prescribed antibiotics was 43.3%, while the estimated combined proportion of improper antibiotic use was 49.2%. Inappropriate indication, duration, mode of administration, usage of unused antibiotics from a family member, and premature antibiotic termination were other causes of inappropriate antibiotic use[8].

2.2 Factors affecting pneumonia

In order to find existing risk factors for pneumonia in Europe, structured searches of PubMed were done. Men were more likely than women to develop pneumonia, as were people with chronic respiratory conditions or HIV infection. Smoking, drinking excessive amounts of alcohol, being underweight, and having comorbid conditions such as HIV, chronic renal or liver disease, Parkinson's disease, epilepsy, dementia, dysphagia, or chronic respiratory and cardiovascular diseases all increased the risk of pneumonia by a factor of two to four. Additional risk factors in resource limited setting are malnutrition, household crowding may further contribute to the burden of pneumonia [25-27]

2.3 Economic burden

According to a retrospective cohort study on the economic impact of pneumonia in US working-age adults (18-64 years old), patients with pneumonia had mean annual healthcare costs of $20,961 compared to those without pneumonia, which were $3783. Depending on the risk level, the average incremental healthcare expenditure per person per year ranged from $4170 to $31,524 for outpatient management of patients with pneumonia and from $39,889 to $113,837 for inpatient management of patients with pneumonia. This shows that patients with pneumonia had healthcare costs that were around seven times greater than those of patients without pneumonia. By reviewing the data from 2 centers in Istanbul province, Turkey, retrospectively, the study aimed to quantify the financial burden placed on pneumonia patients (under the age of 18). The overall mean cost per patient for inpatients was €556.09 ±1,004.77 and for outpatients it was €51.16± 40.92. Inpatients with comorbidities paid more for specialist visits, whereas outpatients with comorbidities paid more for imaging [28, 29].

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3. Conceptual framework

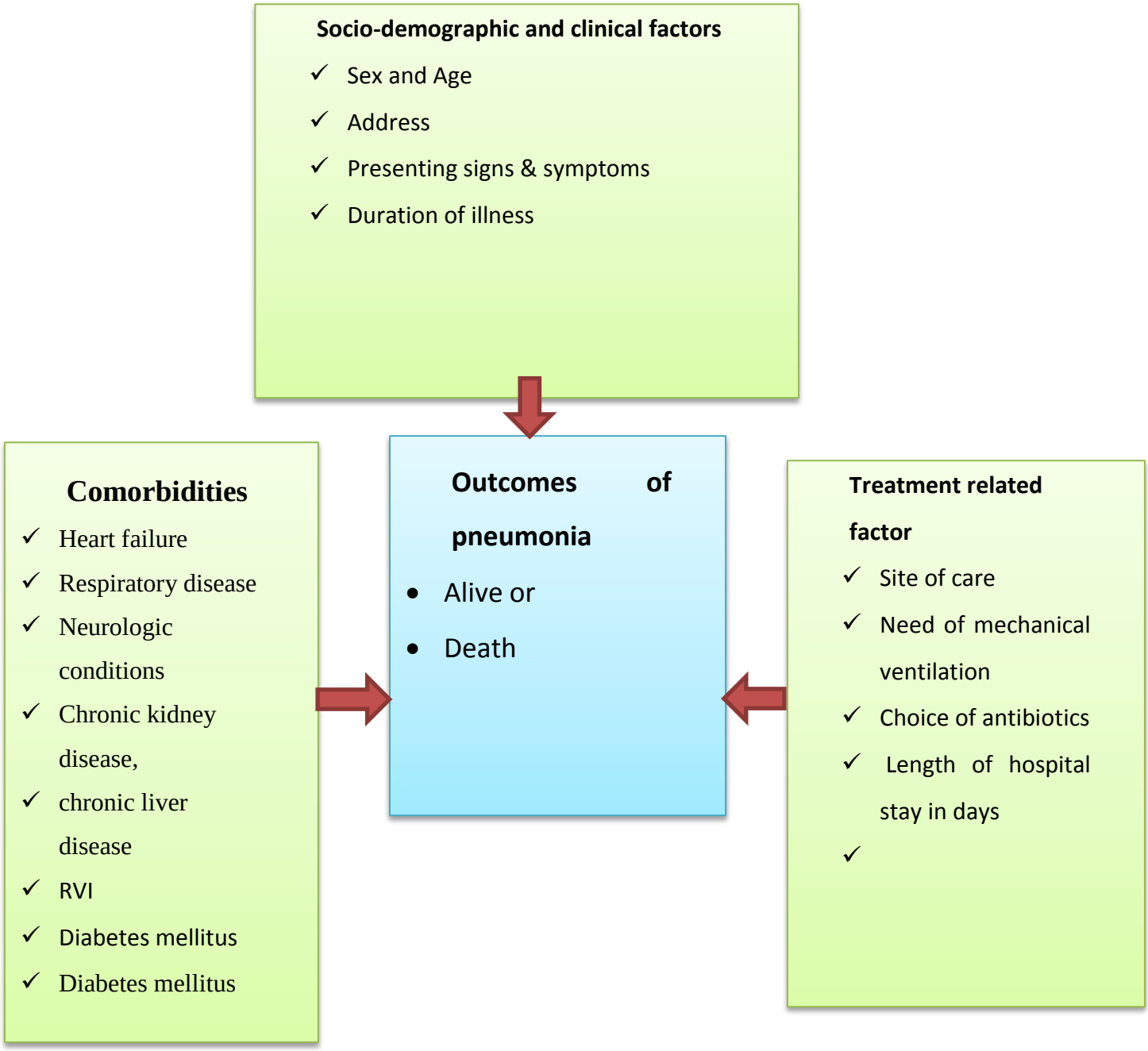

Fig 1: Risk factors and possible outcomes of pneumonia [25-27]

4. Variables

4.1. Dependent variable- Alive or death

4.2. Independent variable

4.2.1 Socio-demographic and clinical factors

- Age
- Sex
- Address
- Presenting signs & symptoms
- Duration of illness
- Investigation

4.2.2. Comorbid-risk factors

- Heart failure
- Respiratory disease
- Neurologic conditions
- Chronic kidney disease,
- chronic liver disease
- RVI

4.2.3. Treatment related factors

- Site of care (medical ward/ ICU)
- Need of mechanical ventilation
- Choice of antibiotics
- Cause of death
- Length of hospital stay in days

5. Objective

5.1 General objective

- To Determine inpatient treatment outcomes and associated factors to poor outcome among adults admitted with pneumonia from Jan. 1st, 2020 to Jan.31, 2022 at TGSH in Bahir Dar, Ethiopia

5.2 Specific objectives

- To determine inpatient treatment outcomes among adults admitted with pneumonia from Jan. 1st, 2020 to Jan.31, 2022 at TGSH in Bahir Dar, Ethiopia
- To identify associated factors for poor outcome among adults admitted with pneumonia from Jan. 1st, 2020 to Jan.31, 2022 at TGSH in Bahir Dar, Ethiopia

6. Methodology

6.1. Study area

Bahir Dar, Ethiopia's third-largest city, is situated in the country's northwest. The city has an estimated population 170,000. It is the capital of the Amhara land area and one of Ethiopia's top tourist destinations with a range of attractions near Lake Tana and the Blue Nile River. By many measures, it is also regarded as one of the most stunning, well-planned, and safest cities in Africa. In 2012, it was given the UNESCO Cities for Peace Prize for successfully navigating the difficulties of accelerating social and economic growth. The city is located approximately 578km North-Northwest of Addis Ababa. This large city has three government hospitals, Tibebe Ghion specialized hospital, Felege Hiwot referral hospital and Addis Alem primary hospital.

Tibebe Ghion specialized hospital is located about 10km south from the city center and about 7 km from the new bus station on the way to Adet District. It is a tertiary university teaching hospital with 450 bed capacity out of which 72 are occupied by medical adult patients. The hospital receives patients who are referred from across the Amhara region and gives outpatient and inpatient services in all major departments.

6.2. Study period and design

Hospital-based cross-sectional study was conducted in Tibebe Ghion specialized hospital, starting from Jan. 1st, 2020 to Jan.31, 2022

6.3. Source population

The study included all adult patients admitted to Tibebe Ghion specialized hospital from Jan. 1st, 2020 to Jan.31, 2022 with the diagnosis of pneumonia.

6.4. Study population

All adult pneumonia patients admitted to Tibebe Ghion specialized hospital who fulfilling the inclusion criteria and gets treatment from Jan. 1st, 2020 to Jan.31, 2022

6.5. Inclusion criteria

The study included all adult patients with complete medical records and who were admitted to the medical ward and medical ICU at Tibebe Ghion Specialized Hospital with pneumonia from January 1st, 2020, to January 31st, 2022

6.6. Exclusion criteria

The study excluded all patients who received treatment for less than 48 hour

6.7. Sample size determination

The sample size for the study was determined using single population formula considering the assumption. According to the study done Saint Paul's Hospital, Addis Ababa, Ethiopia proportion of death due to pneumonia was 31.8%. Level of significance to be 5 %(a=0.05), za/2=1.96 by assuming 95% confidence interval, margin of error to be 5%.[22]

$$no = \frac{z^2 pq}{e^2}$$

No=1.96*0.318(1-0.318)/ $(0.05)^2$

$= (1.96)^2 0.318(1-0.318)/ (0.05)^2 =$**334**

Where:

no= sample size

Z=confidence interval in standard error units

P= is the estimated proportion

e=desired level of precision

q=1-p

Adding 10% of non-response rate; which is 33.4 ~34, gives the total sample of 368 admitted pneumonia patients.

For the second objective the sample size was determined by using Statcalc of Epi info version 7.2 with the assumptions;

Power = 80%, Confidence interval **= 95%,** and Exposed to unexposed ratio of 1:1

In Nigeria study age ≥65years was significant factor for mortality (OR=5.947; 95%CI3.581-17.643), sample size for this becomes 150 [30].

According study in study in Japan the mortality rate for admitted patients' for pneumonia was 12% and having at least one comorbidity was associated with the mortality 1.28 times (CI:1.07-1.56), sample size for this factor becomes 214[31].

Since the sample size for the first objective is largest, therefore the final sample size was 368.

6.8 Sampling technique

Systematic random sampling was used from the study participant. Sampling frame was prepared and sampling interval (K) value calculated using sample =n/N (where n is total number of admitted pneumonia patients over the study period and N is sample size)

Total admission over the study period was 642 pneumonia cases. From these 180(28%) admitted to ICU and to ward 462 (72%). Sampling interval was ~1.5.

Total of 368 study participant selected (105 from ICU and 263 from medical ward admitted cases)

6.9 Data collection procedure

Structured questionnaires were developed and the content and validity of the questionnaire was checked by research team, data were collected by trained residents using data extraction checklist. Data collectors extracted the required data from patients' registration log books and patients' charts after getting permission from the hospital manager, and medical card unit head. They first did the separation of patients' charts as pneumonia. Then, they extracted data from charts of pneumonia cases. They cross-checked data from patients' registration log books. The research teams supervised data collection procedures and principal investigator by using the structured and standardized questionnaires.

6.10 Data quality assurance

Data collectors (residents) were trained for one day about the data extraction checklist, how to collect data, data quality, and data confidentiality issues. Cross-checking of patients' chart data with registration log books was made. Data collection was fully supervised with feedback on the observed gaps and clarity questions raised from data collectors. Data coding, checking for completeness, and data clearances were done after data importing into SPSS version 26.

5.11 Data processing and analysis

To determine the proportion of demographic and other clinical data, descriptive statistics were used. Bivariate analysis was carried out between the dependent and independent variables to determine the associated factors for poor outcome in admitted pneumonia patients. The Hosmer-Lemeshow test for logistic regression was checked to examine the goodness of fit of the model, and data were fitted for the model ($x^2 = 9.38$, p-value = 0.226). Multicollinearity was assessed using variance inflation factors (VIF), and all variables had VIF< 10. Multivariate analysis was performed on variables that had a P-value of < 0.25 on bivariate analysis. To determine how these variables affects poor outcomes of pneumonia with control of other variables constant.

The degree of association was computed using odds ratio with 95% CI taking P-value less than 0.05 as significant level for associations between dependent and independent variable.

6. Ethical considerations

A written legal permission regarding the study was obtained from the Institutional Review board of the Bahir Dar University College of medicine and health science after approval of research proposal.

7. Dissemination of results

The findings of this study will be disseminated to Bahir Dar University, College of Medicine and Health Science, Department of internal medicine to serve as reference material for subsequent research and teaching purpose. The study findings will be submitted to TGSH and an attempt will be made for publication in peer-reviewed national or international journals

8. Operational definition

Pneumonia: is an infection of the pulmonary parenchyma[1]

Outcome: Alive or death

Poor outcome: That patient who died

Community acquired pneumonia (CAP): is pneumonia acquired outside a hospital setting[4]

Hospital-acquired pneumonia (HAP) is pneumonia that develops at least 48 hours after **hospital** admission in patients not receiving mechanical ventilation[4]

Ventilator-associated pneumonia (VAP): is a hospital acquired pneumonia that occurs more than 48 h after mechanical ventilation[4]

Mild pneumonia: patient with pneumonia having flu-like symptoms[2]

Moderate pneumonia: patient with moderate pneumonia include drowsiness and confusion, worsening shortness of breath, and risk factors such as old age and underlying diseases[2]

Severe pneumonia: patient with pneumonia requiring ICU admission (Septic shock and/or respiratory failure[2]

Lower Respiratory Tract Infections (LRTI) are infections that affect the airways (below the level of the larynx), including the trachea and the alveolar sacs[1]

Antimicrobial resistance (AMR) is the resistance of microorganisms to an antimicrobial agent to which they were at first sensitive.

Prior hospitalization: Hospital admission over the past 3 months

Prior COVID-19 treatment: History of treatment for PCR/Rapid test confirmed COVID-19

10. RESULTS

10.1. Socio-demographic characteristics

Two hundred sixteen (58.7 %) of the total patients were female. The mean age of study participants was 43.63 (± 16.347 SD) years. (table3).

		Frequency(n)	Percent
Sex	Female	216	58.7
	Male	152	41.3
Residency	Rural	207	56.3
	Urban	161	43.8
Age	5-24	48	13
	25-39	111	30.2
	40-64	156	42.4
	65 and above	53	14.4

Table 2 – Socio-demographic characteristics of the patients who was admitted to TGSH medical ward/ICU from January 1, 2020 to January 31, 2022 with the diagnosis of pneumonia

10.2. Presenting sign and Symptoms, durations of illness, and comorbid-risk factors

The mean duration of illness was 7.98 days (± 4.94 SD) with minimum of 1day and maximum 30 days). Mean hospital stay was 7.67 days ((± 5.65 SD) with minimum 2 days and maximum 49 days. The mean cost during admission was 1281.46 birr ((± 1779 SD) with minimum cost 121birr and maximum cost of 13,208 birr.

Cough was the most common presenting symptom in three hundred forty seven (94.3%) of patients, followed by shortness of breath in three hundred thirty five (91%), fever in

two handed twenty four (60.9%), pruritic chest pain in one hundred sixty four (44.8%). One hundred fifty-five (42.1%) of patients had at least one comorbid-risk factor for pneumonia. The three most common comorbid-risk factors were heart failure 46 (12.5%), diabetes 36 (9.8%), retroviral infection 27 (7.3%). Followed by COPD 16 (4.3%), Asthma 11 (3%), renal and liver disease 11 (3%) and known malignancy 7 (1.9%).

Three hundred sixteen (85.9%) patients had normal blood pressure only 7(1.9%) patients had hypotension. Oxygen saturation was below 90% in 261 (70.9%). Pulse rate more than hundred in two hundred sixty six (72.3%), three hundred fifty (95.1%) of patients had respiratory rate over 20 in two hundred forty (58.2%) of patient had temperature above 37.4 degree Celsius. (Fig. 2 CURB-65 result)

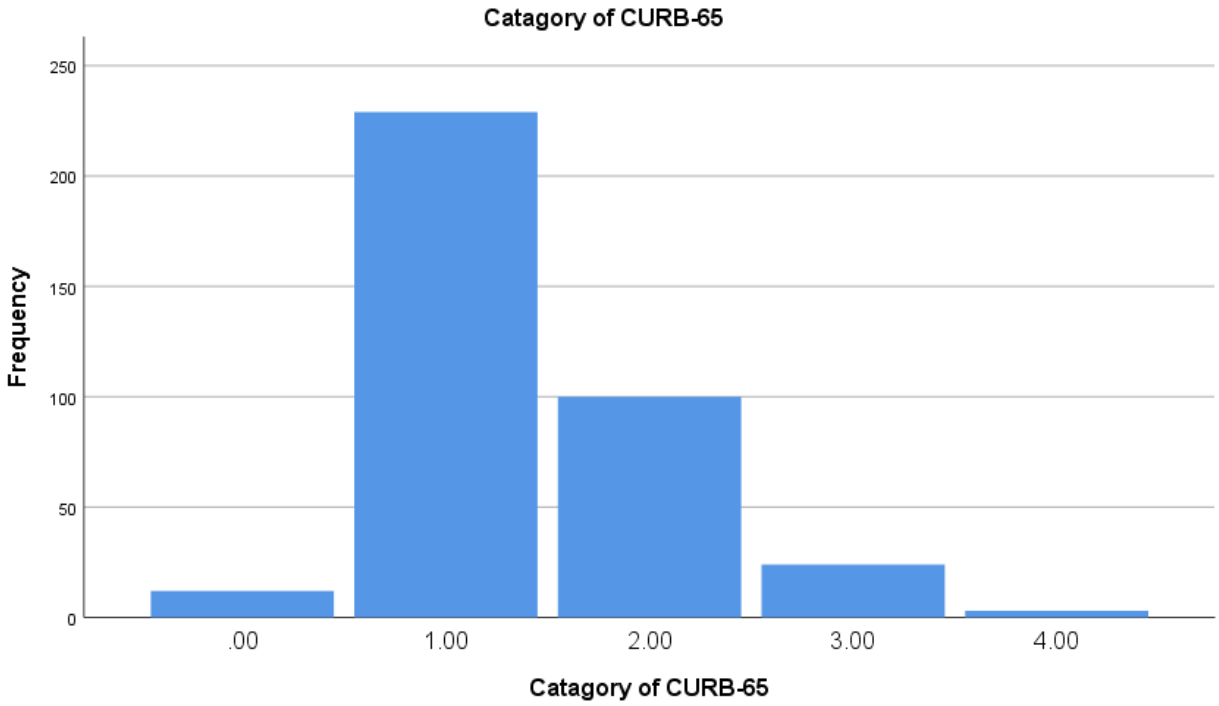

Fig.1 A bar graph showing CURB-65 result of the patients admitted to TGSH medical side from January 1, 2020 to January 31 with the diagnosis of pneumonia

10.3 Investigation result of patient of the patients admitted with pneumonia

Two hundred forty nine (67.6%) of patients had increased WBC count. Liver function test was deranged in eighty five (23.1%) and ninety five (25.8%) had deranged renal function. From one hundred ninety eight (53.8%) COVID-19 tested patients twelve were positive (6.1%). CXR was done two hundred ninety nine (81.3%) (Fig 3 shows common CXR findings) Chest CT was done in thirty nine (10.6%) common findings were twelve (31.6%) multifocal pneumonia, eleven (28.9%) lobar consolidation with mass,

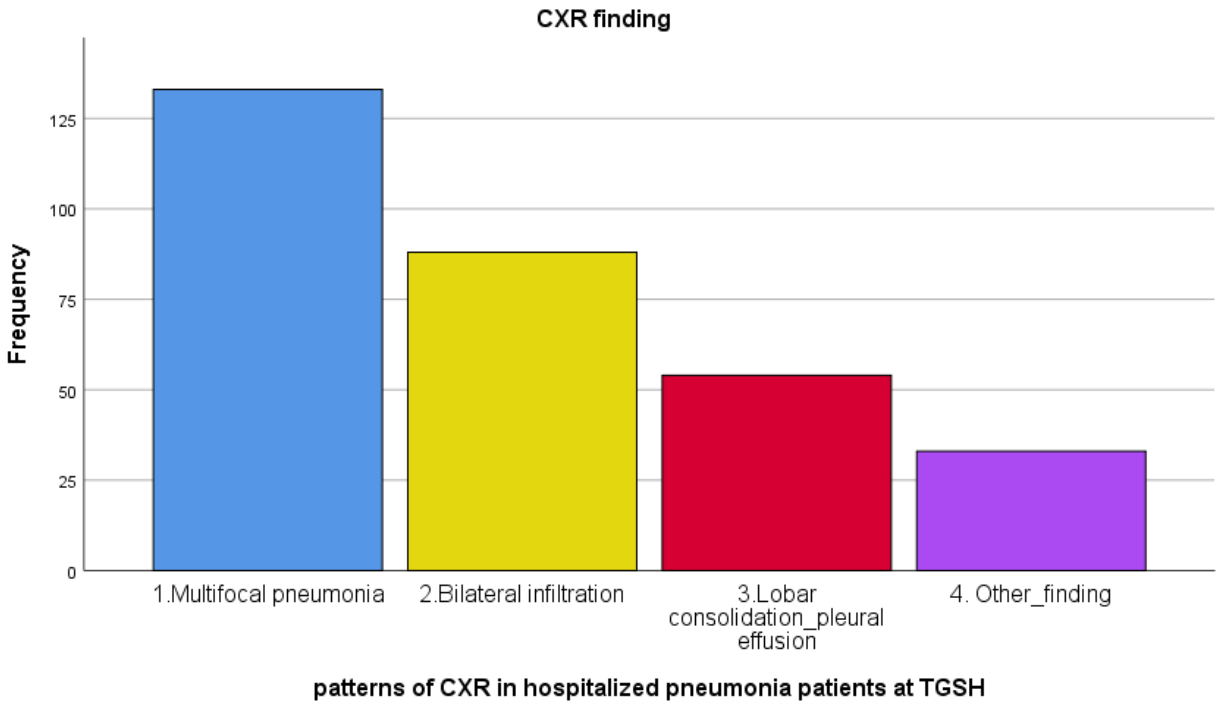

Fig 2.Bar graph showing proportion of CXR findings of the patients admitted to TGSH medical side with pneumonia from January 1, 2020 to January 31, 2022.

10.4 site of care and treatment of hospitalized patients with pneumonia

Among 368 patients two hundred sixty three (72%) were admitted to medical ward and one hundred five (28%) were admitted to ICU. The most common indication to ICU admission was respiratory failure in ninety four (89.5%) and Septic shock in five (4.8%). Of those ICU admitted patients sixty four (59.2%) was treated with mechanical ventilation. Ceftriaxone and azithromycin were used as initial choice of antibiotics in two hundred sixty four (71.1%) pneumonia cases; other antibiotics used were vancomycin with ceftazidime in seventy seven (20.9%), Vancomycin and cefepime in twenty seven (7.4%).

10.5 Outcomes of hospitalized patients with pneumonia

Among 368 admitted patients with pneumonia 315 (85.6%) patients discharged and 53(14.4%) were died. The most common cause of death was multiorgan failure secondary to sepsis of chest focus in 31 (58.5%), other cause of death was respiratory failure in 16 (30.2%) and refractory shock in 6 (11.3%).

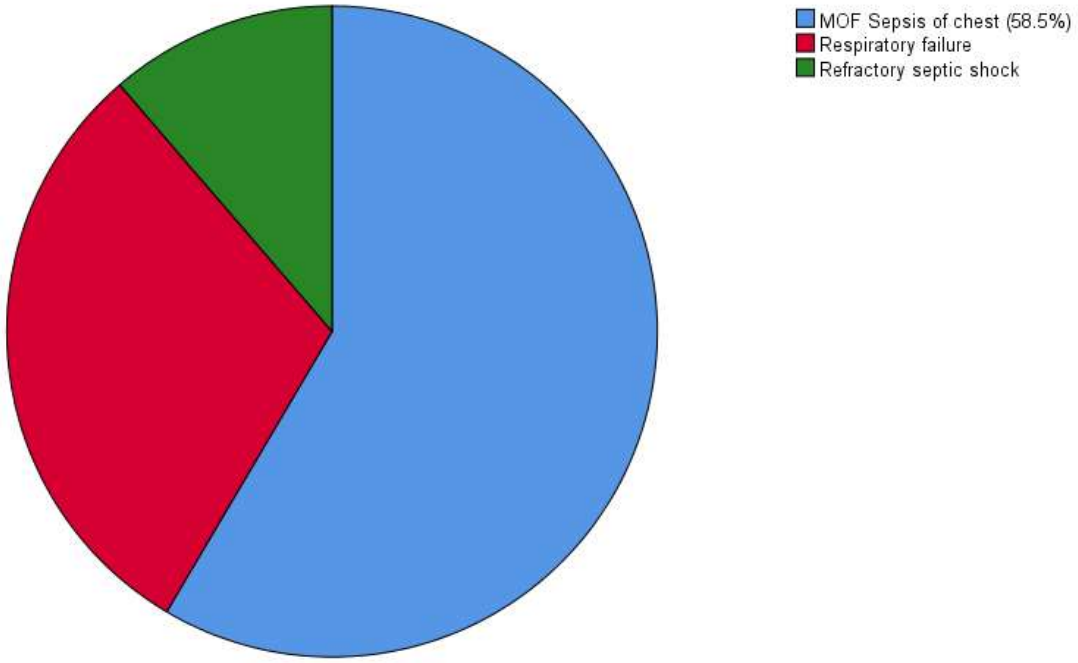

Fig 3 Pie chart showing proportion common cause of death of patients admitted to TGSH medical side with pneumonia from January 1, 2020 to January 31, 2022.

10.6 Bi-Variable and Multi-variable analysis

The following variables were identified on bi-Variable analysis as being significantly associated with a poor outcome in pneumonia patients with significant level P-value > 0.25. These were Age, chest pain, short interval between symptom onset and hospital visit, comorbid factor, renal failure at presentation, need of MV.

The Hosmer-Lemeshow test for logistic regression was checked to examine the goodness of fit of the model, and data were fitted for the model ($x^2 = 9.38$, p-value = 0.226). Multicollinearity was assessed using variance inflation factors (VIF), and all variables had VIF< 10.

Binary logistic regression was performed with all independent variable which had significant association on bi-Variable analysis to determine how these variables affects poor outcomes of pneumonia with control of other variables constant. Age, short interval between symptom onset and hospital visit, presence of at least one comorbid-risk factor, renal failure at presentation, need of MV, were found to have significant association with a p-value of <0.05

Hence, the result showed that patients who were intubated for ARDS 28.5 times more likely to die than those patients not intubated (AOR=28.500, 95% CI: 9.261-87.705). Patients who were age 65 years and above 17.2 times more likely to die compared with patients who had age below 65 years with (AOR=17.242,95% CI:4.887-60.836). Patients who had deranged initial renal function test 8.9 times more likely to die compared normal initial renal function test (AOR=8.941: 95% CI:3.006-26.590). (Table 4- show factor associated with poor outcome in admitted pneumonia patients)

Variable	Death		COR (95% CI)	AOR (95% CI)	P-value
	Yes (%)	Yes or No (%)			
Age of the patient per year					
60 and above	36	39	14.986(7.691-29.204)	17.242(4.887-60.836)	0.000
Below 60	17	276	1	1	
Interval between duration of illness and symptom onset in days					
7 and above	7	221	1	1	
less than 7	46	94	0.344(0.282-0.421)	0.78(0.677-0.900)	0.001
Having at least one comorbidity					
Yes	46	109	12.419(5.424-28.435)	6.367(2.017-20.102)	0.003
No	7	206	1	1	
Deranged initial renal function test					
Yes	45	50	29.8(13.256-67.048)	8.941(3.006-26.590)	0.001
No	8	265	1	1	
Intubated or not intubated					

Yes	39	14	32.31(15.499-67.371)	28.500 (9.261-87.705)	0.000
No	14	290	1	1	

Table 3– Factors associated with death among the patients who were admitted to TGSH medical side from January 1, 2020 to January 31, 2022 with the diagnosis of pneumonia (n = 368)

11. DISCUSSION

This study describes outcomes and associated factors for poor outcome in patients hospitalized with the diagnosis pneumonia. Among 368 study subjects, the largest group accounting for 42.4% was between the ages of 40-64 and 65 and above year's account 14.4% with the total mean age of 43 years and 59% were females. This is different from the study done in Malawi [20]; which showed average age of 34.7 years and male accounts 62%.

39% of patient's visits hospital within seven days of symptom onset and the mean duration of illness was 8 days (± 4.94 SD). Which is different from study done in Jimma [21], Malawi [20] and Nigeria [30], those studies showed late presentation, only 6.7% visits hospital within 7 days of symptom onset and mean hospital stay was 11±8 days [20, 21, 30].The reason could be health seeking behavior of the community, acuteness of the diseases due to COVID-19 outbreak.

The average hospital stay for study participants was 7.67 days (5.65 SD), ranging from 2 days to 49 days. When compared to other studies like Jimma's 11.49-day [21] Switzerland's 9.8 days [32] and Spain 10 days [33]. This result showed a lower mean duration hospital stay. The reason could be financial difficulties, patient's requests to go home as soon as possible and it could be early improvement.

Cough was the most common presenting symptom 94.3% of patients had cough, other symptoms SOB (91%), fever (60.9%), pruritic chest pain (44.8%). This is in line with other studies Nigeria [30] and Canada and US [34]. Patients with pneumonia the air sacs may fill with fluid or purulent material leading to irritation of the airway, which leads to cough and other symptoms like SOB**.**

42% of study participant had documented comorbid-risk factor. The most common comorbidities were heart failure 12.5%, diabetes 10%, RVI 7%, COPD and asthma 6%. This is different from finding other research, study done in Japan, Spain common comorbidity were malignancy, chronic respiratory disease and heart failure in addition to cigarette smoking and significant alcohol intake. Also different from studies from Jimma[21], Malawi[20], Nigeria [30] studies which showed RVI, TB and COPD were most comorbidity conditions. The reason could be selection of study subject for example the study done Malawi took more RVI patients. The other reason could be epidemiology

of that specific comorbidity that area. According to studies done in Spain [35] and Japan [31] common comorbidity were Malignancy, diabetes and COPD. The reason could be diagnostic capability, epidemiological variations, and cultural difference.

Among the study subjects 89% had CURB-65 of 1 0r 2 and only 7.3% had three or more. This was different from the study done in Jimma[21], which shows 80% of the participant had CURB-65 1 or 2, the reason could be the timing of the study, and this study was done during COVID-19 outbreak, patients could have isolated COVID-19 or co-infection with other causes of pneumonia, which can change natural history of pneumonia presentation that was known before COVID-19 era.

The mortality rate in this study was 14.4%, in other studies done in Ethiopia: Saint Paul's Hospital 31.8% [22] Jimma 20.2% [21] and In Malawi study 14.6% [20] Africa 16-23%, United States/Canada 7.3%; Europe 9.1% and Latin America 13.3% [18] These showed the mortality lower that the result of other part of Ethiopian studies. The reason could be early visit to health facility; good patient care and the sample size were smaller in those studies. In relation to developed regions the mortality rate is higher the reason could be better diagnostic approaches like culture, imaging and other supportive diagnostic tools, guideline based treatments, strong health insurance and awareness of the community.

In the adjusted multivariate analysis, the older patients who were age 65 years and above had 17.2 times more likely to die compared with patients who had age below 65 years. This finding is consistent with study conducted in Jimma [21], Nigeria [30], Spain [35] and Japan [31]. The main reason could be associated comorbidities higher in older individuals and aging leading degenerative changes and the declining immune response which leads to the disease progress. Contrary to a study conducted in Malawi [20] and Vietnam [36], which found no significant association between age and pneumonia mortality.

According to this study, mortality was found to be eight times higher in those with at least one comorbid-risk factor than in those without it. This result agrees with research from Jimma [21], Nigeria [30] , Vietnam [36], Spain [35], and Japan [31]. The reason could be Comorbid risk factors may alter the disease's normal course, lengthen hospital stays, and cause complications as a result.

In this study, it was found that hospital visits seven days or more following the onset of symptoms were associated with a 0.8-times reduced mortality rate than those less than that. In contrast to study conducted in Jimma [21] and Malawi [20]. The reason could be the timing of study, the timing of this study coincided with the COVID-19 outbreak, which has the potential to change the course of the disease and increase community health-seeking behavior and the reason for increment for mortality with short presentation could suggest us the acuteness and severity of the illness.

In this study 25.8% had deranged initial renal function which is found to be associated with 9 times increase mortality that those had normal initial renal function. This revealed a comparable outcome to research conducted in China [37] and Vietnam [36]. The reason could be that patients with severe pneumonia are more likely to develop sepsis and are more likely to get dehydrated for a variety of reasons, including as fever, poor intake, GI loss, and the use of renal toxic drugs. The risk of abnormal renal function may be increased by all of these conditions. All of these factors can accelerate the development of organ failure in other systems, which can result in death.

This study found that patients who had intubation had a death rate that was 28.5 times greater than non-intubated patients. This finding is consistent with studies from Saudi Arabia [38] , Spain [39], and the United States [7], but it is exaggerated for reasons that include delaying intubation in those who need it due to resource limitations, high risk of ventilator-associated pneumonia due to inadequate infection control measures, use of antibiotics without a culture, unsatisfactory care due to financial constraints, and lack of renal replacement therapy.

12. STRENGTHS AND LIMITATIONS OF THE STUDY

12.1. Strengths

The data was a retrospective data which was collected from medical records of patients hence preventing patients from additional exhaustion while maintaining professionally recorded objective data and

The data was collected by residents.

12.2. Limitations

The study did not follow the patients, rather used data recorded by the treating physicians and nurses during ICU stays. Although the study retrieved objective data which was documented by heath care professionals, it may have been affected by documentation gap which could have missed additional findings the patients may have had.

13. CONCLUSION AND RECOMMENDATIONS

13.1. Conclusions

The death rate for this study was lower than that of other Ethiopian institutions and African studies, but greater than that of developed countries. The two main causes of death in pneumonia patients were respiratory failure and multiorgan failure due to sepsis, with the kidney being the primary organ affected.

In this study, there is a strong correlation between age, the time between the onset of symptoms and the hospital visit, concurrent comorbid risk factors, an initial abnormal renal function test, and the requirement for intubation.

13.2. Recommendations

Health care professionals – Since pneumonia is the most frequent cause of morbidity and mortality in settings with low resources, it is important to focus on prevention, effective comorbidity management, and early detection and management of organ dysfunction.

Mass media – It is essential to disseminate knowledge regarding lower respiratory tract infections, co-morbidities and the contributing factors to deaths.

Researcher and scientific community – Given the limited resources available, more research on pneumonia should be done, and the system should be helped to improve healthcare to lower the likelihood of poor outcomes in pneumonia patients.

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11. ANNEXES

Annex 11.1: Data extraction instrument

Data extraction tools at TDSH Bahidar Ethiopia

- Data extraction checklist to determine inpatient treatment outcomes and associated factors for poor outcome among adults admitted with pneumonia from Jan. 1st, 2020 to Jan.31, 2022 at TGSH in Bahir Dar, Ethiopia.

Part 1: Socio Demographic Data		
S. N^{o}	Questions	Responses
1	Patient MRN	----------
2	Sex	1.Male 2. Female
3	Age in years	----------
4	Residence	1=Urban 2=Rural
Part 2-clinical presentations		
5	Presenting symptoms	Cough(yes/No) Fever (Yes/No) SOB (Yes/No) Chest pain (Yes/No) Fast breathing (Yes/No) Palpitation (Yes/No) Other Symptoms(mention)
6	Duration of illness	…….. days
7	Comorbidities/risk factors	1. Diabetes 2. RVI 3. Heart failure

		4. Renal and liver diseases 5. Malignancy 6. Neurologic conditions 7. COPD and other chronic lung disease 8. Asthma
8.	Vital sigh	A. Blood pressure 1. Normal 2. Hypotensive 3. Hypertensive B. Pulse rate 1. Normal(60-100Bpm) 2. Tachycardic(>100Bpm) C. Respiratory rate 1. Normal(14-20Bpm) 2. Tachypnea (>20Bpm) D. Temperature 1. Normal (36.5-37.4) 2. Febrile (>37.4) E. Saturation 1. Low (<90%) 2. Normal (>90%)
9	CURB-65	…….value
Part 3- Investigations		
10	Investigations	WBC 1. .leukocytosis 2. Leukopenia 3. Normal 4. Lymphopenia

		5. Anemia(Yes/No) 6. Thrombocytopenia (Yes/no)
11	Organ function test	11.1 Liver function test 1. Normal 2. Deranged (any of liver function) 11.2 Renal function test 1. Normal 2. Deranged
12	Imaging study	CXR, done or not (Yes/No) If done, what was the finding A. Multifocal pneumonia B. Lobar consolidation C. Bilateral infiltrate D. Pleural effusion E. Other findings…….
13	Chest CT scan	Chest Ct scan, done or not (Yes/No) If, yes, what was the finding A. Multifocal pneumonia B. Lobar consolidation/mass C. Bronchiectasis D. Ground glass opacity E. PE F. Other findings…..
14	COVID-19 Test result	Done (Yes/No) If, Yes A. Negative B. Positive
Part 4- treatment and outcomes		
15	ICU admission	Yes/No, If, yes- indication

		A. Impending respiratory failure B. Septic shock of chest focus C. Other (MI,PE)
16	Intubation	Yes/No
17	Initial treatment	1. Ceftriaxone and azithromycin (yes/No) 2. Vancomycin and ceftazidime (Yes/No) 3. Vancomycin and cefepime (Yes/No) 4. Use of dexamethasone (Yes/No) 5. Other-----
18	Outcome	Death or Alive
19.	If, died, Cause of death	Cause of death A. MOF from sepsis of chest B. Respiratory failure C. Refractory shock
20	Duration of hospital stay	……days
21	Total hospital stay cost	……birr