



WALLAGA UNIVERSITY
INSTITUTE OF HEALTH SCIENCES
MEDICAL SCIENCE AND SERVICE DIRECTORATE
DEPARTMENT OF PEDIATRICS AND CHILD HEALTH

**TIME TO RECOVERY FROM SEVERE COMMUNITY-ACQUIRED
PNEUMONIA AND ITS PREDICTORS AMONG PEDIATRIC
PATIENTS ADMITTED TO WALLAGA UNIVERSITY
COMPRESSIVE SPECIALIZED HOSPITAL, EAST WALLAGA
ZONE, OROMIA, WESTERN ETHIOPIA, 2026**

**BY: DESSALEGN LIKISA (MD, FINAL YEAR PEDIATRICS AND
CHILD HEALTH RESIDENT)**

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APPROVAL SHEET FOR SUBMITTING FINAL THESIS

As members of the Board of Examiners for the Final Resident Thesis Open Defense, we hereby certify that we have read and evaluated the thesis prepared by Dessalegn Likisa entitled: “time to recovery from severe community-acquired pneumonia and its predictors among pediatric patients admitted to Wallaga University Compressive Specialized Hospital, Oromia, Western Ethiopia; 2026”. We recommend that this thesis be accepted as partial fulfillment of the requirements for the Speciality Certificate in Pediatrics and Child Health.

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STATEMENT OF THE DECLARATION

By signing below, I declare that this thesis entitled “*Time to Recovery from Severe Community-Acquired Pneumonia and Its Predictors among Pediatric Patients admitted to Wallaga University Comprehensive Specialized Hospital, Oromia, Western Ethiopia; 2026*” is entirely my original work. I confirm that all ethical standards were strictly observed throughout the planning, data collection, analysis, and completion of this study. All sources of information used have been appropriately acknowledged through proper citation and referencing, and every effort has been made to avoid any form of plagiarism. I further affirm that this thesis has not been submitted to any other institution or organization for the award of any academic degree, diploma, or certificate.

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ABBREVIATIONS AND ACRONYMS

BSC	Bachelor of Science
CAP	Community-Acquired Pneumonia
CHD	Congenital Heart Disease
CXR	Chest X- Ray
DM	Diabetes Mellitus
ETB	Ethiopian Birr
EPI	Expanded Program on Immunization
HIB	Haemophilus Influenzae Type B
HMIS	Health Management Information System
HIV	Human Immuno Virus
IMCI	Integrated Management of Childhood Illness
IQR	Inter Quartile Range
ORS	Oral Rehydration Salt
PCV	Pneumococcal Vaccine
SAM	Severe Acute Malnutrition
SCAP	Severe Community-Acquired Pneumonia
UNICEF	United Nations Children's Fund
WUCSH	Wallaga University Compressive Specialized Hospital
WHO	World Health Organization

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ABSTRACT

Background: Severe community-acquired pneumonia remains the leading infectious cause of mortality among children worldwide. In addition to its high mortality burden, the disease imposes a significant economic burden on families, communities, and national healthcare systems, primarily due to prolonged hospital stays. Despite this fact, there is limited evidence regarding the time to recovery and its predictors among pediatric patients hospitalized with severe community-acquired pneumonia in Ethiopia.

Objective: To determine the median time to recovery from severe community-acquired pneumonia and identify its predictors among pediatric patients admitted to Wallaga University Comprehensive Specialized Hospital, East Wallaga Zone, Oromia, Ethiopia, 2026.

Methods: An institution-based prospective follow-up study was conducted among 220 pediatric patients admitted with severe community-acquired pneumonia at Wallaga University Comprehensive Specialized Hospital from September 1, 2025 to January 30, 2026. Data were collected using a structured and pretested data collection tool. A consecutive sampling technique was employed. Data entry was performed using EpiData version 7.2.7 and analysis was carried out using STATA version 17.0. The proportional hazards assumption and model fitness were assessed. Adjusted hazard ratios (AHRs) with 95% confidence intervals were used to identify significant predictors of time to recovery from severe community-acquired pneumonia at a p-value < 0.05.

Results: By the end of the follow-up period, 203 patients recovered, with a median time to recovery of 4 days (IQR: 3–7 days). The overall incidence rate of recovery was 19.39 per 100 person-days observations (95% CI: 16.90–22.25). The presence of danger signs at admission (AHR = 0.54, 95% CI: 0.30–0.76), comorbidities (AHR = 1.74, 95% CI: 1.41–2.16), and complications (AHR = 0.32, 95% CI: 0.11–0.91) were significantly associated with time to recovery.

Conclusion and recommendation: The median time to recovery from severe community-acquired pneumonia was 4 days. The presence of danger signs at admission, comorbidities, and complications were statistically significant predictors of recovery time. Early identification and timely appropriate management of children presenting with these predictors are essential to help shorten the recovery period from severe community-acquired pneumonia.

Keywords: - Time to recovery, severe community-acquired pneumonia, pediatrics

1. INTRODUCTION

1.1. Background

Pneumonia is an inflammation of the lung's parenchymal tissues, including the alveoli and bronchioles. Under normal conditions, the alveoli, which are tiny sacs in the lungs, fill with air during breathing. However, when children develop pneumonia, these alveoli become filled with pus and fluid, impairing breathing and causing pain. (1–3). The World Health Organization (WHO) defines pneumonia in pediatrics clinically by the presence of symptoms such as cough, difficulty breathing, rapid respiratory rate, and chest indrawing (4,5).

The WHO classifies pneumonia into two categories based on the severity of its clinical presentation, as determined through physical examination: pneumonia and severe pneumonia (4). According to WHO, severe pneumonia in children is defined as a history of cough or reported difficulty breathing, accompanied by at least one of the following: oxygen saturation below 90%, severe respiratory distress, general danger signs, or an increased respiratory rate (4).

Pneumonia can also be classified according to its origin or mode of acquisition. Community-acquired pneumonia (CAP) refers to a form of pneumonia acquired outside the hospital or within the first 48 hours of hospital admission. Hospital-acquired pneumonia (HAP), also known as nosocomial pneumonia, develops at least 48–72 hours after hospital admission and was not incubating at the time of admission (6). Ventilator-associated pneumonia (VAP) is a subset of HAP and specifically refers to pneumonia that develops in patients who have been receiving mechanical ventilation for at least 48 hours (6,7).

Pneumonia can result from both non-infectious and infectious causes. Non-infectious causes include aspiration, hypersensitivity reactions, and pneumonitis induced by drugs or radiation. Infectious pneumonia may be caused by bacteria, viruses, or fungi. In children, the most common bacterial pathogen is *Streptococcus pneumoniae*, followed by *Haemophilus influenzae* type b (Hib), while respiratory syncytial virus (RSV) is the most frequent viral cause. Bacterial pneumonia in children often presents as a more severe illness, typically characterized by high fever and rapid breathing (3,8).

Evidence indicates that the majority of childhood pneumonia deaths are attributable to severe community-acquired pneumonia (SCAP) and its complications, including parapneumonic effusion, empyema, necrotizing pneumonia, and lung abscesses (9). Effective management of these cases requires early identification, prompt referral, and access to high-quality care. However, in many resource-limited settings, referral systems are often inadequate, resulting in significant delays in receiving appropriate treatment (10,11).

Governments and the global community have received clear guidance through the Global Call to Action on Childhood Pneumonia to strengthen their commitment and accelerate efforts to combat pneumonia. These directives emphasize the development of pneumonia control strategies, the strengthening of primary healthcare systems, increased government investment in nutrition and health, improved health governance, expanded vaccination coverage, and the promotion of multisectoral partnerships(12,13).

In Ethiopia, substantial initiatives have been implemented to reduce pneumonia-related morbidity and mortality. These efforts focus on three major areas: protection, prevention, and case management. Protection strategies include promoting optimal breastfeeding practices and ensuring adequate child nutrition. Prevention efforts center on expanding vaccination coverage, improving access to safe water, and reducing air pollution. In addition, measures to enhance diagnosis and treatment involve encouraging timely care-seeking behavior, scaling up integrated service delivery, and investing in the training and deployment of healthcare workers (12).

Effective pneumonia management involves not only the recovery rate of children but also the speed of their recovery. Time to recovery is a sensitive, practical, and clinically meaningful outcome that helps bridge patient care, hospital management, and public health in pediatric SCAP. Children admitted for treatment of SCAP should therefore recover as quickly as possible. In most cases, improvement begins within the first 48 hours of antibiotic therapy (14).

1.2. Statement of the Problem

Globally, pneumonia is a leading cause of morbidity, mortality, and hospitalization among pediatric patients. It continues to be a major contributor to childhood illness and death, particularly in developing countries (5,6).

In 2024, the United Nations Children's Fund (UNICEF) reported that severe community-acquired pneumonia is the leading infectious cause of death in children worldwide, claiming the lives of over 700,000 children under the age of 5 each year, or approximately 2,000 every day. Globally, there are over 1,400 cases of pneumonia per 100,000 children annually, which is roughly 1 in every 71 children. The highest incidence is observed in South Asia (2,500 cases per 100,000 children) and West and Central Africa (1,620 cases per 100,000 children), regions that account for over 80% of pneumonia-related deaths (1).

According to the WHO (2024), pneumonia, along with diarrhea, accounts for 23% of under-five mortality, causing an estimated 1.17 million deaths in children under five globally(15). Africa loses thousands of children to severe community-acquired pneumonia each year, with the highest incidence in sub-Saharan African countries, including Ethiopia(16). In Ethiopia, pneumonia is responsible for a significant proportion of child, alongside other major causes such as diarrhea, malaria, measles, and newborn-related complications (17). The WHO (2022) estimates that SCAP is the leading cause of death in Ethiopian children under five, accounting for 18% of all under-five deaths, with over 40,000 deaths occurring annually (5).

Significant efforts have been made worldwide to reduce pneumonia-related morbidity and mortality in children. However, a major challenge is prolonged hospital stays, which have contributed to a decline in survival rates among pediatric patients with severe community-acquired pneumonia (18).

Extended hospitalization is known to increase the risk of local and systemic infections, potentially leading to hospital-acquired infections. In addition, it imposes significant economic burdens, both directly, through medical expenses, and indirectly, due to lost work hours for parents caring for sick children (9,19).

The total medical costs associated with severe community-acquired pneumonia are closely linked to hospital admission expenses, length of stay, and recovery time. The consequences of prolonged hospitalization extend beyond the affected child, affecting mothers or caregivers, the family, the community, and even the country. When caregivers spend extended periods attending to the sick child, the family experiences a loss of labor and economic productivity, which can create additional challenges for other children at home. These negative impacts of inpatient management become even more significant when the length of stay is prolonged and recovery time is unpredictable (19,20).

Identifying the risk factors that contribute to slow recovery in pediatric patients with severe community-acquired pneumonia is crucial for effectively addressing the issue and ensuring the optimal use of limited healthcare resources (10).

Many researchers have conducted studies on the factors associated with, prevalence of, and determinants of pneumonia in children. However, most of these studies have focused specifically on children under five years of age and did not examine the predictors of recovery time(17,21,22). As a result, the recovery period and its determinants for children under 14 years admitted with severe community-acquired pneumonia are not well understood. Based on my literature search, nearly all studies conducted in Ethiopia on estimated recovery time and predictors of severe community-acquired pneumonia were retrospective and focused only on children under five (10,13,23–26). Therefore, given the importance of the issue and the existing knowledge gap, further research is needed to estimate recovery time and identify its predictors in pediatric patients with severe community-acquired pneumonia.

1.3. Significance of the Study

The purpose of this study is to evaluate the recovery time of pediatric patients with severe community-acquired pneumonia and to identify the factors that influence the duration of recovery among those admitted to Wallaga University Comprehensive Specialized Hospital. The study aims to address the ongoing public health challenge of severe community-acquired pneumonia in children, which remains a major concern in developing countries such as Ethiopia.

Despite existing interventions, severe community-acquired pneumonia continues to impose a significant economic burden on families, communities, and the country due to prolonged hospitalizations. There is a notable lack of studies on recovery time and its predictors among pediatric patients, as most existing research has focused on children under five and has been retrospective. Therefore, this study aims to provide valuable insights into the median recovery time and its predictors among pediatric patients admitted with severe community-acquired pneumonia at Wallaga University Comprehensive Specialized Hospital.

The findings of this study will provide healthcare providers with additional guidance on the selection of treatments in relation to recovery time and its predictors, aligning with the standard recovery timeline for severe community-acquired pneumonia. Early estimation of recovery time will also enable providers to inform parents about the expected clinical course, helping them make well-informed decisions regarding treatment options. For policymakers, the study will offer baseline data to develop guidelines, standards, and strategies aimed at improving SCAP management and reducing recovery time. Additionally, the results will contribute to updating the knowledge and skills of healthcare workers, particularly in hospital settings, and will serve as foundational information for future research on related topics.

2. LITERATURE REVIEW

2.1. Median recovery time and incidence rate of recovery from severe community-acquired pneumonia

When a child is admitted with community-acquired pneumonia, severe community-acquired pneumonia should be identified at the time of admission according to the WHO criteria. Severe pneumonia is defined as the presence of cough and difficulty in breathing, accompanied by an increased respiratory rate (more than 60 breaths per minute in children younger than 2 months, more than 50 breaths per minute in children aged 2–12 months, and more than 40 breaths per minute in children aged 13–60 months) along with chest indrawing, with or without inability to drink, cyanosis, or peripheral oxygen saturation below 90%. (4,27).

The possible treatment outcomes in children with severe community-acquired pneumonia include recovery, death, or treatment failure. Complicated pneumonia is associated with high rates of mortality and significant morbidity. However, in previously healthy children, complete recovery is generally expected without permanent sequelae. Despite this favorable prognosis, SCAP may follow a protracted clinical course requiring prolonged hospitalization, although the duration of illness is highly variable, and some children recover within a few days of initiating treatment. A study conducted in Nepal on predictors of duration and treatment failure in severe pneumonia reported a median time to clinical stability of 49 hours (28). Similarly, a prospective observational cohort study conducted in New York found that the median time to recovery was 2 days (29).

A prospective follow-up study conducted in public hospitals of the South Wollo Zone found a median recovery time of 4 days, with an incidence rate of recovery of 20.45 per 100 person-day observations. In this study, out of 270 participants, 205 (75.93%) recovered from their illness, whereas 62 (24.07%) were censored (26). Another prospective follow-up study conducted in governmental hospitals in Southwest Ethiopia reported a median time to recovery of 5 days, with an incidence rate of recovery of 12.48 per 100 person-day observations. Among 791 children with severe pneumonia, 641 (81.04%) recovered, while 150 were censored. Of those censored, 96 (64%) left against medical advice, 28 (18.7%) were referred to other healthcare institutions, and 26 (17.3%) died (30).

A retrospective study conducted at Debre Markos Referral Hospital assessed the time to recovery and predictors of severe community-acquired pneumonia among pediatric patients. Of the 352 study participants, 313 (88.9%) experienced the event (recovery), while the remaining 39 (11.1%) were censored observations. The overall median time to recovery was 4 days, with a recovery rate of 16.25 per 100 person-day observations (31). Another retrospective study conducted in public hospitals of the Benishangul-Gumuz Region on predictors of prolonged hospitalization among children with severe community-acquired pneumonia reported that 488 (94.76%) children recovered from SCAP, while 11 (2.14%) died, 7 (1.36%) were referred for further management, and 9 (1.75%) left against medical advice. The overall recovery rate was 19.69 per 100 person-day observations, and the median length of hospital stay was 5 days (13). Similarly, a retrospective study conducted at Mizan-Tepi University Teaching Hospital on time to recovery from severe pneumonia and its predictors among pediatric patients found that, out of 591 children, 541 (91.54%) recovered and 50 (8.46%) were censored. The overall median recovery time in this study was 4 days, with an incidence rate of 24.10 per 100 person-day observations (12).

A retrospective cohort study conducted in selected hospitals in Addis Ababa on predictors of recovery time from severe community-acquired pneumonia among pediatric patients reported that, out of 388 children with SCAP, 355 (91.5%) recovered, 17 (4.4%) died, and 10 (2.6%) were referred to other facilities. The overall recovery rate was 11.5 per 100 person-day observations, and the median recovery time was 6 days (14).

A retrospective study conducted at Asella Referral and Teaching Hospital assessed recovery time from severe community-acquired pneumonia among pediatric patients. Of the 412 children included in the study, 369 (89.56%) recovered, while 43 (10.44%) were censored. Among the censored cases, 31 (72.01%) were lost to follow-up, 4 (9.30%) were referred, 1 (2.33%) was transferred, and 7 (16.28%) died. The recovery rate was 13.089 per 100 person-day observations, and the median hospital stay was 5 days (32). Another retrospective study conducted in public hospitals of the East Wallaga Zone among under-five children found that, out of 376 participants admitted with severe pneumonia, 356 (94.68%) recovered, 5 (1.33%) died, 10 (2.66%) were referred to other health facilities for further treatment, and 5 (1.33%) left against medical advice. The median recovery time was 4 days, and the incidence rate of recovery was 13.5 per 100 person-day observations (10).

2.2. Predictors of time to recovery from severe community-acquired pneumonia

Despite evidence linking various sociodemographic factors to recovery, several clinical and care-related factors have been identified as key predictors of the length of hospitalization in children admitted with severe community-acquired pneumonia. These include the child's nutritional and immunization status, the presence of danger signs, existing comorbidities and complications at admission, the duration before seeking medical care, and the type of medication used for treatment. Collectively, these factors play a crucial role in determining recovery time and hospital stay (10,31,32).

Treatment outcomes and recovery time in childhood pneumonia are strongly influenced by clinical manifestations, which result from the complex interplay between the host, the pathogen, and environmental factors. In developing countries, the most common risk factors affecting the incidence, recovery time, and treatment outcomes of severe community-acquired pneumonia include low birth weight, non-exclusive breastfeeding, lack of immunization, indoor air pollution, overcrowding, delays in seeking healthcare, the presence of danger signs, and existing comorbidities or complications at admission (10,26).

A cohort study conducted at Mizan Tepi University on time to recovery and predictors of SCAP reported that the median recovery time varied across different socio-demographic categories. Specifically, children under one year of age and those aged one to five years had a median recovery time of 4 days, while children above five years had a median recovery time of 7 days (12).

Similarly, a study conducted in public hospitals of the Benishangul-Gumuz Region found differences in median recovery periods of SCAP based on nutritional status and clinical features. Regarding the duration before seeking care, the majority of children presented to the hospital within 5 days of illness onset, and the overall duration of hospital stay was less than 4 days (13).

2.2.1 Socio-demographic characteristics

Evidence indicates a strong correlation between sociodemographic factors and the time to recovery from severe community-acquired pneumonia. Studies have shown that age, in particular, is an independent predictor of recovery, with younger children often experiencing longer recovery times compared to older children.

A study conducted in Nepal reported that with each one-month increase in age, children experienced a 1.04 times faster recovery from severe pneumonia, and their risk of treatment failure decreased sevenfold (28). Similarly, a study on predictors of delayed recovery from pediatric SCAP in rural health centers of Gambia found that among six patients with delayed recovery, four children over seven years old had fever lasting more than 48 hours, while two three-year-old girls remained hospitalized for over two weeks and were treated for empyema (11). Similarly, a study conducted at Nigist Elleni Memorial Comprehensive Specialized Hospital among children aged 2–59 months found that children aged 12–35 months were twice as likely to recover from severe pneumonia compared to those aged 2–11 months (23). These findings indicate that younger age is associated with a delayed recovery from severe community-acquired pneumonia, highlighting age as an important predictor of prolonged illness in pediatric patients.

In contrast, a study conducted in Debre Markos revealed that the median recovery time from SCAP varied across different age groups. Younger children recovered faster than older children, with those under one year and between one to five years having a median recovery time of 4 days, while children above five years had a median recovery time of 7 days (31). Similarly, a retrospective study in Gondar among children under five reported that for each unit increase in age (2–3 years), the time to recover from severe pneumonia increased by 1.32 times compared to children aged one year or younger (25). These findings consistently indicate that younger age is associated with faster recovery from SCAP, whereas older children experience longer recovery times.

Residence is another important predictor of recovery time from severe community-acquired pneumonia. A study conducted across sub-Saharan Africa reported that a higher proportion of acute respiratory tract infection symptoms were observed among children living in rural areas compared to those in urban areas, suggesting a potential impact on recovery time (33).

A prospective study in governmental hospitals of the South West Ethiopia showed that children from rural areas had an 18% lower recovery rate from severe pneumonia compared to their urban counterparts (29). Similarly, a retrospective study in the Gondar Zone found that recovery time among children from rural residency was delayed by 20% compared to urban children (24). Another retrospective study conducted in the East Wallaga Zone reported a 25% longer recovery time among children from rural areas relative to their urban counterparts (10).

These findings consistently indicate that rural residence is associated with slower recovery from severe pneumonia in children

2.2.2. Vaccination status

Pneumonia is a major contributor to influenza-associated morbidity and mortality. Influenza vaccination has been shown to reduce both morbidity and mortality during influenza seasons, and part of this protective effect may be due to its role in preventing severe pneumonia. Efforts to improve childhood survival have also focused on expanding access to vaccines against *Streptococcus pneumoniae* and *Haemophilus influenzae*, which are key pathogens responsible for severe respiratory infections in children (34).

A study conducted in Morocco reported that, out of 150 patients, 62% had received the pneumococcal conjugate vaccine (PCV). Among the vaccinated patients, 5.33% had received two doses of the PCV, while 85 patients had received only one dose. A majority of unvaccinated patients (88%) developed complications, with parapneumonic effusion (43.33%) and diarrhea (23.33%) being the most common. Six patients (4%) died during the study period (35).

A study conducted on the incidence of recovery from severe pneumonia and its predictors among children aged 2–59 months in Tigray found that children who were not fully immunized had a 68% lower hazard of recovery compared to fully vaccinated children. The study reported that children who were not fully immunized according to the national EPI schedule had a reduced likelihood of early recovery compared to fully immunized children (36). Similarly, a prospective follow-up study in public hospitals of the South Wollo Zone showed that children not fully immunized for their age had, on average, a 65% lower rate of recovery from SCAP compared to those who were fully immunized (26).

2.2.3. Nutritional status

Evidence has shown that infants who were not exclusively breastfed during the first six months of life had a threefold rise in the risk of pneumonia and delayed recovery relative to children who were exclusively breastfed.

A study conducted in India found that children diagnosed with severe community-acquired pneumonia who were not exclusively breastfed were more likely to fail initial antibiotic therapy. These children more frequently required changes in their antibiotic regimen and had longer

hospital stays compared to exclusively breastfed children (37). A study conducted among Nepalese children examining predictors of prolonged recovery and treatment failure in severe pneumonia found that wasting (21%) was significantly associated with slower recovery. According to the study, wasted children had approximately twice the risk of extended hospitalization compared to well-nourished children (28).

A cohort study conducted in Kenya reported that severe acute malnutrition was strongly associated with longer recovery time among children with severe pneumonia (22). Similarly, study conducted in Gambia reported that children presenting with edematous protein-energy malnutrition were six times more likely to experience prolonged hospitalization, while those who were underweight and severely wasted were twice as likely to have extended hospital stays compared to children without these nutritional deficiencies (11).

A retrospective cohort study conducted at Gonder Comprehensive Specialized Hospital examined the impact of nutritional status and feeding practices on recovery from severe pneumonia. The study found that wasting children recovered 11% slower compared to children of normal weight. Underweight children had a median recovery time that was 2.2 times longer than that of children with normal weight. Feeding practices also significantly influenced recovery: children fed cow's milk took 2.4 times longer to recover than breastfed children, whereas formula-fed children had a 32% shorter median recovery time compared to those who were breastfed. These findings underscore the importance of both nutrition and feeding method in determining recovery duration from severe pneumonia (25).

A prospective follow-up study conducted in public hospitals of the South Wollo Zone reported that MUAC below 12.5 cm at admission had a 79% lower recovery rate from SCAP compared to children with MUAC above 12.5 cm at admission (26).

A study conducted in south Ethiopia showed that there was significant association between nutritional status and duration of hospital stay. 6 out of 10 children hospitalized for 10 days were severely malnourished and 2 were moderately malnourished. 13 children were hospitalized for more than 3 days and they were associated with moderate malnutrition (38).

Retrospective studies conducted in selected hospitals in Addis Ababa and public hospitals in the South Wollo Zone examined recovery time and predictors of SCAP) among pediatric patients. The

studies found that, compared to non-stunted children, the recovery rate from SCAP was reduced by 31% in stunted children in Addis Ababa and by 38% in stunted children in South Wollo Zone(14,31).

2.2.4. Duration prior to seeking care

In the context of limited access to formal health care services, delays in seeking professional medical attention for children with severe community-acquired pneumonia were common. Delayed care seeking and consulting multiple, and sometimes inappropriate, sources of treatment are important underlying risk factors for prolonged hospitalization and delayed recovery in children with SCAP. Timely presentation to a formal health facility is crucial; however, this depends on parents' or caregivers' ability to recognize the early warning signs and symptoms of pneumonia and to seek immediate medical attention.

According to a study conducted in a rural health center in the Gambia, 53 (30.3%) of the 175 children who presented late experienced a prolonged hospital stay and a longer median time to recovery, compared with 52 (22.2%) of the 245 children who presented early (11).

A prospective follow-up study conducted in public hospitals in the South Wollo Zone of Ethiopia showed that children who presented to the hospital more than five days after the onset of symptoms had a 65% lower rate of recovery from severe community-acquired pneumonia compared with those who arrived within five days of symptom onset (26).

A retrospective cohort study conducted in Debre Markos, Ethiopia, revealed that the duration of illness prior to seeking care was one of the predictors significantly associated with the median time to recovery. The study reported that the rate of early recovery from severe community-acquired pneumonia among children who sought care after five days of illness decreased by 36% compared to those who presented earlier (31).

Similarly, another retrospective cohort study conducted in the East Wollega Zone of Ethiopia showed that children with severe pneumonia who presented late (> 5 days) to a health facility experienced a 30% longer recovery time compared to those who presented early (≤ 5 days) (10).

2.2.5. Danger sign at admission

Prognosis and the length of hospitalization in pediatric pneumonia are influenced by clinical factors such as the severity of illness and the presence of danger signs at admission. A study conducted in rural Gambia on predictors of prolonged hospitalization in children with severe pneumonia found that children presenting with grunting respiration (32.5%) had a longer hospital stay compared to those without grunting (21.7%). Additionally, the study reported that children who exhibited head nodding were 1.929 times more likely to experience prolonged hospitalization than those without this sign (11).

A retrospective cohort study at the University of Gondar Comprehensive Specialized Hospital found that, compared to children admitted without severe signs and symptoms of pneumonia, those with severe signs had a median time to recovery that was 3.88 times longer, indicating that the presence of danger signs is associated with prolonged recovery (25). Similarly retrospective follow-up study conducted in Debre Markos on time to recovery and predictors of severe community-acquired pneumonia reported that the recovery rate of children admitted with danger signs was 39% lower than that of children admitted without danger signs (31). In line with this, another retrospective follow-up study at Asella Referral and Teaching Hospital showed that the recovery time of children presenting with danger signs was 1.61 times longer than that of children without danger signs (32).

A prospective study conducted in governmental hospitals of the South West Region, Ethiopia, reported that pediatric patients presenting with danger signs of severe pneumonia had a 1.77 times higher hazard for time to recovery compared to children without danger signs. The study also found that children with a history of hypoxemia at admission had a 1.25 times higher hazard of recovery from severe pneumonia than those without hypoxemia (30).

Another retrospective cohort study conducted in the East Wallaga Zone among under-five children found that the presence of danger signs at admission was a significant predictor of recovery time in severe pneumonia. The study reported that children admitted with danger signs had a recovery time 1.46 times longer than that of children without danger signs (10).

2.2.6. Comorbidity and Complications

Prognosis and the length of hospitalization among children with severe community-acquired pneumonia are influenced by clinical factors such as underlying comorbid illnesses and the development of medical complications before or during hospitalization. Pneumonia can lead to serious complications that prolong recovery time (38). A study conducted in Osogbo, Nigeria, demonstrated that the presence of complications at admission was associated with delayed recovery and contributed significantly to mortality. In this study, out of 129 participants, 70 (54.3%) had complications, with the most common being parapneumonic effusion, empyema, and pneumatocele (9).

A study conducted in Debre Markos on time to recovery and predictors of severe community-acquired pneumonia found that, compared to children without comorbidities at admission, the rate of recovery for children with comorbidities decreased by 55%. In this study, half (50.57%) of the children admitted with SCAP had at least one comorbidity, and about 4.3% had more than one comorbidity at admission. The most frequent comorbidity was childhood asthma, followed by acute gastroenteritis, and the rate of recovery for children with these comorbidities was reduced by 36% (31). Similarly, a retrospective cohort study conducted in Gondar reported that children admitted without comorbidities recovered faster than those with comorbidities. The most common comorbid conditions associated with SCAP affecting recovery time included childhood asthma, pertussis, tuberculosis, HIV infection, and diabetes mellitus (25).

A prospective follow-up study conducted in public hospitals of the South Wollo Zone reported that children admitted with comorbidities had, on average, a 51% lower rate of recovery from severe community-acquired pneumonia compared to children without comorbidities (26). Similarly, a prospective study conducted in governmental hospitals of the South West Region, Ethiopia, found that children with comorbidities at admission had a 40% lower recovery rate than those admitted without additional comorbid conditions (30).

Retrospective cohort studies conducted at Asella Referral and Teaching Hospital and in East Wallaga Zone hospitals on time to recovery from severe community-acquired pneumonia among children reported that those admitted with comorbidities had recovery times 1.67 and 1.63 times longer, respectively, than children admitted without comorbidities (10,32). This indicates that the

presence of comorbid conditions at admission is associated with a prolonged recovery time in children with severe community-acquired pneumonia.

2.2.7. Treatment related factors

Studies have shown that the type of drug regimen used to treat patients with severe community-acquired pneumonia significantly influences recovery time. In a prospective observational cohort study conducted in New York involving 648 patients treated with parenteral antibiotics, the median duration of therapy was 6 days. The median period from switching from parenteral to oral antibiotics to achieving clinical stability was 3 days (29).

A study conducted in Nigeria on predictors of prolonged hospitalization among children with pneumonia found that intravenous ampicillin was more effective than oral amoxicillin or macrolides. The study reported that fever persisted for more than 24 hours in only 1 (4.8%) child treated with intravenous ampicillin, compared to 19 (28.8%) children treated with oral amoxicillin and 2 (50.0%) of those treated with macrolides (11).

A retrospective cohort study conducted in Hossana, Ethiopia, identified the type of initial antibiotic therapy and subsequent modification of antibiotics as significant predictors of time to recovery among children with severe pneumonia. Specifically, children who received ampicillin plus gentamicin as first-line treatment experienced a longer recovery period. In addition, children whose antibiotic regimen was changed due to a lack of clinical improvement during treatment had a significantly prolonged duration of hospitalization compared to those whose initial antibiotic therapy was not modified (39).

2.3. Conceptual framework

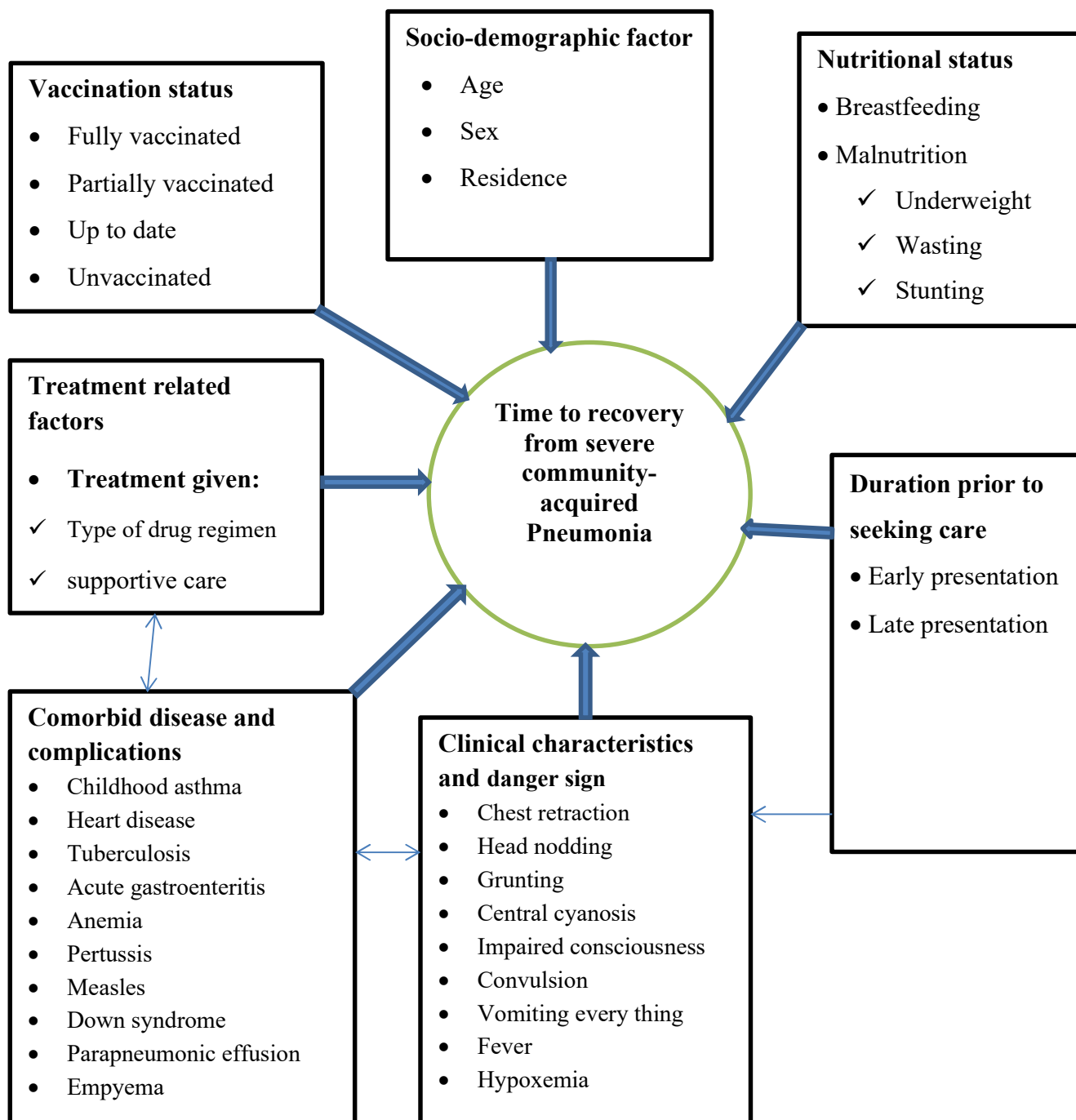


Figure 1:- Conceptual frame that shows time to recovery and its predictors among pediatric patients admitted with severe community-acquired pneumonia at Wallaga University Compressive Specialized Hospital, East Wallaga Zone, Oromia, Ethiopia, 2026 (11,29,31)

3 OBJECTIVES

3.1 General objective

- To determine the median time to recovery from severe community-acquired pneumonia and identify its predictors among pediatric patients admitted to Wallaga University Comprehensive Specialized Hospital, East Wallaga Zone, Oromia, Ethiopia; 2026.

3.2 Specific objectives

- To determine median time to recovery from severe community-acquired pneumonia among pediatric patients admitted to Wallaga University Compressive Specialized Hospital, East Wallaga Zone, Oromia, Ethiopia; 2026.
- To identify predictors affecting recovery time among pediatric patients admitted with severe community-acquired pneumonia at Wallaga University Compressive Specialized Hospital, East Wallaga Zone, Oromia, Ethiopia; 2026.

4. METHODS AND MATERIALS

4.1. Study Area and Study Period

The study was conducted at three units (pediatric ward, pediatric intensive care unit and pediatric emergency) of Pediatric Department of Wallaga University Comprehensive Specialized Hospital (WUCSH), situated in Nekemte town, East Wallaga Zone, Oromia Regional State, West Ethiopia, from September 1, 2025 to January 30, 2026.

Nekemte, the capital of the East Wallaga Zone, is located 334 km west of Addis Ababa. The town lies at an altitude between 1,960 and 2,170 meters above sea level and experiences a Woina Dega climate. The annual temperature ranges from 14 to 26 degrees Celsius. According to the 2022 population projection by the Ethiopian CSA, Nekemte has a population of 156,004, with 78,820 males and 77,184 females. The town covers an area of 29.5 km², resulting in a population density of 5,288 people per km².

Wallaga University Comprehensive Specialized Hospital (WUCSH), located in Nekemte town, provides healthcare services to a population of approximately 7 million within its catchment area. The hospital treats around 238,988 patients annually (10,000 inpatients and 228,988 outpatients), with 51,932 (2372 inpatients and 49,560 outpatients) of these being pediatric cases (21.73%). From over all annual pediatric patients, severe community-acquired pneumonia accounts 502 (420 cases treated at pediatric ward, 60 cases treated at pediatric emergency and 24 cases treated at pediatric intensive care unit). The pediatric department is one of the hospital's key departments having different units. The department is staffed by a team of 11 pediatricians, 12 residents, and 21 nurses (from this 5 were pediatric nurses).

4.2. Study design

An institution-based prospective cohort study was conducted at Wallaga University Comprehensive Specialized Hospital, Western Ethiopia, 2026.

4.3. Population

4.3.1. Source of population

The source population were all pediatric patients admitted to Wallaga University Comprehensive Specialized Hospital for the treatment of severe community-acquired pneumonia.

4.3.2. Study population

All pediatric patients admitted to Wallaga University Comprehensive Specialized Hospital for the treatment of SCAP who met inclusion criteria during study period.

4.4. Inclusion and Exclusion criteria

4.4.1. Inclusion criteria

All children aged 1 month to 14 years diagnosed with SCAP and admitted to Wollega University Comprehensive Specialized Hospital during the study period.

4.4.2. Exclusion criteria

Pediatric patients who were readmitted with SCAP during the study period were excluded to avoid counting the same patient more than once.

4.5 Sample Size Determination and Sampling Procedure

4.5.1 Sample Size Determination

The sample size for this study was determined based on predictors significantly associated with recovery time from severe community-acquired pneumonia. Evidence from a prospective cohort study conducted in 2024 among pediatric patients admitted to public hospitals in South Wollo Zone, North East Ethiopia identified not being fully immunized age-appropriate immunization as a significant predictor of delayed recovery, with an adjusted hazard ratio (AHR) of 0.35 and a 95% confidence interval (CI).

Assuming a recovery probability of 64% among the unexposed group (fully immunized) and 22% among the exposed group (not fully immunized), with a 1:1 ratio of unexposed to exposed participants, 80% statistical power, and a 5% level of significance (26), the sample size was calculated using the double population proportion formula in Epi Info version 7. Based on these assumptions, the final required sample size was **220** pediatric patients.

This sample size is sufficient to address the first objective (median time to recovery) and provides adequate power to detect the effect of key predictors.

4.5.2. Sampling technique

Based on the previous year's WUCSH data, there were 502 annuals pediatric SCAP cases: 420 managed in the pediatric ward, 60 in the pediatric emergency unit, and 24 in the pediatric intensive care unit. This translates to approximately 42 pediatric SCAP cases per month. Assuming a similar

patient flow, it was estimated that about five months was required to reach the target sample size of 220 cases. A consecutive sampling method was used until the desired sample size is achieved.

4.6. Variables of the study

4.6.1. Dependent variable

- Time to recovery from severe community-acquired pneumonia

4.6.2. Independent variables:

- Socio-demographic factors (age, sex, residence).
- Nutritional status of children (exclusive breastfeeding, underweight, stunting, wasting).
- Vaccination status of children (fully vaccinated, partially vaccinated, up to date, unvaccinated).
- Duration prior to seeking care (early and late presentation).
- Clinical characteristics and danger signs (chest retraction, head nodding, grunting, central cyanosis, impaired consciousness, convulsion, vomiting everything, fever, hypoxemia).
- Presence of comorbid diseases and complications (wheezing disorder (Childhood asthma), heart disease, tuberculosis, acute gastroenteritis, anemia, pertussis, measles, down syndrome, parapneumonic effusion, empyema, and others).
- Treatment related factors- treatment given: drug regimen (ceftriaxone, cefotaxime, vancomycin, ampicillin, gentamycin, azithromycin), supportive care (oxygen, feeding, antipyretics), other treatments like treatment of complications (chest tube insertion).

4.7. Operational definitions

Recovery: - children improved from severe community-acquired pneumonia as discharged from the hospital by a physician when the child improved (when respiratory distress has resolved, no hypoxemia (oxygen saturation > 90%), complications and comorbidities treated appropriately, feeding well, able to take oral medication and parents understand the signs of pneumonia) (4)

Recovery time: - the time from admission to when the child is discharged from the hospital with improvement in symptoms calculated by number of days (hospital stay) (36).

Event: - refers to recovery from an illness during the study period (29).

Censored:- refers to children referred, died, or leave against medical advice without recovery during the study period (28).

Severe community-acquired pneumonia: - refers to a life-threatening form of pneumonia acquired outside a hospital setting, or diagnosed within the first 48 hours of hospital admission. It is characterized by the presence of any of the following signs: altered consciousness, convulsions, central cyanosis, oxygen saturation below 90%, severe respiratory distress, inability to drink or breastfeed and vomiting everything (4).

Community-acquired pneumonia: - refers to a form of pneumonia acquired outside the hospital (or within the first 48 hours of admission) and has no general danger sign (4).

Pediatrics: - refers to children from 1 month to 14 years of age (31).

Exclusive breast feeding: - children who are introducing only breast milk except for oral rehydration solution (ORS), drops, and syrups (vitamins, medicine, and minerals) with his/her age during the age of less than 6 months (24).

Underweight: - Weight-for-age Z-scores less than -2 standard deviations (-3SD to -2SD is moderate underweight and < -3SD is severe underweight) (40).

Stunting: - Height-for-age Z-scores less than -2 standard deviations (-3SD to -2SD is moderate stunting and < -3SD is severe stunting) (40).

Wasting: - Weight -for- height Z-scores less than -2 standard deviations (-3SD to -2SD is moderate wasting and < -3SD is severe wasting) (40).

Fully vaccinated: - children who had completed all forms of vaccinations (41).

Partially vaccinate: - children who missed at least one of the immunizations expected for his/her age (41).

Up-to-date: - children who had vaccinated according to their age (41).

Not vaccinated: - children who had never vaccinated for all forms of vaccines (41).

Time to seeking care: - children getting appropriate care with in < 5 days after getting sick are considered as early presenters while those children getting appropriate care after ≥ 5 days are considered as late presenters (31).

Danger sign: - the child having loss of consciousness, convulsion, central cyanosis, vomiting everything, severe chest retraction, head nodding and grunting (15,27).

Comorbidity:- any disease condition (acute or chronic) present at admission in addition to severe community-acquired pneumonia which includes wheezing disorder (childhood asthma), malnutrition, heart disease, tuberculosis, acute gastroenteritis, anaemia, pertussis, measles, down syndrome and others (31).

Complication:- the presence of one or more local (parapneumonic effusion, empyema, pneumatocele) or systemic (acute respiratory distress syndrome, sepsis, meningitis, or other organ dysfunction) conditions that develop as a consequence of severe community-acquired pneumonia and result in worsening of the clinical course of the disease(38).

4.8. Data Collection tool and Procedure

4.8.1. Data collection tool

Data was collected by pediatric nurse using a pre-tested, structured data collection format. The form was developed after a thorough review of similar literature and examination of pediatric patient charts with severe community-acquired pneumonia. The questionnaire was developed in English, then translated into Afan Oromo language, and again translated back to English to ensure consistency. The tool was designed to capture study variables, including sociodemographic, nutritional, vaccination and clinical predictors.

4.8.2. Data collection procedure

Data were collected through interviews with the child's mother or caregiver and by reviewing daily patient records. Data collection began at the time of admission, and each patient was followed until the occurrence of the outcome of interest. The frequency of follow-up was determined by the patient's clinical condition, with critically ill patients requiring more frequent assessments.

Generally, patients were assessed at least twice on the first day of admission, followed by daily follow-up thereafter. Recovery was confirmed clinically at the time of discharge. In cases of censoring, data collection relied on information recorded at admission, supplemented by a thorough review of the patient's medical chart to ensure completeness.

One pediatric nurse was assigned as a supervisor, and another pediatric nurse was recruited as the data collector. A one-day training session was provided for both the data collector and supervisor, focusing on the objectives of the study and the procedures for data collection. The supervisor was responsible for overseeing the data collection process to ensure data quality, accuracy, and consistency.

4.9. Data quality Assurance

To ensure data quality, both the supervisor and data collector was trained on the information they need to collect from the target sources. Before data collection begins, the data extraction form was tested using 5% of the total sample size from randomly selected pediatric patients admitted with SCAP at Nekemte Comprehensive Specialized Hospital to evaluate the reliability and consistency of the tool. The completeness of the collected data was checked daily on-site during the data collection process, with prompt feedback provided by the supervisor and the principal investigator. During data management, storage, cleaning, and review, all completed data collection forms was examined for completeness and accuracy. The principal investigator assesses consistency by randomly selecting records and comparing their similarity.

4.10. Data processing and analysis

Data were entered into EpiData version 7.2.7 and exported to STATA version 17 for analysis. Prior to analysis, the data were cleaned and edited using simple frequency distributions and cross-tabulations. Recategorization of categorical variables and categorization of continuous variables were performed as appropriate for the analysis. Descriptive non-parametric survival analyses, including the Kaplan–Meier survival curve and the log-rank test, were conducted to assess differences in survival probabilities across categorical covariates. Time was measured in days to estimate the median time to recovery. Nutritional status of the study participants was assessed using a WHO guideline–based z-score chart.

A Cox proportional hazards regression model was employed to identify factors associated with recovery time. Variables with a p-value < 0.25 in the bivariable Cox regression analysis were included in the multivariable Cox proportional hazards model. Further variable selection was performed using a backward stepwise selection approach. Adjusted Hazard Ratios (AHRs) with 95% confidence intervals (CIs) were computed, and statistical significance was declared at a 5% significance level (p-value < 0.05).

The proportional hazards assumption was assessed using log–log survival plots graphically and Schoenfeld residuals statistically. Overall model adequacy was evaluated using Cox–Snell residuals. The Nelson–Aalen cumulative hazard function of the residuals was plotted against the Cox–Snell residual graph. Finally, the results were presented using tables, graphs, and text.

4.11 Ethical Considerations

Ethical approval was obtained from the Ethics and Research Review Committee of the Institute of Health Sciences, Wallaga University, and submitted to the administrative office of Wallaga University Comprehensive Specialized Hospital prior to the commencement of data collection and pretesting. Hospital manager writes an official letter of permission. Additionally, written consent from parents-/caregiver and assent from the children was required before data collection, and all recorded data was kept strictly confidential, with access limited to the principal investigator.

4.12 Dissemination of Results

The results of the study will be presented to Wallaga University, Institute of Health Sciences, Medical Science and Service Directorate, as partial fulfilment of the requirements for a specialty certificate in pediatrics and child health. The study findings will be submitted to the department upon completion. The findings and recommendations will also be shared with WUCSH and other organizations working in related fields to serve as a baseline for intervention. Additionally, the study's findings will be submitted to peer-reviewed journals for publication.

5. RESULTS

5.1 Socio-demographic characteristics of the study participants

The study included pediatric patients (1 month to 14 years of age) who were admitted with a diagnosis of severe community-acquired pneumonia at Wallaga University Comprehensive Specialized Hospital. At enrollment, a total of 220 children were included in the prospective follow-up study, of whom 115 (52.27%) were male. The median age at baseline was 12 months (IQR: 6–26 months). Children aged <1 year and 1–5 years each accounted for 98 (44.55%) of the participants, while 24 (10.90%) were aged 5–14 years. At enrollment, the majority of participants, 128 (58.18%) were rural residents (Table1).

Table 1: - Sociodemographic characteristics of pediatric patients admitted with severe community-acquired pneumonia at Wallaga University Comprehensive Specialized Hospital, Western Ethiopia, September 1, 2025 to January 30, 2026.

Variables	Category	Survival status		Total (n=220)
		Recovered	Censored	
		No	No	No (%)
Age	<1 year	93	5	98(44.55)
	1–5 year	90	8	98(44.55)
	5–14 year	20	4	24(10.90)
Sex	Male	106	9	115(52.27)
	Female	97	8	105(47.73)
Residence	Urban	88	4	92(41.82)
	Rural	115	13	128(58.18)

5.2 Nutritional and vaccination status of study participants

At enrollment, 119 (54.09%) of the 220 enrolled children were exclusively breastfed. Regarding vaccination status at enrollment, 70 (31.82%) children were fully vaccinated, 102 (46.36%) were up-to-date for age (vaccinated according to their age), 28 (12.73%) were partially vaccinated, and 20 (9.09%) had not received any vaccination according to the National Expanded Program of Immunization (EPI). Nutritional status was assessed at enrollment by comparing anthropometric measurements with the WHO child growth standards. Based on these criteria, 17 (7.74%) children were classified as underweight, 16 (7.27%) as stunted, and 20 (9.09%) as wasted. (Table 2).

Table 2: - Nutritional and vaccination status of pediatric patients admitted with severe community-acquired pneumonia at Wallaga University Comprehensive Specialized Hospital, Western Ethiopia, September 1, 2025 to January 30, 2026.

Variables	Category	Survival status		Total (n=220)
		Recovered	Censored	
		No	No	No (%)
Exclusive breast feeding	Yes	114	5	119(54.09)
	No	89	12	101(45.91)
Vaccination status	Fully vaccinated	68	2	70(31.82)
	Partially vaccinated	21	7	28(12.73)
	Up-to-date	96	6	102(46.36)
	Not vaccinated	18	2	20(9.09)
Weight for age	Normal	191	12	203(92.27)
	Underweight	12	5	17((7.74)
Height for age	Normal	192	12	204(92.73)
	Stunting	11	5	16(7.27)
Weight for height	Normal	188	12	200(90.91)
	Wasting	15	5	20(9.09)

5.3 Time to seeking care, clinical characteristics and danger signs

Of the 220 study participants, 203 (92.27%) sought medical care within five days of illness onset. At enrollment, 199 (90.45%) were hypoxemia (oxygen saturation <90%) and 162 (73.64%) were febrile (temperature >37.5 °C). The median oxygen saturation was 85% (IQR: 82%–88%), and the median body temperature was 37.9 °C (IQR: 37.5–38.1 °C). At enrollment, 118 (53.64%) of the 220 study participants had at least one danger sign. The most common danger sign was chest retraction, observed in 92 children (41.82%), followed by head nodding in 60 (27.27%), grunting in 53 (24.09%), and central cyanosis in 33 (15.00%). (Table 3).

Table 3: - Clinical characteristics and danger signs of pediatric patients admitted with severe community-acquired pneumonia at Wallaga University Comprehensive Specialized Hospital, Western Ethiopia, September 1, 2025 to January 30, 2026.

Variables	Category	Survival status		Total (n=220)
		Recovered	Censored	
		No	No	No (%)
Duration prior to seeking care	≤ 5 days (early presenters)	190	13	203(92.27)
	>5 days (late presenters)	13	4	17(7.73)
Oxygen saturation	< 90%	182	17	199(90.45)
	≥ 90%	21	0	21(9.55)
Temperature	≤ 37.5°C	53	5	58(26.36)
	>37.5°C	150	12	162 (73.64)
Presence of danger Sign	Yes	102	16	118(53.64)
	No	101	1	102(46.36)
Types of danger signs	Chest retraction	82	10	92(41.82)
	Head nodding	54	6	60(27.27)
	Grunting	47	6	53(24.09)
	Central cyanosis	27	6	33(15.00)
	Vomiting everything	10	3	13(5.91)
	Convulsion	1	0	1(0.45)
	Impaired consciousness	0	1	1(0.45)

5.4 Co-morbidities and complications

Out of the 220 study participants, comorbidities were present in 60 children (27.27%). Malnutrition was the most common comorbidity, observed in 20 (9.09%) children, followed by wheezing disorders (childhood asthma) in 19 (8.64%) and heart disease in 8 (3.64%). Complications were identified in 8 children (3.64%). The most common complication was parapneumonic effusion, occurring in 7 cases (3.18%), while empyema was observed in 1 child (0.45%). (Table 4).

Table 4:- Co-morbidities and complications of pediatric patients admitted with severe community-acquired pneumonia at Wallaga University Comprehensive Specialized Hospital, Western Ethiopia, September 1, 2025 to January 30, 2026.

Variables	Category	Survival status		Total (n=220)
		Recovered	Censored	
		No	No	No (%)
Presence of Comorbidity	Yes	47	13	60(27.27)
	No	156	4	160(72.73)
Types of co-morbidity	Malnutrition	17	3	20(9.09)
	Wheezing disorder	16	3	19(8.64)
	Heart disease	4	4	8(3.64)
	Acute gastroenteritis	4	0	4(1.82)
	Tuberculosis	3	1	4(1.82)
	Anemia	2	0	2(0.09)
	Pertussis	0	1	1(0.45)
	Measles	0	1	1(0.45)
	Down syndrome	0	1	1(0.45)
Presence of complications	Yes	6	2	8(3.64)
	No	200	12	212(96.36)
Types of complications	Parapneumonic effusion	6	1	7(3.18)
	Empyema	0	1	1(0.45)

5.5 Treatment given

At enrolment, non-invasive respiratory support was provided to 216 (98.18%) of the 220 children, while 4 (1.82%) required mechanical ventilation.

Regarding initial antibiotic therapy at enrollment for the treatment of severe community-acquired pneumonia, 155 (70.45%) children received ceftriaxone alone. Combination regimens included ceftriaxone plus azithromycin in 26 (11.82%) children and ceftriaxone plus vancomycin in 21 (9.55%). Additionally, 9 (4.09%) children each were treated with ampicillin plus cefotaxime and ampicillin plus gentamicin as part of their management. (Table 5).

Table 5:- Treatment given for pediatric patients admitted with severe community-acquired pneumonia at Wallaga University Comprehensive Specialized Hospital, Western Ethiopia, September 1, 2025 to January 30, 2026.

Variable	Category	Survival status		Total (n=220)
		Recovered	Censored	
		No	No	No (%)
Treatment given	Ceftriaxone	148	7	155(70.45)
	Ceftriaxone+Azithromycin	23	3	26(11.82)
	Ceftriaxone +Vancomycin	11	10	21(9.55)
	Ampicillin + Cefotaxime	9	0	9(4.09)
	Ampicillin + Gentamycin	8	1	9(4.09)
	Intranasal oxygen	198	15	213(96.82)
	Face mask	2	1	3(1.36)
	Mechanical ventilation	0	4	4(1.82)

5.6 Treatment outcome and incidence rate of recovery from severe community-acquired pneumonia

The majority of the study participants 203(92.27%) recovered from their illness, while 6 (2.73%) died, 4(1.82%) were referred to other health facilities for further treatment, and 7(3.18%) refused (left against medical advice). During the follow-up time, a total of 1047 person-day risks were observed with a minimum and maximum follow-up time of 1 and 30 days, respectively. The overall incidence rate of recovery was 19.39 per 100 person-days observations (95% CI: 16.90–22.25) (Fig.2).

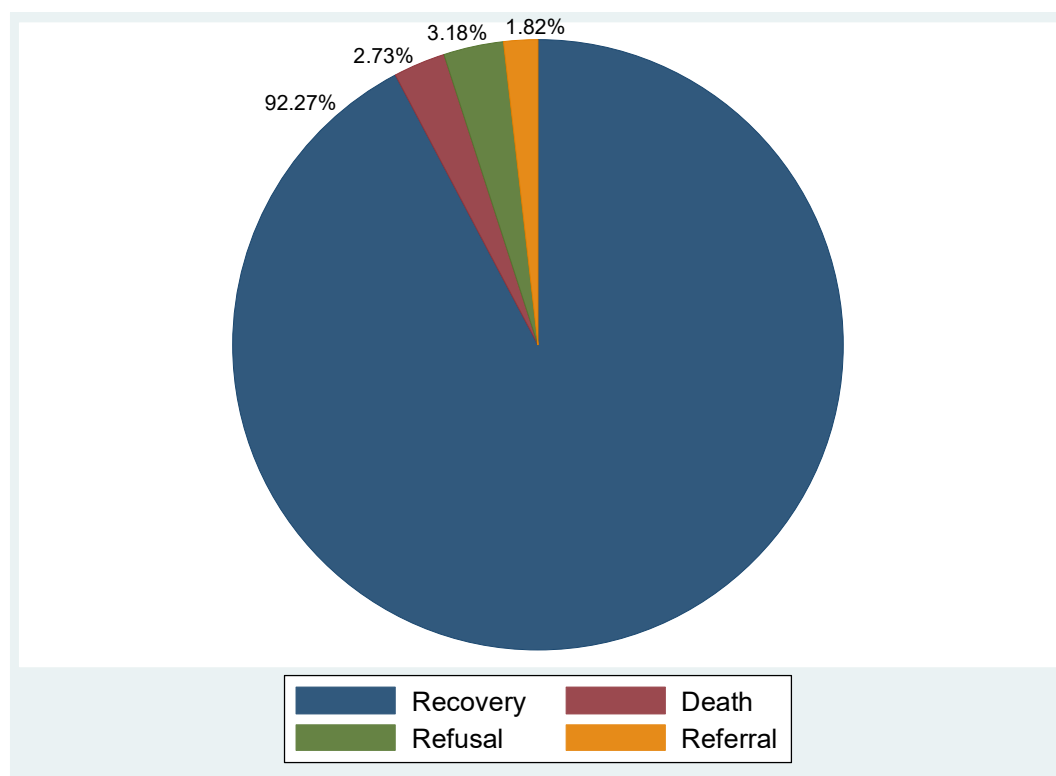


Figure 2: - Treatment outcome of pediatric patients admitted with severe community-acquired pneumonia at Wallaga University Comprehensive Specialized Hospital, Western Ethiopia, September 1, 2025 to January 30, 2026. (n=220)

5.7 The median recovery time and comparisons of survival status between categories of predictors

Out of 220 total study participants admitted with severe community-acquired pneumonia, about 203 (92.27%) developed an event (recovered). The overall median recovery time among pediatric patients admitted with severe community-acquired pneumonia at Wallaga University Comprehensive Specialized Hospital was 4 days (IQR: 3-7 days).

To assess differences in survival, a log-rank test was conducted at a 5% significance level. The results indicated a statistically significant difference in survival status with respect to residence, vaccination status, anthropometric status, time elapsed before seeking care, presence of danger signs, comorbidity, complications, and type of antibiotics administered ($p < 0.05$). In contrast, the median time to recovery did not differ significantly across age groups, sex, breastfeeding status, temperature, and oxygen saturation ($p > 0.05$) (Table 6).

Table 6:- Comparison of time to recovery of pediatric patients admitted with severe community-acquired pneumonia at Wallaga University Comprehensive Specialized Hospital, Western Ethiopia, September 1, 2025–January 30, 2026. (n=220)

Variables	Category	Median recovery time in the day with IQR	Log-rank x2 value (df)	P-value
		Point estimate (95%CI)		
Age-group	<1 year	4(3-7)	4.08(2)	0.1297
	1–5 year	4(2-6)		
	5–14 year	4(3-7)		
Sex	Male	4(3-7)	0.02(1)	0.9005
	Female	4(3-7)		
Residence	Urban	3(2-5)	9.68(1)	0.0019
	Rural	4(3-7)		
Exclusive breast feeding	Yes	4(3-7)	0.52(1)	0.4695
	No	4(3-7)		
Vaccination status	Fully vaccinated	3(2-5)	18.22(3)	0.0004
	Partially vaccinated	6(4-8)		
	Up-to-date	4(3-6)		
	Not vaccinated	7(4-9)		
Weight for age	Normal	4(2-6)	20.16(2)	0.0000
	Underweight	8(6-11)		

Height for age	Normal	4(2-6)	20.97(2)	0.0001
	Stunting	10(6-14)		
Weight for height	Normal	4(2-6)	19.55(2)	0.0001
	Wasting	8(5-11)		
Duration prior to seeking care	≤ 5 days	4(3-6)	27.02(1)	0.0000
	>5 days	9(7-14)		
Temperature	≤37.5 °C	3(2-7)	1.38(1)	0.2404
	> 37.5 °C	4(3-7)		
Oxygen saturation	<90%	4(3-7)	6.42(1)	0.0113
	≥90%	3(2-4)		
Danger signs	Yes	6(3-7)	35.70(1)	0.0000
	No	3(2-4)		
Co-morbidity	Yes	7(3-9)	22.75(1)	0.0000
	No	3(2-6)		
Complications	Yes	14(9-19)	18.94(1)	0.0000
	No	4(3-7)		
Treatment	Ceftriaxone	3(2-6)	38.67(1)	0.0000
	Ceftriaxone+	4(3-7)	0.43(1)	0.5117
	Azithromycin			
	Ceftriaxone+	10(8-14)	21.78(1)	0.0000
	Vancomycin			
	Ampicillin+	7(6-10)	3.77(1)	0.0520
	Cefotaxime			
	Ampicillin+	8(7-10)	6.59(1)	0.0102
	Gentamycin			
	Intranasal oxygen	4(3-7)	0.09(1)	0.7616
	Face mask	3(3-7)	0.06(1)	0.8021
	Mechanical ventilation	-	3. 53(1)	0.0601

Note: - df: - degree of freedom

IQR: Interquartile range

Table 7:- A life table showing survival probability to the recovery of pediatric patients admitted with severe community-acquired pneumonia at Wallaga University Comprehensive Specialized Hospital, Western Ethiopia, September 1, 2025 to January 30, 2026. (n=220)

Interval time in days	Number at risk	Recovered	Censored	Probability to recovery	Cumulative probability of recovery
0–5	220	125	9	0.580	0.580
5–10	86	62	6	0.747	0.894
10–15	18	14	1	0.800	0.979
15–20	3	1	0	0.333	0.986
20–25	2	0	1	0.000	0.991
25–30	1	1	0	1.000	1.000

A Kaplan-Meier estimation technique was used to see the estimate of survival time. The overall graph of Kaplan-Meier survival function depicted that the graphs decrease rapidly during the first 7 days showing most patients recovered from severe community-acquired pneumonia during this time (Fig 3).

Separate Kaplan–Meier survival curves were constructed for each covariate to estimate time to recovery and to assess differences in recovery rates between categories of individual predictors. Visual inspection of the Kaplan–Meier curves demonstrated notable differences in recovery patterns across groups. Based on these estimates, children those who had danger signs at admission, those with comorbidities and complications experienced a longer time to recovery from severe community-acquired pneumonia compared with their respective counterparts (Fig 4-6).

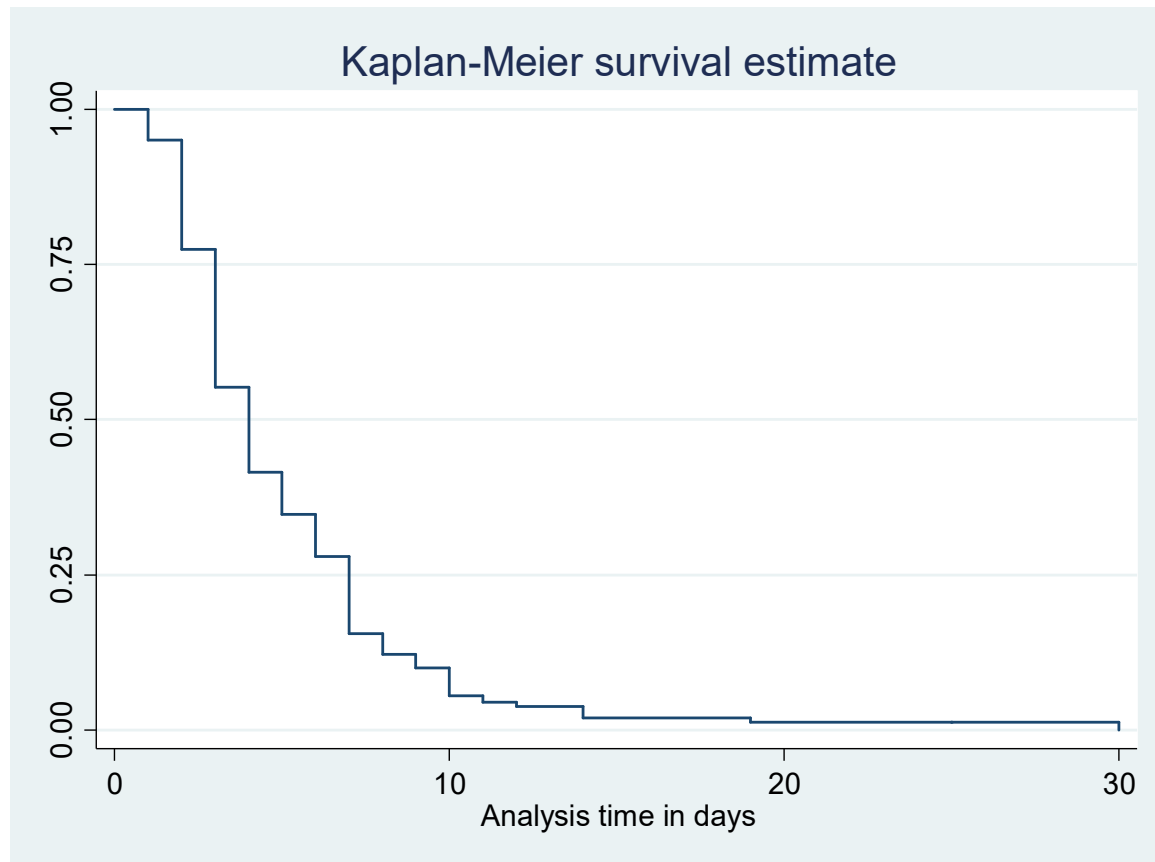


Figure 3:- The overall Kaplan–Meier estimation of survival function from admission to recovery of pediatric patients admitted with severe community-acquired pneumonia at Wallaga University Comprehensive Specialized Hospital, Western Ethiopia, September 1, 2025 to January 30, 2026. (n=220)

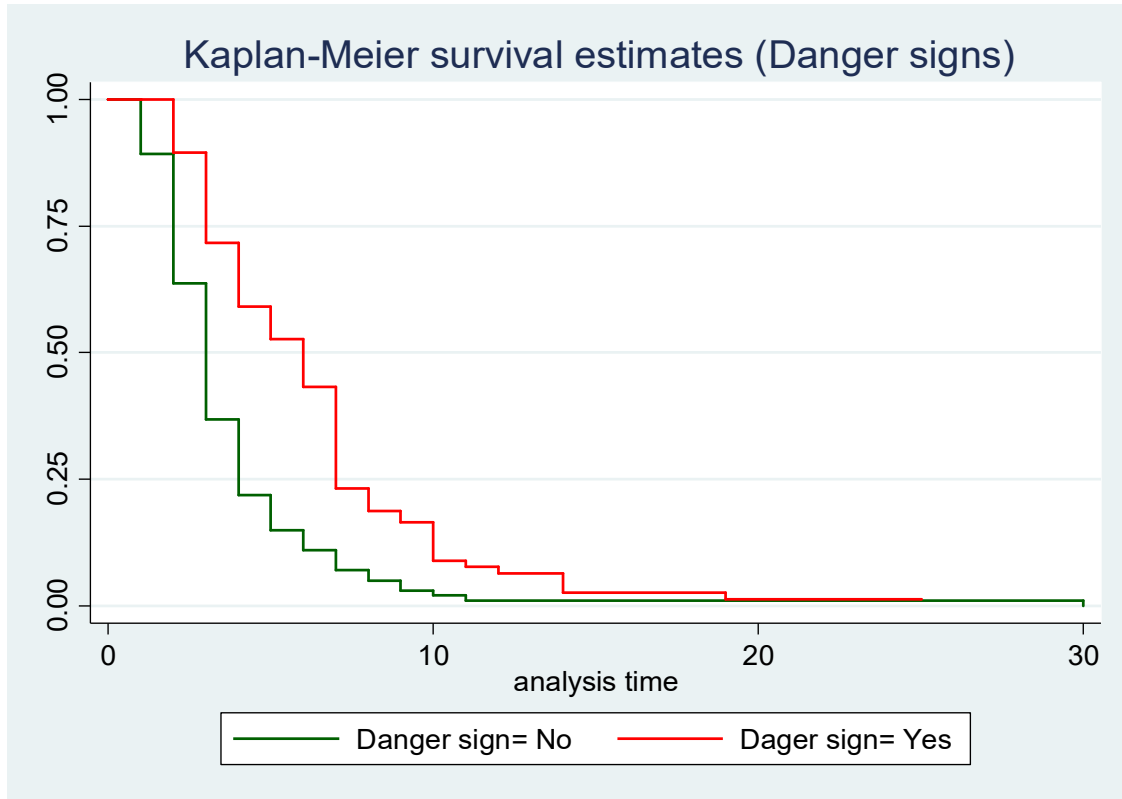


Figure 4:- Kaplan-Meier survival estimates of time to recovery of pediatric patients admitted with severe community-acquired pneumonia with danger signs at Wallaga University Comprehensive Specialized Hospital, Western Ethiopia, September 1, 2025 to January 30, 2026. (n=220)

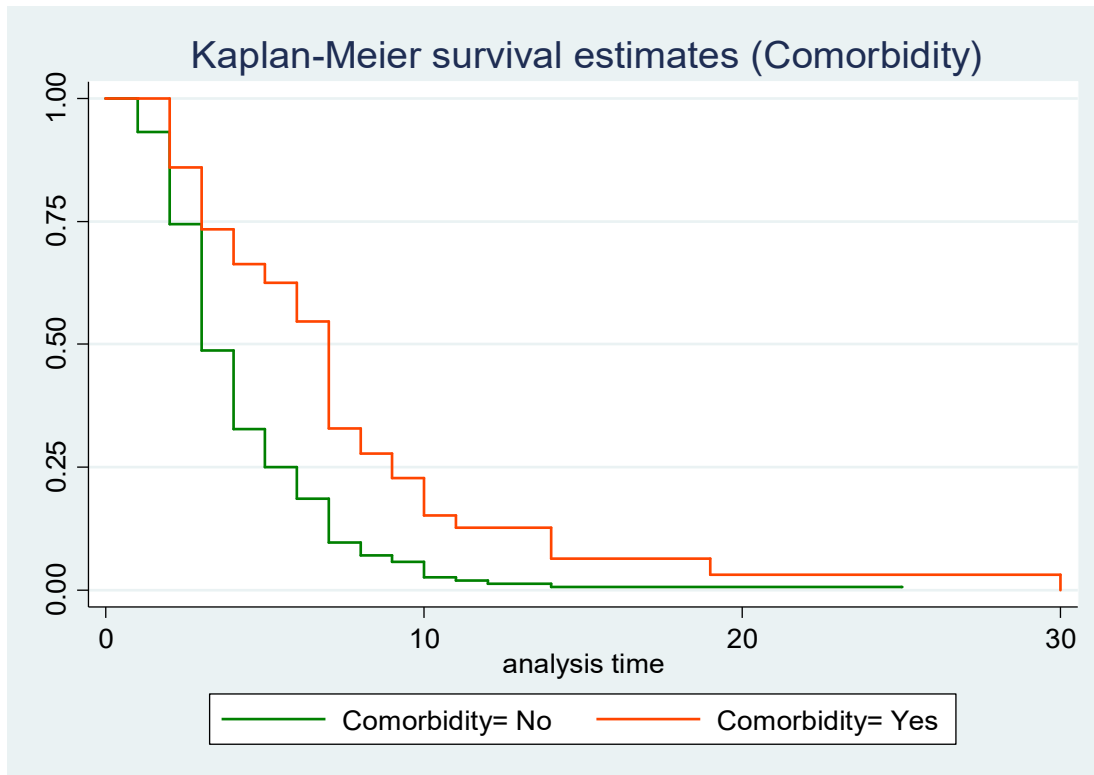


Figure 5:- Kaplan-Meier survival estimates of time to recovery of pediatric patients admitted with severe community-acquired pneumonia with comorbidity at Wallaga University Comprehensive Specialized Hospital, Western Ethiopia, September 1, 2025 to January 30, 2026. (n=220)

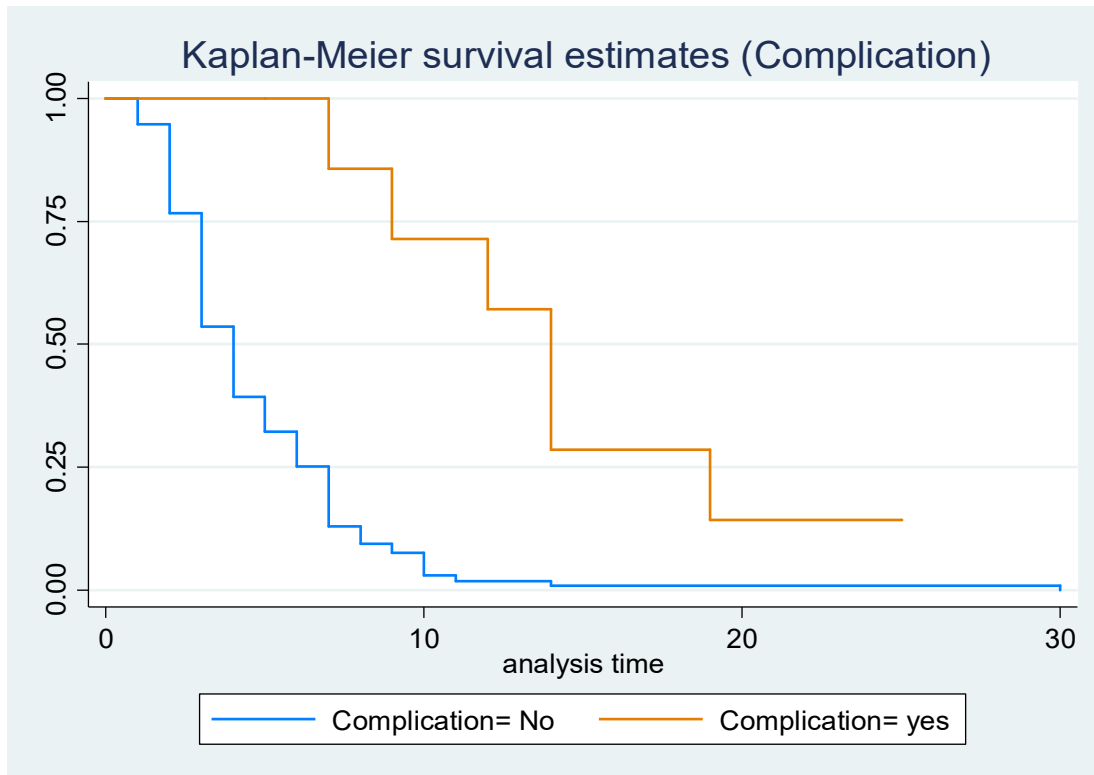


Figure 6:- Kaplan-Meier survival estimates of time to recovery of pediatric patients admitted with severe community-acquired pneumonia with complication at Wallaga University Comprehensive Specialized Hospital, Western Ethiopia, September 1, 2025–January 30, 2026. (n=220)

5.8 Proportional hazard assumption test

In this study, the proportional hazards assumption was assessed on the final Cox regression model both graphically and statistically. Graphical assessment was performed using log–log survival plots (**Annex-2**), while statistical evaluation was carried out using Schoenfeld residuals. Tests were conducted for each covariate as well as a global test, with a p-value less than 0.05 considered evidence of violation. As shown in the table below, all covariates in the final model had p-values greater than 0.05, and the global test yielded a p-value of **0.6830**, indicating that the proportional hazards assumption was satisfied for the final model. (Table 8).

Table 8:- Proportional hazard assumption test by Schoenfeld residuals for each predictor and global test of pediatric patients admitted with severe community-acquired pneumonia at Wallaga University Comprehensive Specialized Hospital, Western Ethiopia, September 1, 2025 to January 30, 2026. January30,2026. (n=220)

Predictors	Rho	chi2	Df	Prob>chi2
Age group	-0.04117	0.37	1	0.5419
Sex	-0.01559	0.05	1	0.8146
Residence	0.03364	0.24	1	0.6269
Exclusive breast feeding	-0.02176	0.11	1	0.7447
Vaccination status	0.10820	2.45	1	0.1173
Weight for age	-0.05402	0.62	1	0.4309
Height for age	-0.08544	1.79	1	0.1814
Weight for height	-0.00750	0.01	1	0.9126
Duration	0.04922	0.60	1	0.4377
Temperature	0.02773	0.18	1	0.6728
Oxygen saturation	-0.00047	0.00	1	0.9945
Danger sign	0.05437	0.65	1	0.4187
Comorbidity	0.02993	0.19	1	0.6619
Complication	0.08282	1.02	1	0.3126
Global test		11.04	14	0.6830

5.9 Model goodness-of-fit

After fitting the final multivariable Cox proportional hazards model, model adequacy was evaluated using Cox–Snell residuals. The Nelson–Aalen cumulative hazard function of the residuals was plotted against the Cox–Snell residuals and compared with the 45-degree reference line. For the final model, the cumulative hazard closely followed the diagonal line, indicating that the model provided an adequate fit to the data (Fig 7).

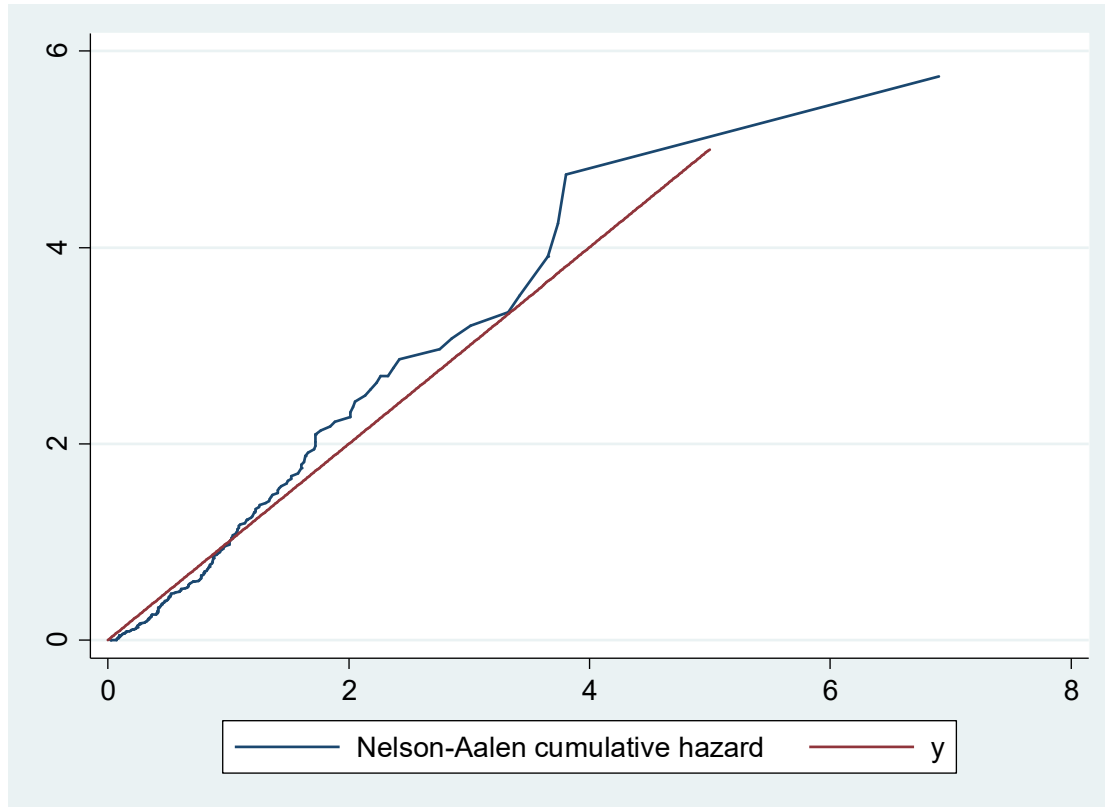


Figure 7:- Cox Snell residual test for overall adequacy of the model of pediatric patients admitted with severe community-acquired pneumonia at Wallaga University Compressive Specialized Hospital, western Ethiopia, September 1, 2025 to January 30, 2026. (n=220)

5.10 Predictors of recovery time from severe community-acquired pneumonia

Covariates with a P-value < 0.25 in the bivariable Cox regression analysis were considered for inclusion in the multivariable model. These included age, residence, vaccination status, anthropometric status, temperature, oxygen saturation, duration to seeking care, presence of danger signs, presence of comorbidity, presence of complication, and treatment. In the multivariable Cox proportional hazards analysis, three predictors (presence of danger signs, comorbidity, complication) were independently and statistically significantly associated with recovery time ($p < 0.05$).

According to the multivariable Cox regression analysis, recovery time was delayed by 46% among patients presenting with danger signs at admission compared with those without danger signs (AHR=0.54; 95% CI: 0.38–0.76). Comorbidity was also a significant predictor of recovery time; children admitted with comorbidity had 1.74 times longer recovery time than those without comorbidity (AHR=1.74; 95% CI: 1.41–2.16), indicating that comorbidity prolongs the recovery period. Additionally, the presence of complications was associated with a 68% delay in recovery compared with children without complications (AHR=0.32; 95% CI: 0.11–0.91) (Table 9).

Table 9:- Multivariable Cox regression analysis of median recovery time and its predictors of pediatric patients admitted with severe community-acquired pneumonia at Wallaga University Compressive Specialized Hospital, western Ethiopia, September 1, 2025 to January 30, 2026. (n=220)

Variables	Category	Survival status		CHR (95% CI)	AHR (95% CI)	P-value
		Recovered	Censored			
Age group	<1 year	93	5	1	1	0.323
	1–5 years	90	8	0.93(0.76-1.13)	0.84(0.60-1.18)	
	5–14 years	20	4	1.28(0.94-1.74)	1.19(0.85-1.67)	
Residence	Urban	88	4	1	1	0.069
	Rural	115	13	0.68(0.51-0.90)	0.76(0.57-1.02)	
Vaccination	Fully vaccinated	68	2	1	1	0.854
	Partially vaccinated	21	7	0.90(0.79-1.03)	0.95(0.55-1.63)	
	Up-to-date	96	6	0.52(0.37-0.74)	1.01(0.63-1.64)	
	Not vaccinated	18	2	0.92(0.81-1.05)	0.58(0.30-1.13)	
WFA	Normal	191	12	1	1	0.972
	Underweight	12	5	3.20(1.72-5.96)	0.96(0.09-10.27)	

HFA	Normal	192	12	1	1	
	Stunting	11	5	3.44(1.80-6.57)	1.96(0.20-19.12)	0.563
WFH	Normal	188	12	1	1	
	Wasting	15	5	2.75(1.58-4.77)	1.23(0.37-4.08)	0.735
Duration prior to seeking care	≤ 5 days	190	13	1	1	
	>5 days	13	4	0.62(0.47-0.82)	0.61(0.27-1.38)	0.235
Temperature	< 37.5 °C	53	5	1	1	
	≥ 37.5 °C	150	12	0.85(0.62-1.16)	1.05(0.74-1.47)	0.792
Oxygen saturation	≥ 90%	21	0	1	1	
	< 90%	182	17	1.67(1.06-2.62)	1.25(0.75-2.10)	0.394
Danger Sign	No	101	1	1	1	
	Yes	102	16	0.48(0.34-0.63)	0.54(0.38-0.76)	0.001**
Co-morbidity	No	156	4	1	1	
	Yes	47	13	0.50(0.36-0.70)	0.62(0.42-0.91)	0.016*
Complication	No	197	12	1	1	
	Yes	6	2	0.23(0.09-0.51)	0.32(0.11–0.91)	0.032*
Treatment	Ceftriaxone	174	7	2.98(1.98-4.50)	1.09(0.19-6.29)	0.921
	Ceftriaxone+ Vancomycin	11	10	0.30(0.16-0.55)	0.47(0.07-3.09)	0.434
	Ampicillin+ Cefotaxime	9	0	0.57(0.29-1.11)	0.40(0.06-2.57)	0.333
	Ampicillin+ Gentamycin	8	1	0.46(0.23-0.93)	0.94(0.13-6.72)	0.952

Notes: - AHR: Adjusted Hazard Ratio; CHR: Crude Hazard Ratio

Cox regression. Variables with $p < 0.05$ were considered statistically significant

* $p\text{-value} < 0.05$; ** $p\text{-value} \leq 0.001$

1: Reference

WFA: Weight for age; HFA: Height for age; WFH: Weight for height

6. DISCUSSION

This prospective follow-up study aimed to determine the time to recovery and its predictors among pediatric patients admitted with severe community-acquired pneumonia at Wallaga University Comprehensive Specialized Hospital, western Ethiopia. The overall recovery rate was 19.39 per 100 person-days observations (95% CI: 16.90–22.25), with a median recovery time of 4 days (95% CI: 3–7 days). The presence of danger signs at admission, comorbidities, and complications were identified as significant independent predictors of prolonged recovery time.

The overall incidence rate of recovery of this study is comparable with studies conducted in Benishangul-Gumuz public hospitals (19.69 per 100 person-day observations) (13) and South Wollo zone public hospitals, North East Ethiopia (20.45 per 100 person-day observation) (26). The similarity may be attributed to similarities in sociodemographic characteristics and disease severity at admission and type of comorbidities detected.

However, the recovery rate observed in the current study is higher than those reported from selected hospitals in Addis Ababa (11.50 per 100 person-day observations) (14), South West Region governmental hospitals, South West Ethiopia (12.48 per 100 person-day observations) (30), Debre Markos Referral Hospital (16.25 per 100 person-day observations) (31) and Asella Referral and Teaching Hospital (13.09 per 100 person-day observations) (32). This variation may be attributed to differences in early health-seeking behavior, as well as variations in nutritional and vaccination status among patients.

In contrast, the recovery rate observed in this study is lower than the finding from Mizan-Tepi University Teaching Hospital, which reported a recovery rate of 24.10 per 100 person-day observations (12). This variation may be attributed to differences in disease severity and the presence of comorbid conditions among the children included in the respective studies.

The median time to recovery observed in the current study is consistent with findings from studies conducted in Mizan-Tepi University (12), public hospitals of the South Wollo zone (26) and Debre Markos Referral Hospital (31), where the median time to recovery was reported to be four days. This similarity may be attributed to comparable patient care and treatment practices across the study settings.

However, a study conducted in selected hospitals in Addis Ababa reported a median recovery time of six days (14), which is longer than that observed in the present study. This difference may be explained by the fact that Addis Ababa, as the capital city, serves as a major referral center and receives more severely ill children from across the country. In addition, delays in obtaining appropriate care during the referral process may further contribute to prolonged recovery time.

On the other hand, the median time to recovery in this study is longer than that reported in a study conducted in New York and Nepal, where recovery occurred within two days (28,29). This discrepancy may be due to variations in treatment and care practices, healthcare settings, and socioeconomic factors between the study areas.

This study demonstrated that the presence of danger signs at admission was a significant predictor of recovery time among pediatric patients admitted with severe community-acquired pneumonia. The danger signs identified in this study included chest retractions, head nodding, grunting, central cyanosis, persistent vomiting, abnormal body movements, and impaired consciousness. Children who presented with one or more danger signs at admission required a longer time to recover compared with those who did not exhibit danger signs. This may be explained by the fact that danger signs indicate advanced disease severity and physiological instability, including impaired oxygenation, reduced feeding ability, and altered consciousness. Children presenting with danger signs are more likely to have extensive lung involvement and systemic illness, which delays clinical stabilization and prolongs recovery. In addition, danger signs are often associated with complications, as well as underlying comorbidities, which further slow response to treatment and prolongs recovery time. This finding is in line with other different studies done in the Gambia (11), University of Gondar Comprehensive Specialized (25), South West Region governmental hospitals, South West Ethiopia (30), Debre Markos Referral Hospital (31) and Asella Referral and Teaching Hospital (32).

The presence of comorbidity was another important predictor significantly associated with recovery time from severe community-acquired pneumonia. In this study, comorbid conditions identified among affected children included malnutrition, wheezing disorders (childhood asthma), heart disease, acute gastroenteritis, tuberculosis, anemia, pertussis, measles, and Down syndrome. Children with one or more comorbid conditions had a prolonged time to recovery compared with those without comorbidities. This is due to the fact that the presence of concurrent illnesses in a

child is associated with compromised immune function, reduced physiological reserve, and increased vulnerability to severe infection, which in turn prolongs the length of hospital stay and delays recovery time. This finding is similar with previous studies conducted in University of Gondar Comprehensive Specialized (25), South Wollo zone public hospitals, North East Ethiopia (26), governmental hospitals in the South West Region of Ethiopia (29), Debre Markos Referral Hospital (31) and Asella Referral and Teaching Hospital (32).

The presence of complications was also an important predictor significantly associated with recovery time from severe community-acquired pneumonia. In this study, parapneumonic effusion and empyema were the identified complications. Children who developed complications experienced a prolonged time to recovery compared with those without complications, reflecting the increased disease severity and need for more intensive management (9).

7. STRENGTH AND LIMITATIONS

7.1 Strength of the study

- Prospective follow-up design: the prospective nature of the study allowed for real-time data collection, which minimizes recall bias and improves the accuracy of exposure and outcome measurement.
- Adequate sample size and complete follow-up: the relatively sufficient sample size, along with complete follow-up and a high recovery rate, increased the statistical power and precision of the estimated outcomes.
- Used appropriate survival analysis methods (Kaplan-Meier, Cox regression): it allows for accurate analysis of time-to-event outcomes, proper handling of censored data, and adjustment for potential confounders, thereby enhancing the validity and reliability of the findings.
- Clinical relevance of identified predictors: the study identified clinically important predictors of recovery, providing valuable evidence to inform clinical decision-making and improve the management of pediatric patients with severe community-acquired pneumonia.

7.2 Limitation of the study

- Single-center study design: the study was conducted in one hospital, which may limit the generalizability of the findings to other regions or healthcare settings.
- Consecutive sampling technique: the use of consecutive sampling may have introduced selection bias and limited the representativeness of the broader pediatric population with severe community-acquired pneumonia.
- Short follow-up period: the follow-up period was limited to hospital stay, which did not allow assessment of long-term outcomes such as, readmission, or post-discharge mortality.

8. CONCLUSION AND RECOMMENDATION

8.1 Conclusion

In general, this study assessed the median time to recovery from severe community-acquired pneumonia and its associated predictors. The overall median time to recovery was four days which is within the recommended national standards. The presence of danger signs at admission, comorbidities, and complications were significant predictors of recovery time among patients with severe community-acquired pneumonia.

8.2 Recommendation

To health care providers

Health care providers should give special attention to children presenting with the identified predictors during the management of severe community-acquired pneumonia.

Health care providers should create awareness among parents and caregivers at every possible opportunity, such as during vaccination visits and routine hospital consultations, about the signs and symptoms of severe community-acquired pneumonia and provide appropriate advice on the need for prompt medical attention for affected children.

To the community

Parents or caregivers should seek prompt medical care for their children as soon as illness begins, before the development of danger signs and complications.

To future researchers

Further prospective studies should be conducted by including additional parental-related variables that were not addressed in this study and by involving a larger number of hospitals.

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ANNEXES

ANNEX I: CONSENT FORM

Code number _____

I consent acceptance, has been explained to me in a language I understand on time to recovery and its predictors among pediatric patients with SCAP. I understand that time to recovery and its predictors among pediatric patients with SCAP are not well known. For this reason, doing research on this title is important.

Therefore, I am informed about giving required information via interview. More over all the information obtained will be kept strictly confidential. Decline to answer the questions; the right not to participate or withdraw and decide not to participate has no influence on any services that my child seeks to get.

Therefore, by understanding the objective of the consent, I agreed to give information for the stated purpose and I have no any objection if this information also used for similar research in the future. Participating in this study is purely voluntarily; I am very happy and I have informed this to the consent offering personnel.

For this, I declared with my signature.

Consent acceptor signature (no name) _____ Date _____

Witness signature signature _____ Date _____

Person Obtaining Consent signature _____ Date _____

Contact information – Dr. Dessalegn Likisa

- Cell phone +251917853512

- Email- dessalegnlikisa@gmail.com

ANNEX II: ASSENT FORM

I am conducting a research study to learn about how long it takes for children to recover from severe community-acquired pneumonia (SCAP) and what factors might influence that recovery time. I invite you to participate by answering a few questions about your health. Your participation is completely voluntary—you may choose to decline or withdraw from the study at any time without affecting your medical care. If you have any questions now or later, feel free to ask or ask your parent to call Dessalegn at +251917853512.

ANNEXES III: QUESTIONNAIRES

This tool was developed to collect data essential for assessing the recovery time and its predictors among pediatric patients admitted with severe community-acquired pneumonia at Wallaga University Comprehensive Specialized Hospital, Western Ethiopia, 2025. All relevant information for the study was extracted with interview and from the patients' charts without including their names. Data was collected by healthcare professionals (pediatric nurse) working at the WUCSH, and all information was kept confidential.

Contact information:

- Dr. Dessalegn Likisa
- Cell phone +251917853512
- Email- dessalegnlikisa@gmail.com

Name of data collector _____signature_____

Name of supervisor _____signature_____

Code number _____

Date of collection date _____

Part-I Socio Demographic Characteristics

No.	Socio demographic data of children	Possible answers	Skip
1	Age	_____ years or _____ months	
2	Sex	1. Male 2. Female	
3	Residence	1. Urban 2. Rural	

Part-II Base line nutritional and clinical information

4	Was the child exclusively breast feed/ currently on exclusively breast feed?	1. Yes 2. No	
5	If complementary feeding was started, at what age started?	Specify the age _____	
6	Weight for age	_____	
7	Height for age	_____	
8	Weight for height	_____	
9	Vaccination status of children	1. Fully vaccinated 2. Partially vaccinated 3. Up-to-date 4. Not vaccinated 5. Unknown	
10	How many days elapsed prior to seeking appropriate Care?	_____ days	

11	Does the child have danger signs during admission?	1. Yes 2. No	If No skip to Q No-13
12	What danger signs the child have?	1. Severe chest retraction 2. Head nodding 2. Grunting 3. Central cyanosis 4. Vomiting every thing 5. Impaired consciousness 6. Convulsion 7. Other specify _____	
13	Body temperature at admission	_____	
14	Respiratory rate at admission	_____	
15	Oxygen saturation at admission	_____	
16	Does the child have co-morbidity?	1. Yes 2. No	If No skip to Q No-18
17	What co-morbidity does the child have?	1. Malnutrition 2. Asthma (wheezing disorders) 3. Heart disease 4. Tuberculosis 5. Acute gastroenteritis 6. Measles 7. Pertussis 8. Anemia 9. Down syndrome 9. others specify _____	
18	Was CXR taken on admission?	1. Yes 2. No	If No skip to Q No-20

19	What was the CXR finding?	_____	
20	Does the child have complication on admission?	1. Yes 2. No	If No skip to Q No-22
21	What complications does the child have	1. Parapneumonic effusion 2. Empyema 3. Others, specify _____	
22	Treatment given	1. Ceftriaxone 2. Ceftriaxone & Vancomycin 3. Ampicillin & gentamycin 4. Ampicillin & Cefotaxime 5. Azithromycin 6. Supportive care a. oxygen (specify mode of delivery) _____ b. feeding (specify) _____ c. antipyretics (specify) _____ 7. Chest tube insertion 8. Other specify _____	
23	What was the outcome?	1. Recovery 2. Referral 3. Death 4. Refusal (LAMA) 5. Other specify _____	
24	Date of admission	_____	
25	Date of recovery/event happened	_____	
26	For how long was the child admitted in the ward	_____ days	

ANNEXES IV: LOG-LOG SURVIVAL PLOTS

Figures: - Proportional hazard assumption test by Log-log plot for each predictor among pediatric patients admitted with severe community-acquired pneumonia at Wallaga University Comprehensive Specialized Hospital, Western Ethiopia, September 1, 2025 to January 30, 2026. (n=220)

