



ARSI UNIVERSITY COLLEGE OF HEALTH SCIENCES
DEPARTMENT OF PEDIATRICS AND CHILD HEALTH

PREDICTORS OF PROLONGED HOSPITAL STAY AMONG CHILDREN AGED 3 MONTHS TO 14 YEARS ADMITTED WITH SEVERE PNEUMONIA AT ASELLA REFERRAL AND TEACHING HOSPITAL, SOUTHEAST ETHIOPIA, 2024/2025.

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Abbreviations and acronyms

CHD: congenital heart disease

CXR: chest x-ray

DAMA: discharge against medical advice

FMOH: federal ministry of health

HEWs: health extension workers

Hgb: hemoglobin

HIV: human immune deficiency virus

HSTP: Health Sector Transformation Plan

IMNCI: integrated management of newborn and child illnesses

LOS: length of stay

SCAP: Severe community acquired pneumonia

TB: tuberculosis

Summary

Background: Severe pneumonia is a leading cause of hospitalization and death among children under five, especially in low-income countries like Ethiopia. Various factors such as malnutrition, Anemia, Comorbidities, and delayed treatment are associated with prolonged hospital stay in children with severe pneumonia. Prolonged hospital stay increases health care costs, risks of hospital acquired infections, and resource burden on health systems.

Objective: This study aimed to determine the magnitude of prolonged hospital stay and identify its predictors among pediatric patients admitted with severe pneumonia at Asella referral and teaching hospital, Arsi zone, southeast, Ethiopia from 2024 to 2025.

Methods: A hospital based retrospective cross-sectional study was conducted using secondary data analysis on pediatric patients with severe pneumonia. Data was entered into Microsoft Excel for data cleaning, coding, and preliminary processing, then exported to Statistical Package for Social Sciences (SPSS) version 27.0.1 for analysis.

Bivariate logistic regression analysis at a significance level of 0.25 and multivariate logistic regression analyses with a significance level of 0.05 were conducted to determine the factors associated with prolonged hospital stay among pediatric patients.

Results: In this study 42% (95% CI: 37.21%- 46.81%) of patients with severe Pneumonia had prolonged hospital stays. The presence of underlying comorbidity (adjusted odds ratio [AOR]: 3.16, 95% CI: [1.832-5.336]), unvaccinated status (AOR: 2.01, 95% CI [1.694-3.815]), Malnutrition (AOR: 2.94, 95% CI [1.383-6.290]), having history of previous pneumonia (AOR: 3.277, 95% CI [1.798-5.971]) and delayed in seeking health care provider (AOR: 3.773; CI [2.037-6.989] were independent predictors of prolonged hospital stay among pediatric patients with severe pneumonia.

Conclusion: In this study, more than one-third of pediatric patients with severe pneumonia had a length of stay of more than 5 days, and not vaccination status, malnutrition, previous history of pneumonia, delayed health care seeking, and underlying comorbidities were independent predictors of prolonged hospital stay. Therefore, healthcare providers, parents, and other stakeholders should work to improve vaccination rate, improve community early health care seeking behavior through education, and inpatient management of malnutrition and other comorbid diseases to reduce hospital stays for pediatric patients with severe pneumonia.

Key words: pediatric patients, prolonged hospital stay, severe pneumonia, southeast Ethiopia

Introduction

1.1 Background

Pneumonia, characterized by inflammation of the lung parenchyma, remains the leading infectious cause of death among children under five globally(1,2). According to the United Nations 2030 Agenda for Sustainable Development 2015, the main cause of under-five mortality are pneumonia, diarrhea, injury and NCDs, accounting for an estimated 920,000 deaths each year. More than 99% of pneumonia deaths are in low- and middle-income countries, with the highest pneumonia mortality rate occurring in poorly developed countries in Africa and South Asia.

Severe pneumonia is defined by the WHO as the presence of cough or difficulty breathing in conjunction with either lower chest wall in drawing or an inability to breastfeed, drink, or persistent vomiting, along with impaired consciousness, central cyanosis, or peripheral oxygen and saturation below 90% as measured by pulse oximetry.(3)

Childhood severe pneumonia is more deadly than non-severe pneumonia and is linked to higher long term respiratory morbidity and disease burden (4). 8.7% of pneumonia cases in high incidence countries are potentially fatal (5). Up to 15% of deaths in children under five worldwide are caused by childhood pneumonia, which continues to be one of the leading causes of death for children (6).

The medical costs of care, both direct and indirect are burdensome for parents in resource-poor areas. It exhibits a substantial variation depending on the duration of a child's hospitalization for various conditions(5,7). Prolonged hospitalization from severe pneumonia has the potential to negatively impact a child's motor, cognitive, emotional and social development(5,8). It also increases the likelihood of infection and contributes to the development of adverse drug reactions, as well as depriving parents of work time(6,8). In addition to the impact on patients, the prolonged recovery from severe pneumonia also places a burden on the time spent by clinical staff and parents(9,10).

Several studies in Ethiopia and elsewhere have identified multiple predictors associated with prolonged hospital stay among children admitted with severe pneumonia.

Rural residence(11), late presentation to health facilities(4), lack of health insurance(6), and incomplete vaccination(10) were consistently associated with prolonged recovery and hospital stay. The presence of comorbidities such as congenital heart disease(12) or other chronic illnesses are a strong and consistent predictor of prolonged hospital stay. Danger signs at admission including hypoxia, respiratory distress, impaired consciousness and pleural effusion(13) are also linked to delayed improvement. Moreover, severe pneumonia on admission and late initiation of treatment contributed to extended recovery times.

Malnutrition, reflected by low weight-for-length ($WFL < -3$ Z-score) or mid-upper arm circumference ($MUAC \leq 12.5$ cm)(14), was significantly associated with prolonged hospital stay. Underweight and anemic children(15) similarly experienced delayed recovery. These findings highlight the critical role of nutritional status in the management and prognosis of severe pneumonia.

1.2 Statement of the problem

In developing countries, respiratory tract infections are not only more common, but they are also more serious, about 13% of pneumonia cases are severe enough to require hospitalization (8).

In developing countries including Ethiopia, the length of hospitalization for children with severe pneumonia is influenced by a variety of interrelated factors. These include socio-demographic, clinical, nutritional, environmental, and treatment-related factors (3,6,11,16).

Socio-demographic characteristics, including the child's age, gender, parental education, place of residence, and socioeconomic status, have been shown to affect the length of recovery and hospital stay(17–19). Children from rural areas and low-income families are more likely to present late with advanced disease, leading to prolonged hospitalization.

Delays in recovery and longer hospital stays have been linked to clinical characteristics like the presence of comorbidities (malnutrition, anemia, HIV infection, congenital heart disease), hypoxemia, high respiratory rate, and severe chest in drawing (3,4,20)). Similarly, prolonged hospital stays have been linked to poor oxygen saturation, abnormal laboratory results (such as leukocytosis or anemia), and consequences such pleural effusion or sepsis (6,7). Among pediatric pneumonia cases, nutritional characteristics such as malnutrition and wasting continue to be significant predictors of both morbidity and recovery time (14,16). Children who are malnourished have compromised immunity, which prolongs hospital stays by causing numerous problems and a delayed rate of clinical rehabilitation. Long-term hospital stays have also been linked to environmental and treatment-related factors, such as delayed care-seeking, poor early management, and inappropriate antibiotic usage (10,21).Recovery time is also influenced by hospital capacity, career health-seeking behaviour, and the quality of care (22).

Although multiple factors have been linked to prolonged hospital stay among children with severe pneumonia in Ethiopia, the magnitude and relative contribution of these predictors remain inconsistent across regions and hospital settings (6,9,20).

While there is limited information available for older pediatric age groups (5-14 years), who also face high pneumonia-related morbidity, the majority of published research, including one conducted at this institution, has focused on children under the age of five (4,18,23).

Thus, the goal of this study is to determine the role of socio-demographic, clinical, nutritional, and treatment-related factors in the prolonged hospital stay of children aged 3 months to 14 years admitted with severe pneumonia at Asella referral and teaching hospital in southeast Ethiopia between 2024 and 2025.

1.3 Significance of the study

According to the WHO's 2018 Pneumonia and Diarrhea Report, Ethiopia ranks fifth among high-burden countries, reporting around 4 million cases annually. A significant portion of affected children lack access to adequate, facility-based clinical care.

Identifying the predictors of prolonged hospital stay from severe pneumonia may assist the primary care physicians to counsel parents on the likely duration of hospitalization. This will enable them to mobilize resources for the hospital care of the child and re-adjust to any disruption that the admission may cause. This may reduce the incidence of DAMA, thereby ensuring adequate management and reducing risk of death. It also helps the physicians to allocate scarce resource and pay special attention for high risk group children on admission and during hospital stay, and may eventually add an input in the struggle to reduce deaths and to achieve the national targets.

While similar studies have been conducted at Debre Markos and southwest Ethiopia involving children under 14years excluding the neonatal age groups(6,20), to date, there is a paucity of data specific to the Asella region, representing a critical gap in knowledge. This lack of region-specific information hinders the development of tailored, evidence-based interventions and policies that are crucial for identifying predictors of prolonged hospital stays and improving the duration of hospitalization due to severe pneumonia. Therefore, further investigation in this area is important for providing policymakers with locally relevant insights.

2 Literature Review

2.1 Prolonged hospital stay

Cross sectional study conducted in Spain to assess Initial risk class and length of hospital stay in community-acquired pneumonia showed that the magnitude of prolonged hospital stay was 32% of patients (24).

Cross sectional study conducted in south west Ethiopia to assess Predictors of Prolonged Hospital Stay among Pediatric Patients with Severe Pneumonia showed that the magnitude of prolonged hospital stay was around two fifth (38.22%) of studied participants (25).

Prospective cohort study done at Debre Tabor comprehensive specialized hospital to assess Survival status and predictors of mortality from severe community-acquired pneumonia among under-five children showed LOS of 8.2days(12).

Cross sectional study conducted in Gambia to determine Predictors of prolonged hospitalization in childhood pneumonia in a rural health center found that 105 (25.0%) of the children had a prolonged hospital stay (26).

Cross sectional study conducted in Benishangulgumuz, Ethiopia to assess prolonged hospital stay and its predictors among children aged 2-59 months with severe pneumonia showed that around one fourth (28.23%) of studied participants had prolonged hospitalization (27).

2.2 Socio-demographic related factors

Globally, socio-demographic characteristics influence pneumonia severity, recovery time, and length of hospital stay. Younger age groups, particularly children aged 12–35 months, are consistently associated with prolonged recovery from severe pneumonia (9). Sex differences have also been documented, with some studies reporting slightly longer hospital stays among male children, possibly due to sex-related differences in immune response (28).

In sub-Saharan Africa, prolonged hospitalization reflects both individual and systemic socio-demographic challenges. The region bears nearly half of the global pneumonia burden, with an estimated 200,000 under-five deaths annually (19). Factors such as rural residence, low socioeconomic status, delayed healthcare-seeking behavior, and limited pediatric intensive care capacity significantly contribute to extended hospital stays(10,11,29) . Similar patterns have been

observed in Oromia Region, including Asella Referral Hospital, Jimma University Medical Center, and East Wollega Zone hospitals, where rural residence and delayed presentation were associated with prolonged hospital stay (4,11,23).

2.3 Clinical-Related Factors

Clinical characteristics at presentation and during hospitalization are key determinants of recovery and length of hospital stay. Globally, severe pneumonia presentations characterized by hypoxemia, high fever, respiratory distress, and altered consciousness are associated with delayed recovery and prolonged hospitalization(1).

Radiologic and laboratory findings also play a critical role. Bilateral or multi lobar lung involvement on chest radiography has been consistently linked with prolonged hospital stay and increased complication rates (1,30,31). Elevated inflammatory markers, particularly C-reactive protein levels greater than 100 mg/L, have been shown to predict prolonged hospitalization(18). In sub-Saharan Africa, clinical severity is often compounded by comorbid conditions such as anemia, HIV infection, and hypoxemia, and history of pneumonia which significantly prolong hospital stay and increase mortality risk (21,30).

2.4 Nutritional-Related Factors

Malnutrition remains a major global determinant of pneumonia severity and prolonged hospitalization, particularly in low-resource settings. Undernourished children are more susceptible to severe disease, delayed clinical improvement, and complications that necessitate longer hospital stays (8,32). In sub-Saharan Africa, malnutrition is highly prevalent and closely intertwined with pneumonia-related morbidity. Hospital-acquired and pre-existing malnutrition are both associated with prolonged length of hospital stay(21,30). Evidence indicates that underweight children have a 44% lower chance of recovery from severe pneumonia compared to children with normal nutritional status (33,34).

Ethiopian studies consistently identify malnutrition as one of the strongest predictors of prolonged hospitalization (4,16). In Oromia Region, malnutrition was reported as a significant predictor of prolonged hospital stay in studies conducted at Asella Referral Hospital and other tertiary facilities (23).

2.5 Treatment Related Factors

Globally, the introduction of pneumococcal conjugate and Haemophilus influenza type b vaccines has substantially reduced pneumonia incidence and severity. However, incomplete immunization remains a significant risk factor for severe pneumonia and prolonged hospitalization (15). In sub-Saharan Africa, gaps in vaccination coverage persist, contributing to high pneumonia-related hospitalization rates and extended length of stay (21). Incomplete immunization often coexists with malnutrition and delayed healthcare-seeking, compounding disease severity (3,30).

In Ethiopia, incomplete vaccination status has been repeatedly associated with prolonged recovery and hospital stay among children with severe pneumonia(4,11). Studies from Oromia Region, including Jimma University Medical Center and East Wollega Zone hospitals, similarly report incomplete immunization as a significant predictor of prolonged hospitalization(4,11).

Globally, prolonged hospitalization has been linked to treatment failure, delayed initiation of appropriate antibiotics, and inadequate supportive care(35). Health system limitations, including shortages of oxygen therapy and critical care services, further prolong hospitalization in low-resource settings (3,30).

In Ethiopia, treatment-related predictors of prolonged hospitalization include delayed presentation, late initiation of antibiotics, limited access to oxygen therapy, and poor treatment response(16,23). Studies from Oromia Region highlight that children experiencing treatment failure or requiring changes in antibiotic regimens are more likely to have prolonged hospital stays(23).

2.6 Conceptual framework

This conceptual framework was developed after reviewing different related literature (13,24–27,36–38). As we can understand from the fig.1 below, the potential factors which can have an association with outcome variable (prolonged hospital stay) are summarized as Socio-demographic factors, nutritional related factors, clinical related factors, and treatment related factors.

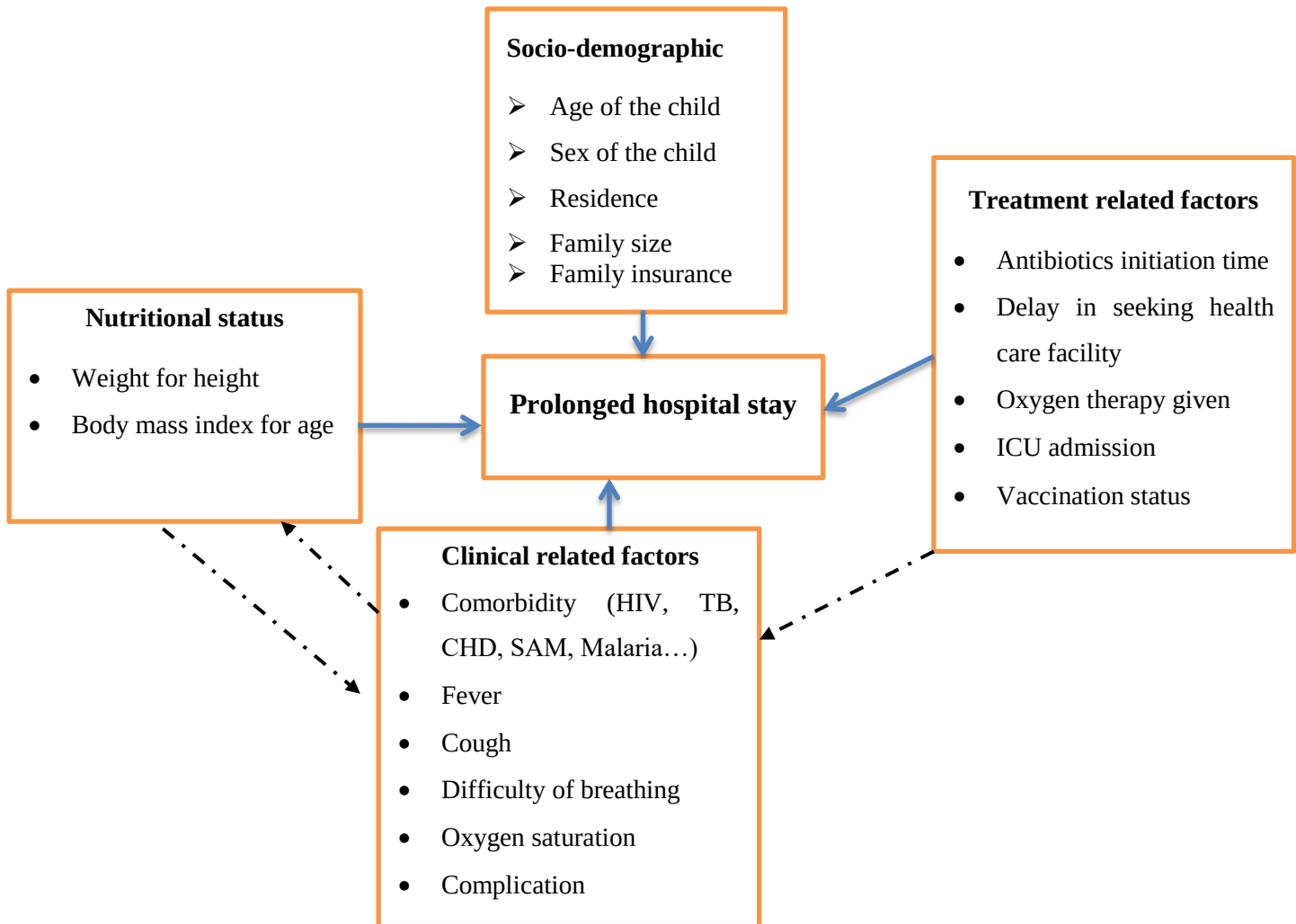


Figure 1:-Conceptual framework developed to assess *prolonged hospital stay and associated factors among children from 3 months to 14 years old with severe pneumonia at Asella referral and teaching hospital, southeast Ethiopia, 2025*

3 OBJECTIVES

3.1 General objective

- ✓ To assess prolonged hospital stay and its predictors among children aged 3month to 14yrs admitted with severe pneumonia at Asella referral and teaching hospital, Arsi zone, southeast, Ethiopia

3.2 Specific Objectives

- ✓ To determine the magnitude of prolonged hospital stay among children aged 3month to 14yrs admitted with severe pneumonia at Asella referral and teaching hospital, Arsi zone, southeast, Ethiopia.
- ✓ To identify predictors of prolonged hospital stay among children aged 3month to 14yrs admitted with severe pneumonia at Asella referral and teaching hospital, Arsi zone, southeast, Ethiopia

4 Materials and Methods

4.1 Study setting

The study was conducted at Arsi University, College of health science, Asella Referral and Teaching Hospital which is located in the town of Asella. Asella is located in the Arsi Zone of the Oromia Region about 175 kilometers from Addis Ababa, the capital city of Ethiopia. ARTH has been serving populations in Arsi and the nearby zones since 1964. The service deliveries are organized under different departments in which majorly include internal medicine, surgery, obstetrics Gynecology, pediatric and Child health and diagnostic departments. Pediatric and Child health department is one of the major units of the hospital delivering services under four main sub-units with 106 beds for the pediatric patients (42 NICU, 54 Pediatric medical ward and 10 for pediatric emergency). In the department of Pediatrics and Child Health, there are 12 pediatricians and 23 residents. There are also 22 nurses in pediatrics ward.

4.2 Study period and design

4.2.1 Study design

A hospital- based retrospective cross-sectional study was conducted using secondary data analysis to assess predictors of prolonged hospital stay among children aged 3month to 14yrs admitted with severe pneumonia at Asella referral and teaching hospital, Arsi zone, southeast, Ethiopia.

4.2.2 Study period

The study was conducted from August 1, 2024-July 30, 2025

4.3 Source population and study population

4.3.1 Source population

The source population includes all pediatric patients (three months to fourteen years) admitted to pediatric ward of Asella Referral and Teaching Hospital, southeast, Ethiopia from 2024 to 2025 G.C

4.3.2 Study population

All randomly selected records of pediatric patients (three month-fourteen years) admitted to pediatric ward of Asella Referral and Teaching Hospital, southeast, Ethiopia from 2024 to 2025 G.C

4.4 Eligibility criteria

4.4.1 Inclusion criteria

All pediatric patients aged three month to fourteen years who were admitted to pediatrics wards and hospitalized with the diagnosis of severe pneumonia from August 1, 2024 to July 31, 2025.

4.4.2 Exclusion criteria

Patients whose results are unknown or not documented. Patients, whose records of independent important variables, such as age, sex, comorbidities, vaccination status, etc., are not complete.

4.5 Sample size determination

The sample size was determined by using a single population proportion formula for sample size calculation. Assumptions, d = margin of error of 5% with 95% confidence interval, $\alpha = 0.05$ (level of significance), (P=38.22%) study done from southwest Ethiopia (25).

$$= \frac{(\frac{Z_{\alpha}}{2})^2 \cdot p \cdot q}{d^2} = \frac{(1.96)^2}{(0.05)^2} * 0.382 * 0.618 = 362$$
 and after adding 10% non-response rate the final sample size was **398**

4.6 Sample method

The pediatric ward admission register was used as a sampling frame for the selection of pediatrics patients (3mo-14yrs) chart admitted during the study period. Charts of patients were selected systematically at random from archives using the admission register as a sampling frame. The first case was chosen by count up to “K=5” charts, then draw a lottery method from “K’s” charts to get the first case included in the study and add every “Kth=3 to get the next sampled chart. If there was an incomplete chart (if the chart is inconsistent), the next chart was observed until the required sampled chart arrives. The number of intervals from one chart unit to the next was determined by dividing the total number of chart units in the given time periods by the assigned sample size $\rightarrow K = N/n$ (1260/398=3.1~3) and continuing with the same sampling procedure until the required sample size is reached.

4.7 Variables

4.7.1 Dependent Variables

➤ Prolonged hospital stay

4.7.2 Independent Variables

Socio-demographic factor: (age, sex, residence, family size, family insurance)

Clinical related factor: (fever, cough, presence of danger sign, comorbidities, complication)

Nutritional status: (weight for height, BMI for age)

Treatment and related factor: (delayed seeking of care, antibiotic initiation, vaccination status, ICU admission,)

4.8 Operational definition

Prolonged Hospital Stay: defined as the time from hospital admission to hospital discharge. It was dichotomized as ≤ 5 and > 5 days based on the median time (length) of hospital stay. Patients who stayed in the hospital for more than five days were categorized as having “prolonged” hospitalization(6,16).

Time Scale: the LOS was measured in days.

Severe pneumonia: children presented with inability to drink, persistent vomiting, oxygen saturation less than 90%, convulsion, and lethargy or reduced level of consciousness

Co-morbidity: any disease condition (acute or chronic) present at admission in addition to SCAP .

Danger sign: loss of consciousness, abnormal body movement, vomiting everything, convulsions, and inability to feed in addition to SCAP

Vaccination status: Fully Vaccinated which refers to Children who had received all forms of vaccination; Partially Vaccinated (Children who had taken at least one PCV dose) and Unvaccinated (Children who have never received PCV or any form of vaccination)

Malnutrition: refers to Children having weight for height or BMI for age is less than $-2Zs$

4.9 Data collection tool and procedure

Data was collected using a structured electronic data extraction checklist developed based on a review of relevant literature and adapted to the local context. The tool was designed and deployed using Kobo Toolbox, an electronic data collection platform, and included variables

related to socio-demographic characteristics, clinical-related factors, nutritional status, vaccination status, and treatment related factors.

Data collection was conducted through retrospective review of eligible pediatric patients' medical records by four trained medical interns using Android mobile devices installed with the Kobo Collect application. The interns received prior training on the study objectives; variables included in the data extraction tool, and standardized procedures for accurate and consistent abstraction of information from medical records, as well as the use of the Kobo-Toolbox platform.

The electronic data extraction tool was configured with built-in validation rules, skip patterns, and mandatory fields to minimize data entry errors and missing values. Extracted data were uploaded on a daily basis to the secure Kobo-Toolbox server.

The principal investigator supervised the data collection process, monitored submitted records regularly, and reviewed the data for completeness, consistency, and accuracy

4.10 Data processing and Analysis

After completion of data collection, the dataset was exported from Kobo-Toolbox to Microsoft Excel for data cleaning, coding, and preliminary processing. The data were checked for completeness, consistency, and accuracy. Categorical variables were coded numerically, and appropriate coding schemes were applied for variables with multiple categories. String variables were converted into numeric formats to facilitate statistical analysis.

The cleaned and coded data were then imported into the Statistical Package for Social Sciences (SPSS) version 27.0.1 for statistical analysis. Descriptive statistics were used to summarize baseline characteristics of children admitted with severe pneumonia. Categorical variables were described using frequencies and percentages, while continuous variables were summarized using mean with standard deviation (SD) for normally distributed data.

Bivariable binary logistic regression analysis was performed to assess the association between each independent variable and prolonged hospital stay. Variables with a p-value ≤ 0.25 in the bivariable analysis were selected as candidates for multivariable analysis.

Multivariable binary logistic regression analysis was conducted to identify independent predictors of prolonged hospital stay while controlling for potential confounders. The strength of associations was expressed using adjusted odds ratios (AORs) with 95% confidence intervals (CI). A p-value < 0.05 was considered statistically significant.

A collinearity diagnostic test was undertaken and showed there was no problem of multicollinearity. Model goodness-of-fit test such as Hosmer and Lemeshow test was undertaken. Accordingly, Hosmer and Lemeshow test statistics indicated that the logistic regression model was of good fit (P-value = 0.858). The results were presented in the form of tables, figures, and text.

4.11 Ethical consideration

Ethical clearance was obtained from Arsi University, ATRH Institution Review Board to conduct the research. The study was conducted through a review of records. To ensure confidentiality, the name and other identifiers of patients, physicians, and other health care members who examine the patient will not be recorded on the data abstraction format.

4.12 Dissemination plan

The result of the study will be presented to Arsi University College of Medicine and Health Science and Asella Referral and Teaching Hospital and it will also be disseminated to the program of medical school officer, Arsi University College of Medicine and Health Science library and it might be published in health journal.

5. RESULTS

5.1 Socio demographic characteristics of participants

From three hundred ninety eight patient cards reviewed, data was collected from three hundred ninety five patient cards and making response rate of 99.2%. Among them, majority (60.3%) were male. Majority (46.3%) of them were found in the age category between 3-11 months. Majority of them (67.1%) were from rural area. Majority (57%) of study participants were from family size of 3-5persons. Concerning insurance status of the patients almost three fourth (73.4%) were insured. **(See Table 1).**

Table 1:Socio-demographic characteristics of children from 3 months to 14 years old with severe pneumonia at Asella referral and teaching hospital, southeast Ethiopia, 2025 (n=395)

Variable	Category	Frequency	Percent
Sex	Female	157	39.7
	Male	238	60.3
Age category	3-11 months	183	46.3
	1-4 years	146	37
	5-9 years	37	9.4
	10-14 years	29	7.3
Residence	Urban	130	32.9
	Rural	265	67.1
Family size	3-5	226	57
	6-8	154	39
	>=9	15	3.8
Health insurance	Insured	290	73.4
	Not insured	105	26.6

5.2 clinical related factors

From three hundred ninety five participants, around three fourth (78%) of studied participants were presented with symptoms of less than five days. Three fourth (74.4%) of them were had fever, majority (93.7%) of them has breathing difficulty, majority (92.9%) had chest indrawing, nine out of ten (90.6%) of the studied participants had oxygen saturation less than ninety percent. Concerning comorbidities, majority (64.3%) of studied participants had no comorbidities. **(See Table 2).**

Table 2: Clinical characteristics of children aged from 3 months to 14 years admitted with severe pneumonia at Asella referral and teaching hospital, southeast Ethiopia, 2025 (n=395)

Variable	Category	Frequency	Percent
Duration of symptoms	<5 days	308	78
	>=5 days	87	22
Fever	No	100	25.3
	Yes	295	74.4
Cough	No	7	1.8
	Yes	388	98.2
Difficulty of breathing	No	25	6.3
	Yes	370	93.7
Chest in drawing	No	28	7.1
	Yes	367	92.9
Oxygen saturation	>=90%	37	9.4
	<90%	358	90.6
Comorbidity	No	254	64.3
	Yes	141	35.7
Previous history of Pneumonia	No	114	28.9
	Yes	281	71.1

5.3 TREATMENT AND NUTRITIONAL RELATED FACTORS

From total studied participants, majority (69.9%) of them were fully vaccinated. Majority (62.5%) of children's were started their antibiotics after 24 hours. Concerning delays of seeking health care facility majority (59.7%) of them seeks health care facility on time. Among children admitted with severe pneumonia almost nine out of ten children's were received oxygen therapy(93.9%). Concerning Intensive care unit admission and history of complication, majority 95.4% and 89.9% of studied participants neither had history of admission to Intensive care unit nor complication history respectively. Moreover, the majority (88.1%) of children admitted with severe pneumonia were well nourished. (See Table 3).

Table 3: Treatment and nutritional related characteristics of children from 3 months to 14 years old with severe pneumonia at Asella referral and teaching hospital, southeast Ethiopia, 2025 (n=395)

Variable	Category	Frequency	Percent
Vaccination status	Not vaccinated	27	6.8
	Partially vaccinated	92	23.3
	Fully vaccinated	276	69.9
Antibiotics initiation time	Within 24 hours	136	34.4
	After 24 hours	247	62.5
	Unknown	12	3.1
Delay in seeking health care facility	No	236	59.7
	Yes	159	40.3
Oxygen therapy given	No	24	6.1
	Yes	371	93.9
Intensive care unit admission	No	377	95.4
	Yes	18	4.6
Nutritional status	Normal	348	88.1
	Malnourished	47	11.9
Complication during admission	No	355	89.9

Yes	40	10.1
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Nutritional status of children

Higher proportions (88.1%) of children admitted with severe pneumonia were well nourished. (See figure 2).

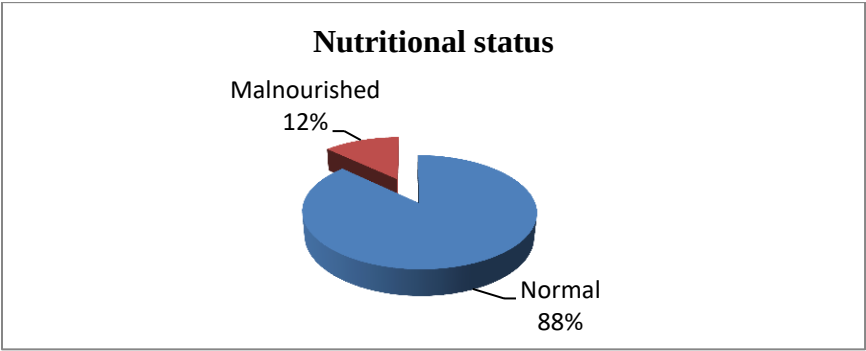


Figure 2: Nutritional status of children from 3 months to 14 years old with severe pneumonia at Asella referral and teaching hospital, southeast Ethiopia, 2025 (n=395)

5.5 Prolonged hospital stay

Concerning magnitude of prolonged hospital stay 42% (95%, CI: 37.21%, 46.81%) had prolonged hospital stay (See. Figure 3).

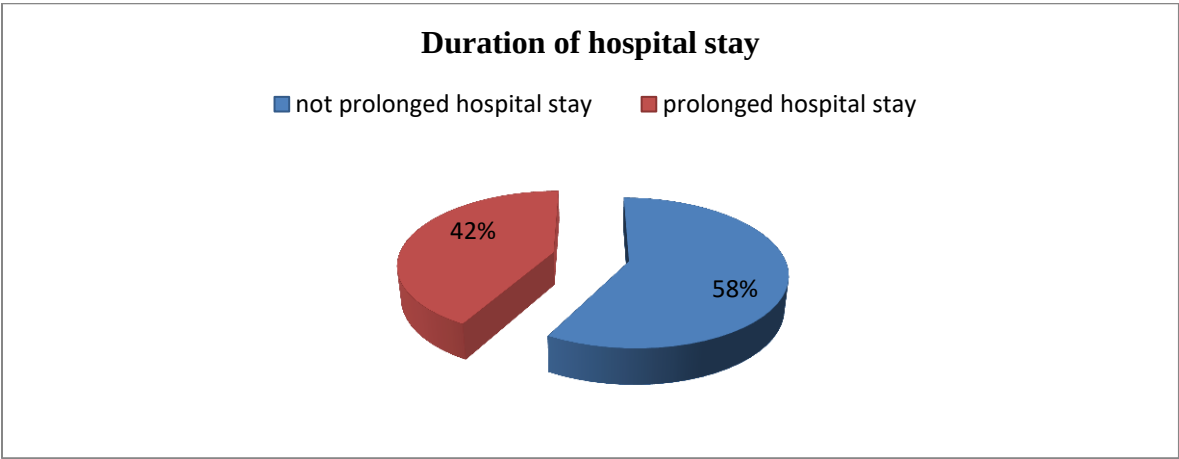


Figure 3: Magnitude of prolonged hospital stay of children from 3 months to 14 years old with severe pneumonia at Asella referral and teaching hospital, southeast Ethiopia, 2025 (n=395)

5.6 Factors associated with prolonged hospital stay

In bivariate logistic regression, having chest in drawing, vaccination status, presence of comorbidities, presence of complication, history of previous pneumonia, Antibiotics initiation time, delay in seeking health care, oxygen given, Admission to Intensive care unit, and nutritional status were associated with duration of hospital stay at p-value ≤ 0.25 . Finally, in multivariate logistic regression variables like Presence of comorbidity, previous history of pneumonia, nutritional status, vaccination status and delay of seeking health care facility, were remained associated with prolonged hospital stay.

Regarding presence of comorbidity, children presented with comorbidity were three fold more likely to stay prolonged duration in hospital when we compared with children presented without comorbidity (P=0.000, AOR = 3.126; CI: 1.832, 5.336). Concerning vaccination status, current study demonstrated that the odds of staying prolonged duration in hospital is increased by two among children not vaccinated when we compare with fully vaccinated children. (p = 0.000, AOR=2.010; CI: 1.694, 3.815). The odds of staying prolonged duration in hospital were nearly threefold times more likely among children with a history of previous pneumonia as compared with those with no history of pneumonia (p = 0.000, AOR = 3.277 :1.798,5.971).

Additionally, the present study showed that the odds of staying prolonged duration in hospital were two fold more likely among malnourished children when compared with those with normal nutritional status. (p = 0.005, AOR = 2.494; CI: 1.383, 6.290). The study found that the odds of staying prolonged duration in hospital was increased by nearly four times among children delayed in seeking health care provider when we compared with children who seek health care on times (p = 0.000, AOR = 3.773; CI: 2.037,6.989).

Table 4: Bivariate and multivariable analysis on factors associated with prolonged hospital stay children from 3 months to 14 years old with severe pneumonia at Asella referral and teaching hospital, southeast Ethiopia, 2025 (n=395)

Variables	Variables category	Prolonged hospital stay		COR (95% CI)	AOR (95% CI)	P- value
		Yes	No			
Chest In drawing	Yes	161	206	3.595(1.337,9.664)	2.172(0.693,6.803)	0.183
	No	5	23	1	1	1
Vaccination status	Not vaccinated	18	9	3.872(1.675,8.952)	2.010(1.694,3.815)	0.000*
	Partially vaccinated	54	38	2.751(1.696,4.464)	3.019(1.681,5.420)	.1980
	Fully vaccinated	94	182	1	1	1
Presence of comorbidities	Yes	94	47	4.439(3.234,7.881)	3.126(1.832,5.336)	0.000*
	No	82	182	1	1	
Presence of Complications	Yes	39	7	9.793(5.44,24.75)	7.412(2.286,24.038)	
	No	127	222	1	1	.213
Previous history of pneumonia	Yes	129	152	1.766(1.118,2.789)	3.277(1.798,5.971)	0.000*
	No	37	77	1	1	
Antibiotics initiation after 24hrs	Yes	89	59	3.012(1.951,4.613)	2.873 (1.146,7.205)	0.603
	No	81	166	1	1	0.583
Delay in seeking health care provider	Yes	103	56	5.051(3.270,7.802)	3.773(2.037,6.989)	0.000*
	No	63	173	1	1	
Oxygen therapy given	Yes	160	211	2.275(0.883,5.862)	1.636(0.553,4.840)	0.374
	No	6	18	1	1	1
Admitted to	Yes	11	150	2.378(1.019,7.364)	2.960(0.438,20.043)	0.266

ICU	No	7	227	1	1	
Malnutrition	Yes	34	17	3.212(1.725,5.980)	2.494(1.383,6.290)	0.005*
	No	132	212	1	1	

6. DISCUSSION

This study was conducted to determine prolonged hospital stay and associated factors among children's from 3 months to 14 years old with severe pneumonia in order to minimize unnecessary hospital stay and to improve economic consequences due to prolonged hospitalization.

The finding of the present study demonstrated that 42% (95% CI: 37.21%, 46.81%) of studied participants had prolonged hospital stay. Our current finding was comparable with another study conducted in south west Ethiopia which revealed that around two fifth (38.22%) of studied participants stayed in hospital for extended duration (25).

In contrast, our current finding was greater than previous studies conducted in central Ethiopia (19.6%) (36), Gambia (25.0%) (26), and Spain (32%) (24). The possible justification might be due to sample size difference, socio economic status and standard of health facility. The fact that European countries had better socioeconomic status and standard of health facility which helps in turn to minimize unnecessary hospital stay. However the present study indicated lower proportion than previous study in New Delhi, India (51%) (13). The observed discrepancy might be due to the nature of study population and current study used children's with severe pneumonia and children aged 3 months to 14 years and previous study used children's aged less than five years, sample size difference and socio-demographic factors.

The present study indicated that children presented with comorbidity were three fold more likely to stay prolonged duration in hospital when we compared with children presented without comorbidity ($P=0.000$, AOR = 3.126; CI: 1.832, 5.336). This study was supported by (24). Clinical severity is often compounded by comorbid conditions such as anemia, HIV infection, and hypoxemia, and history of pneumonia which significantly prolong hospital stay and increase mortality risk (21,30).

Concerning vaccination status, current study demonstrated that the odds of staying prolonged duration in hospital is increased by two among children's not vaccinated when we compare with fully vaccinated children's. ($p = 0.000$, AOR=2.010; CI: 1.694, 3.815). supported by many previous studies, Incomplete vaccination status has been one strong risk factors for prolonged recovery and hospital stay among children with severe pneumonia(4,11). Gaps in vaccination

coverage persist, contributing to high pneumonia-related hospitalization rates and extended length of stay (21). Incomplete immunization often coexists with malnutrition and delayed healthcare-seeking, compounding disease severity (3,30).

The odds of staying prolonged duration in hospital were nearly threefold times more likely among children's with a history of pneumonia as compared with those with no history of pneumonia ($p = 0.000$, AOR = 3.277 :1.798,5.971) clinical severity is often increased with those children's with history of pneumonia which significantly prolong hospital stay (21,30)..

Additionally, the present study showed that the odds of staying prolonged duration in hospital were twofold more likely among malnourished children when compared with those with normal nutritional status. ($p = 0.005$, AOR = 2.494; CI: 1.383, 6.290). previous Evidence also indicated that underweight children have a 44% lower chance of recovery from severe pneumonia compared to children with normal nutritional status (33,34). The previous study conducted identified that malnutrition was one of the strongest predictors of prolonged hospitalization (4,16).

The study found that the odds of staying prolonged duration in hospital was increased by nearly four times among children delayed to seek health care provider when we compared with children seek hospitals on times ($p = 0.000$, AOR = 3.773; CI: 2.037,6.989). supported by study in Ethiopia which indicated that time of arrival health care facility were significantly associated with prolonged hospital stay (38). Delayed healthcare seeking behavior, and limited pediatric intensive care capacity significantly contribute to extended hospital stays (19,21,22). Delayed presentation were associated with prolonged hospital stay (4,11,23).

Strength and limitation of the study

This study included children aged 3 months to 14 years a population in which children older than five years are rarely studied in the local context which allows a comprehensive assessment of factors associated with prolonged hospital stay across different pediatric age groups. Due to the nature of the study design (cross-sectional), it does not establish a strong causal association. Additionally, the study does not consider the impact of psychosocial factors. Since the study is retrospective some important socio-demographic variables are not available from the patient

records. This study is a single center study, which may limit the generalizability of the findings to other regions of Ethiopia or similar settings.

7. CONCLUSION AND RECOMMENDATIONS

7.1 CONCLUSION

The present study concluded that in the study area, about four out of ten (42%) children stay prolonged duration in hospital

Prolonged hospital stay was significantly associated with presence of comorbidity, delay in seeking health care, Malnutrition, not being vaccinated, and, having previous history of pneumonia.

7.2 RECOMMENDATIONS

Regarding health care providers

- Children with comorbid illnesses and those with a previous history of pneumonia should be identified early at admission and given close follow-up and timely management.
- Routine nutritional screening should be performed for all admitted children, and early nutritional support should be provided for malnourished children to improve recovery and reduce length of hospital stay.
- Health professionals should closely monitor children who present late to health facilities, as delayed care is associated with prolonged hospitalization.

Regarding immunization and prevention

- Strengthening routine childhood immunization is essential to reduce the burden of severe pneumonia and prolonged hospital stay.
- Special attention should be given to identifying and following up unvaccinated and partially vaccinated children, in line with the Ethiopian Expanded Programme on Immunization (EPI).
- Community awareness programs should emphasize the importance of complete vaccination to prevent severe pneumonia and its complications.

Regarding community and health-seeking behavior

- Health education activities should focus on improving early healthcare-seeking behavior among caregivers, particularly when children develop cough, fast breathing, or difficulty breathing.
- Health extension workers should continue to play a key role in educating families about early recognition of pneumonia symptoms and timely referral.

Regarding health system strengthening

- Primary healthcare facilities should be supported to detect and manage pneumonia early.
- Referral systems should be strengthened to ensure timely transfer of severely ill children from lower-level facilities.

Regarding future research

- Further studies using prospective and multicenter designs are recommended to better understand factors affecting hospital stay among children with pneumonia.
- Future research should also explore barriers to timely care seeking, vaccination, and proper nutrition at the community level.

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ANNEXES

ANNEXE I: QUESTIONNAIRES

The questionnaire used to assess prolonged hospital stay and its associated factors among pediatrics patients admitted with severe pneumonia at Asella Teaching and Referral Hospital, Southeast, Ethiopia, 2025

PART I: SOCIO-DEMOGRAPHIC INFORMATION

No.	Variable	Response Options
1.	Child's age	☐ 3–11 month ☐ 1–4 years ☐ 5–9 years ☐ 10–14 years
2.	Sex of child	☐ Male ☐ Female
3.	Residence	☐ Urban ☐ Rural
4.	Household size	_____ persons
5.	Family insurance	☐ Insured ☐ Not insured

PART 2: CLINICAL RELATED FACTORS

No.	Variable	Response Options
1.	Duration of symptoms before admission	☐ <5days ☐ ≥5days
2.	Fever at admission	☐ Yes ☐ No
3.	Cough	☐ Yes ☐ No
4.	Difficulty breathing	☐ Yes ☐ No
5.	Chest in drawing	☐ Yes ☐ No
6.	Oxygen saturation on admission	☐ <90% ☐ ≥90%
7.	Presence of comorbidities	☐ Yes ☐ No
8.	History of previous pneumonia	☐ Yes ☐ No
9.	Complications during admission	☐ Yes ☐ No

PART 3: NUTRITIONAL RELATED FACTORS

No.	Variable	Response Options
4.	Weight for height/BMI for age	☐ <-3Zs ☐ >=-3Zs & <-2ZS ☐ >-2ZS

PART 5: MANAGEMENT AND TREATMENT RELATED FACTORS

No.	Variable	Response Options
1.	Antibiotic initiation time	☐ Within 24 hours ☐ After 24 hours
3.	Delay in seeking care (per caregiver)	☐ Yes ☐ No
4.	Oxygen therapy given	☐ Yes ☐ No
5.	ICU admission	☐ Yes ☐ No
6.	Vaccination status	☐ Fully vaccinated ☐ Partially vaccinated ☐ Not vaccinated

PART 6: OUTCOME

No.	Variable	Response Options
1.	Length of hospital stay	☐ >5 days (prolonged stay) ☐ <=5 days (not prolonged)

Declaration of Investigator

I, the undersigned Pediatrics and Child Health Resident, declare that this Thesis is my original work in partial fulfillment of the requirement for the Specialty certificate in Pediatrics and Child Health to my best knowledge.

Name of investigator: Dr. Mubarek Redwan

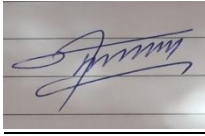
Signature: _____

Date: February/02/2026

Declaration of Advisors

We, the undersigned Advisors, declare that this Thesis is the investigator original work in partial fulfillment of the requirement for the Specialty certificate in Pediatrics and Child Health. We confirmed that this Thesis is ready for defense with our approval as the university Advisors.

Date of Submission: February/02/2026

Name of Advisors:	Signatures	Date
1. Dr. Bereket Belete (MD, Assistant professor of pediatrics and Child health)	_____	<u>February 02/2026</u>
2. <u>Dr. Gizachew Abdeta (MD, MPH)</u>		<u>February 02/2026</u>