

Health system factors contributing to mortality from pneumonia among children aged 5 years and below at Mubende Regional Referral Hospital. A cross-sectional study.

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Abstract

Background:

This study focused on determining health system factors contributing to mortality from pneumonia among children aged 5 years and below at Mubende Regional Referral Hospital.

Methods:

A descriptive cross-sectional study was adopted, employing quantitative data collection methods with the use of self-administered questionnaires to collect data. A simple random sampling technique was used to select 52 participants. Data were manually tallied and analyzed using Microsoft Excel, then presented in the form of tables, charts, and graphs for clarity.

Results:

The most, 22(42.31%) of the respondents were aged 1- 2 years, while the minority, 4(7.69%), were aged 6-12months. Most respondents, 32(61.54%), were Male children, while the least of the respondents, 20(38.46%), were female children. Regarding drugs and medical supplies, the availability of drugs and medical supplies was inconsistent. Findings further revealed that 69.23% of the respondents received all the recommended immunizations, while 30.77% did not receive all the recommended immunizations.

Conclusion:

Health facility factors include the distance of the health facility from home and the availability of medical supplies. Addressing these factors is critical to reducing pneumonia-related deaths.

Recommendations:

Prioritization of resource allocation and community sensitization to reduce pneumonia mortality in rural districts, strengthening caregiver education, improving immunization and nutrition programs, and expanding hospital capacity for pediatric pneumonia management.

Keywords: Health system factors, mortality, pneumonia, children aged 5 years and below, Mubende Regional Referral Hospital.

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Background

Pneumonia is a respiratory disease characterized by inflammation of the lung parenchyma and causes inflammation and fluid or pus accumulation in the alveoli of the lungs. This can make it more difficult for oxygen to enter circulation. Cough, fever, chills, and difficulty breathing are moderate to severe pneumonia symptoms. Fungi, bacteria, and viruses cause this infectious illness (Al-Dalfi et al., 2023).

Worldwide, there are about 1,400 cases of pneumonia per 100,000 children, or one case every 71 children per year (Al-Dalfi et al., 2023). Childhood death due to pneumonia

occurs disproportionately in low-and middle- income countries (LMICs), with the greatest number observed in South Asia and sub-Saharan African countries (Nasrin et al., 2022), having an estimated 61 million and 35 million annual cases of pneumonia in under-five children, respectively (Biruk Beletew et al., 2020).

Pneumonia incidence is high among children in South Asia, and it is the leading cause of hospitalization among children under five years of age in Bangladesh (Naheed et al., 2019). The African Region has the highest burden of global child mortality, 50% of worldwide deaths from pneumonia in this age group (Roble et al., 2024).

In Ethiopia, pneumonia is a leading single disease killing under-five children. It is estimated that 3,370,000 children encounter pneumonia annually, which contributes to 18% of all causes of death, killing over 40,000 under-five children every year (Leweyehu Alemaw Mengstie, 2022).

In East Africa, a study conducted in Uganda found that the incidence of severe pneumonia was 108 per 100,000 children under five years in 2022, based on routinely collected weekly national surveillance data (Wanyana et al., 2024a).

This remains a major public health concern, particularly in rural districts where access to healthcare is limited. Mubende Regional Referral Hospital, serving a large catchment area, has reported high mortality rates among pediatric pneumonia cases, raising concern about underlying contributing factors. This growing burden creates a need to understand the factors associated with mortality from pneumonia among children <5 years in order to implement effective evidence-based control and prevention strategies. This study sought to determine health system factors contributing to mortality from pneumonia among children aged 5 years and below at Mubende Regional Referral Hospital.

Methodology

Study design and rationale

The study employed a descriptive cross-sectional design to assess factors contributing to mortality from pneumonia among children aged 5 years and below at Mubende Regional Referral Hospital, Mubende District.

Study area

The study was conducted at Mubende Regional Referral Hospital, located in Mubende District, Central Uganda, located on Old Kampala Road, in the central business district of the municipality of Mubende, about 150 kilometers (93 mi) west of Mulago National Referral Hospital. This is approximately 148 kilometers (92 mi) east of Fort Portal Regional Referral Hospital. The coordinates of Mubende Hospital are 0°34'03.0" N, 3°23'35.0" E (Latitude:0.567496; Longitude: 31.393041).

Study population

Children aged five years and below admitted with pneumonia at Mubende Regional Referral Hospital, Caregivers of these children, and Health workers involved in pediatric care at the hospital who consented to participate in the study.

Sample Size Determination

Based on this, the desired sample size was calculated using the formula of Kish Leslie (1995).

$n = Z^2PQ/d^2$ Where n = desired sample size if target population is greater than 10,000; Z = standard normal deviation corresponding to a 95% confidence interval,

which is 1.96, P =Proportion of characteristics of target population approximated as 50 %, $Q = 1 - 0.5 = 0.5$

d = precision margin of error; in this case, 0.05. Hence, $z = 1.96$

$N = z^2pq/d^2$ $n = 1.96^2 \times 0.5 \times 0.5 / 0.05^2 = 384$

$n = 384$ Target population (N) = 60. Since the target population under study is less than 10,000, the formula is $n = n / 1 + (n / N)$ $n = 384 / 1 + (384 / 60)$ $n = 384 / 1 + 6.4$ $n = 384 / 7.4$

$n = 51.9$. Therefore, the desired sample size is 52

Sampling technique and rationale

This study employed a simple random sampling technique to select participants. In this method, each individual in the target population had an equal chance of being included in the sample, thereby reducing selection bias and enhancing representativeness. The choice of simple random sampling ensured that every eligible child within the hospital records had the same probability of selection. This strengthened the validity of the findings by providing a fair and unbiased representation of the study population.

Sampling procedure

During sampling, respondents were assigned identification codes, which were written on pieces of paper, folded, and placed into a container. The papers were thoroughly shuffled, and one was randomly picked, read, and recorded. After recording, the paper was returned to the container and reshuffled to maintain equal probability of selection. If the same code was picked more than once, the child previously assigned that code was confirmed as a participant, and the paper was returned for subsequent draws. This process was repeated until the required sample size of 52 participants was obtained.

Inclusion and Exclusion Criteria

Caregivers of children under five admitted with pneumonia at Mubende Regional Referral Hospital who consented to participate were included in the study. Those who were severely ill, those with bias, and those unable to understand any language were excluded.

Study variables

The independent variables in this study included health system factors that may influence care-seeking behavior and management of childhood pneumonia.

The dependent variable included pneumonia-related outcomes among children under five, specifically mortality associated with pneumonia cases at Mubende Regional Referral Hospital.

Data collection tool

Semi-structured questionnaires with predominantly closed-ended questions were utilized as the primary data collection

tool. The questionnaires were written in simple and clear language to ensure comprehension by literate caregivers of children under five admitted with pneumonia at Mubende Regional Referral Hospital. For respondents who were unable to read or write, the research assistants assisted in interpreting the questionnaires, thereby ensuring equal participation opportunities and minimizing exclusion bias. This approach enhanced the reliability of responses while accommodating the diverse literacy levels within the study population.

Data collection method and procedure

A semi-structured, administered questionnaire was used to collect data from caregivers of children under five admitted with pneumonia at Mubende Regional Referral Hospital. The questionnaire was designed to capture quantitative information relevant to the study objectives. It included multiple-choice questions, where respondents selected the most appropriate option from those provided.

The research committee of Mildmay Institute of Health Sciences issued a letter authorizing the researcher to obtain permission from the hospital administration. This facilitated coordination with the in-charge of the pediatric ward to identify eligible caregivers of children under five admitted with pneumonia at Mubende Regional Referral Hospital.

To uphold ethical standards, informed consent was obtained from all participants. Caregivers were provided with clear information about the study and voluntarily signed consent forms, with the option to withdraw at any stage without penalty. Unique identification codes were assigned to participants to maintain confidentiality and protect their privacy.

During data collection, semi-structured questionnaires were distributed. For illiterate respondents, the research assistants helped in the interpretation of the questionnaires to ensure equal participation opportunities. The questionnaires were completed by marking small boxes corresponding to the selected responses. After completing the questionnaires, participants were encouraged to ask questions about the study, reinforcing the importance of their involvement and highlighting potential benefits for themselves, the community, and the country.

Participation was entirely voluntary, with no obligations attached, and withdrawal carried no consequences.

Data analysis and presentation.

The collected data was first manually analyzed using statistical tally sheets to ensure accuracy and completeness. Responses were then coded and entered into Microsoft Excel software for further processing. Descriptive statistics were employed to summarize the data, with results presented in the form of frequency distribution tables, pie charts, and bar graphs. These visual presentations provided

a clear overview of the findings and facilitated comparison across variables.

Quality control

To ensure the validity and reliability of the study, several quality control measures were implemented, and these included;

Pretesting of the Research Tool: The questionnaire was pretested at Kiboga General Hospital on respondents who were not part of the main study, under the guidance of the supervisor. This was used to confirm that the tool captured only the required information in line with the specific objectives. The pretest helped to identify ambiguities and errors, allowing for adjustments to be made before the actual data collection.

Training of Research Assistants: Research assistants were trained on the objectives of the study a day before data collection and were equipped with the necessary skills for administering questionnaires and assisting illiterate respondents. This training helped save time and minimize disruption to the community's normal activities.

Time Allocation: Adequate time was allocated for data collection, with approximately 20 minutes given to literate respondents and 30 minutes to illiterate respondents, ensuring accuracy and completeness of responses.

Observation of Standard Operating Procedures (SOPs): Confidentiality, privacy, and adherence to community policies were strictly observed. Hand hygiene practices were maintained throughout the process to prevent cross-infection.

Ethical consideration

An introductory letter from the Dean of the School of Clinical Officers was presented to the hospital administrator, who subsequently introduced the investigator to the in-charge of the pediatric ward and participants, children under five admitted with pneumonia at Mubende Regional Referral Hospital. Informed consent was obtained from all participants. Caregivers were clearly informed about the purpose of the study, their right to confidentiality, and their freedom to withdraw at any stage without penalty. Consent forms were signed voluntarily, and participants were assured that their information remained private and confidential.

During data collection, questionnaires were distributed to literate caregivers, while illiterate caregivers were guided by the research assistants to ensure equal participation opportunities. This approach minimized exclusion bias and safeguarded the rights of all respondents.

The ethical procedures adopted in this study emphasized respect for participants, voluntary participation, confidentiality, and privacy. These measures ensured that the research was conducted in line with established ethical standards and protected the dignity of the study population.

Results

Socio-demographic factors contributing to mortality from pneumonia among children aged five years and below.

Table 1: Showing the socio-demographic characteristics.

Variable	Category	N	%
Age of Child (n=52)	< 6 months	10	19.23
	1–2 years	22	42.31
	3–5 years	16	30.77
Sex of Child (n=52)	Male	32	61.54
	Female	20	38.46
Child Born at Time of Delivery	Yes	39	75.00
	No	13	25.00

From Table 1, the most (22 (42.31%)) of the respondents were aged 1- 2 years, while the minority (4 (7.69%)) were aged 6-12months. Most respondents, 32(61.54%), were Male children, while the least number of respondents, 20(38.46%), were female children. Regarding the time of delivery, the majority, 39(75.00%), of the respondents were born at the actual time of delivery, and the least, 13(25.00%), were born before the time of delivery.

Figure 1: Showing distribution by number of times the child had pneumonia.

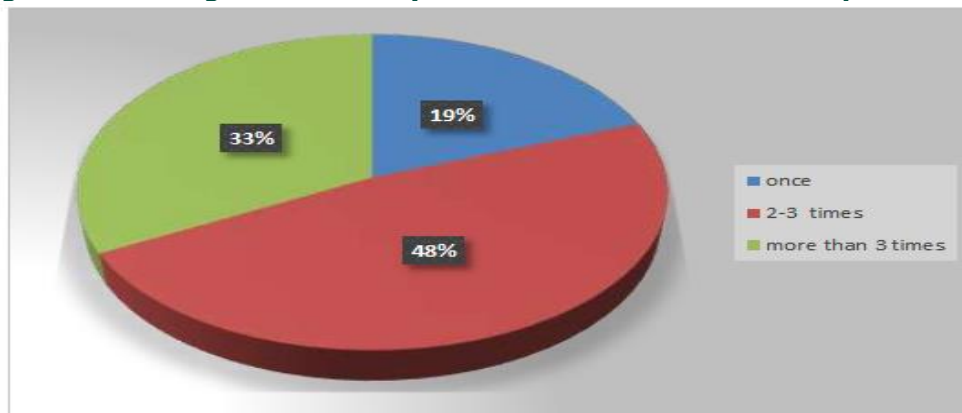
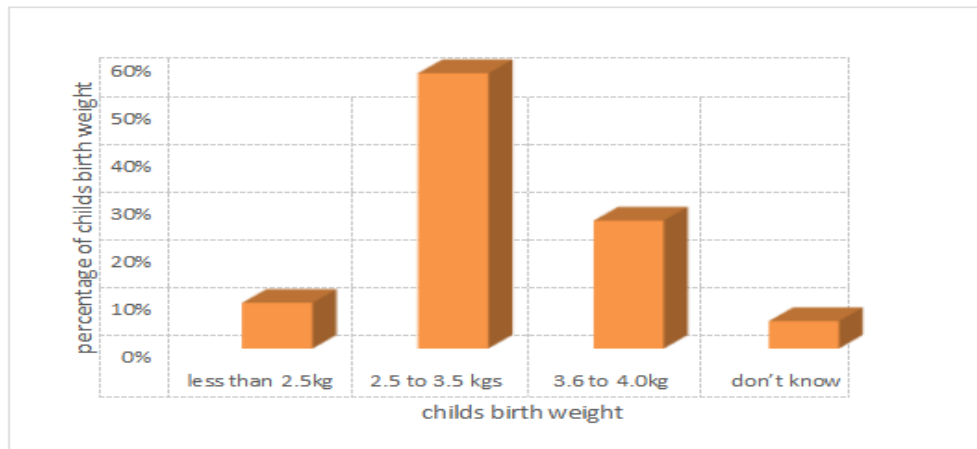


Figure 1 shows that the most, 25(48.08%), of the respondents have had pneumonia 2-3 times, and the least, 10(19.23%), have had pneumonia once.

Figure 2: Showing distribution by child's weight.



Based on Figure 2, the majority, 30(57.69%), of the respondents had a birth weight between 2.5kg to 3.5kg and the least, 3(5.77%), of the respondents, the caregivers didn't know the birth weight.

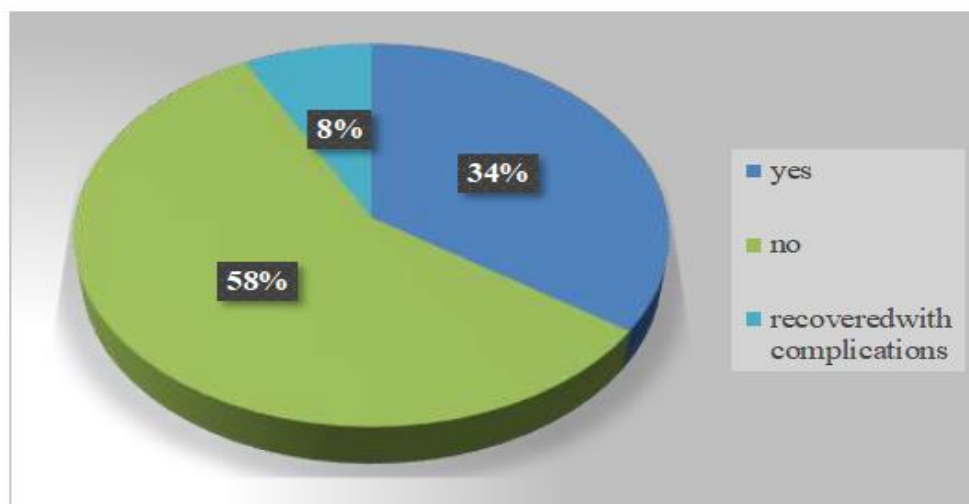
Health facility factors contributing to mortality from pneumonia among children aged five.
Table 2: Showing hospital factors.

Variable	Category	n	%
Distance from Hospital (n=52)	< 5 km	18	34.62
	5–10 km	24	46.15
	> 10 km	10	19.23
Travel Time to Hospital (n=52)	< 30 min	18	34.62
	30–60 min	27	51.92
	> 1 hour	7	13.46
Availability of Drugs and Medical Supplies (n=52)	Always Available	13	25.00
	Sometimes Available	19	36.54
	Rarely Available	15	28.85
	Not Available	5	9.61

From the table 2, most 24(46.15%) of the respondents live 5-10km away from Mubende regional referral hospital while minority 10(19.23%) of the respondents live more than 10km away from Mubende regional referral hospital. Regarding the time taken to reach the hospital, the majority of respondents, 27(51.92%), take 30-60 minutes, while the

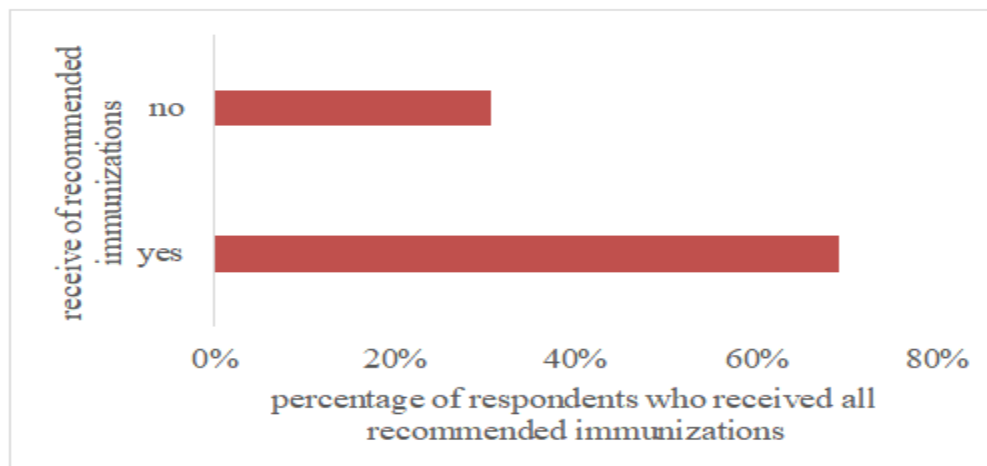
least number of respondents, 07(13.46%), take more than 1 hour to reach the hospital. Regarding drugs and medical supplies available during the stay at the hospital, most (19 (36.54%) of the respondents said sometimes it's available, and the least (0.5 (9.61%) of the respondents said not available.

Figure 3: Showing whether children faced challenges accessing health services.



The majority, 30(57.69%) of respondents, didn't face challenges while accessing health services, and the least, 04(7.69%) of the respondents, recovered with complications.

Figure 4: Showing respondents who received all recommended immunizations.



According to Figure 4, the majority, 36(69.23%), of the respondents received all the recommended immunizations, and the most, 16(30.77%), of the respondents didn't receive all the recommended immunizations.

Discussion

Health facility factors contributing to mortality from pneumonia among children aged five

Regarding the time taken to reach the hospital, 51.92% of respondents take 30-60 minutes, while 13.46% of respondents take more than 1 hour to reach the hospital. These findings suggest that while most caregivers can reach the hospital within an hour, delays in care may still occur due to Physical access barriers, and walking or reliance on limited transport options may prolong travel time and delay arrival. This aligns with a study in Nekemte town, Ethiopia, where mothers/Caregivers who moved less than 1 h to reach the nearby health facility for healthcare seeking, 49.27% sought a health facility just after 24 hours of symptom recognition (Temesegen et al., 2023). This comparison shows that even when travel times are relatively short, delays in care-seeking remain common, influenced by both physical access and caregiver behavior. Further, 69.23% of the respondents received all the recommended immunizations, and 30.77% of the respondents did not receive all the recommended immunizations. The findings suggest that immunization coverage is relatively strong but not universal. This is consistent with the study done in Kiryandongo General Hospital, Uganda, where, out of all the children with pneumonia interviewed, 36.9% had not received immunization for their appropriate ages, 9.7% were born before 37 weeks of gestation, and 48.2% were not breastfed exclusively for 6 months (Mugume, 2019). These findings show that while immunization coverage is improving nationally, gaps in vaccine uptake remain a challenge, particularly among children with pneumonia. The persistence of unimmunized children may be explained by Access barriers, such as distance to health facilities and vaccine stock-outs may limit timely immunization; knowledge gaps in Caregivers may cause a lack of awareness of the importance of completing immunization schedules.

Conclusion

The findings revealed that pneumonia mortality is influenced by a combination of health facility factors (long distance to health facilities, limited resources at the hospital, and delayed treatment initiation). Thus, pneumonia remains a major public health burden in Mubende District, reflecting both biological vulnerability and systemic gaps in healthcare delivery.

Recommendation

The Ministry of Health should strengthen immunization programs, ensuring full coverage of pneumococcal conjugate vaccine (PCV) and other essential vaccines. Integrate pneumonia prevention into broader child health strategies, prioritizing high-burden districts such as

Mubende. Support Village Health Teams (VHTs) to conduct household sensitization and follow-up for at-risk children. Increase funding for pneumonia surveillance and monitoring systems to guide evidence-based interventions. Health facilities should expand staffing and resources in pediatric and emergency units to reduce delays in diagnosis and treatment. Establish outreach clinics and mobile health services to improve access for rural families. Strengthen triage systems and emergency response protocols for severe pneumonia cases. Enhance health education programs within the hospital to sensitize caregivers during routine visits.

Implications for health professional practice, hospital management, and clinical staff

Pneumonia mortality among children under five years at Mubende Regional Referral Hospital is linked to gaps in caregiver practices and facility support. Hospital management and clinical staff should prioritize early detection, timely treatment, and caregiver guidance, with special attention to children less than five years. Health workers should also provide Completion of antibiotic courses, Promotion of breastfeeding and adequate nutrition, family-centered education on medication adherence and infection prevention, and early recognition of danger signs.

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List of abbreviations

ARI: Acute Respiratory Infection
HIV: Human Immunodeficiency Virus
IMCI: Integrated Management of Childhood Illness
PCV: Pneumococcal Conjugate Vaccine
UNICEF: United Nations International Children's Emergency Fund
WHO: World Health Organization

Source of funding

The study was not funded.

Conflict of interest

No conflict of interest declared.

Author contributions

SM: Conceptualization, Methodology, Investigation, Writing—original draft.

HN: Data curation, Formal analysis, Visualization.

FS: Formal analysis, Visualization.

IPN: Writing review and editing

JFN: Supervision, Validation.

All authors: Approved the final version of the manuscript and agreed to be accountable for the work.

Data availability

Data are available upon request.

Informed consent

Written informed consent was obtained from all participants prior to their inclusion in the study. Participants were informed about the purpose of the study, procedures involved, potential risks and benefits, and their right to withdraw at any time without penalty.

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