

Maternal knowledge of childhood pneumonia among mothers of under-five children in Khulna, Bangladesh

Sabikunnahar Eva¹, Smrity Biswas¹, Most. Hashi Khatun¹, Shahanara Khatun¹, Rupa Sarkar¹, Tripti Biswas¹, Rahima Akter¹, Mst. Nasima Khatun¹, Mahmuda Akter Lima¹, Jakia Sultana¹, Rikta Khatun¹, Prokash Kumar Biswas¹, Lakshmi Basak^{2*}

¹Department of Public Health Nursing, Khulna Nursing college, Khulna, Bangladesh

²Nursing instructor, Khulna Nursing college, Khulna, Bangladesh

ARTICLE INFO

Article history

Received: 20 July 2026

Accepted: 25 September 2026

Published: 15 October 2026

Keywords

Childhood pneumonia, maternal knowledge, pneumonia prevention, under-five children, health education, Bangladesh

Corresponding Author

Lakshmi Basak

Email:

lakshmiBasak83@gmail.com

ABSTRACT

Childhood pneumonia remains an important cause of morbidity and mortality, particularly in low- and middle-income settings. Maternal recognition of symptoms, danger signs, preventive measures, and appropriate care-seeking may support earlier management and prevention. To assess the level of knowledge regarding prevention of pneumonia among mothers of under-five children attending Khulna Shishu Hospital, Khulna. A descriptive cross-sectional study was conducted at Khulna Shishu Hospital, Khulna, Bangladesh, during January-December 2025. Mothers of under-five children were selected using purposive sampling. Data were collected through face-to-face interviews using a pre-tested, structured questionnaire administered in Bangla. The questionnaire covered sociodemographic characteristics, child-related information, and maternal knowledge of pneumonia, including symptoms, danger signs, management, and preventive measures. A total of 250 mothers were included in the final analysis. Descriptive statistics were reported as frequencies and percentages. The mean maternal age was 26.72 years, and 53.2% of mothers were aged 21-30 years. Most mothers were housewives (81.2%), while 49% had secondary education. Pneumonia had most commonly been heard about by health workers (44%). Seventy percent identified pneumonia as a lung infection. Eighty-two percent identified cough with chest indrawing as a common symptom, 71% recognized that pneumonia has danger signs, and 89% reported that a child with pneumonia symptoms should be taken to hospital immediately. Fifty-seven percent believed complete immunization could prevent pneumonia, 63% recognized the preventive value of exclusive breastfeeding and a balanced diet, and 24% identified handwashing with soap as a preventive practice. Overall, 31% of mothers were categorized as having good knowledge, 15% very good, 6% excellent, 22% average, and 26% below average knowledge. The findings indicate substantial awareness of some core features of childhood pneumonia but important gaps in several preventive domains, particularly hand hygiene and comprehensive recognition of prevention measures. Strengthened, targeted health education through health facilities and community-based services may help address these gaps.

1. Introduction

Pneumonia remains a major cause of illness and death among children under five years of age, particularly in low- and middle-income countries. Although substantial progress has been made in reducing childhood mortality globally, lower respiratory infections continue to contribute substantially to preventable child deaths. Recent global estimates indicate that lower respiratory infections accounted for approximately 2.50 million deaths worldwide in 2023, with children younger than five years remaining one of the most heavily affected age groups (GBD 2023 Lower Respiratory Infections and Antimicrobial Resistance Collaborators, 2026). UNICEF similarly identifies pneumonia as the leading infectious cause of death among children under five, with more than 700,000 child deaths occurring annually. The burden is disproportionately concentrated in South Asia and sub-Saharan Africa, where socioeconomic

disadvantage, undernutrition, environmental exposures, and unequal access to health services continue to influence childhood pneumonia outcomes (UNICEF, n.d.).

Pneumonia is largely preventable and treatable when appropriate preventive measures, early recognition, and timely management are available. The World Health Organization (WHO) recommends a comprehensive approach that includes vaccination, adequate nutrition, exclusive breastfeeding during the first six months of life, reduction of exposure to household air pollution and tobacco smoke, and timely access to appropriate healthcare (World Health Organization, 2024). The updated WHO guideline on pneumonia and diarrhoea emphasizes early recognition of severe illness and appropriate management at both community and health-facility levels. These strategies are particularly important for young children because delayed recognition of danger signs and delayed care-seeking can allow a

potentially treatable respiratory infection to progress to severe disease.

Several household and environmental conditions increase children's vulnerability to respiratory infections. Overcrowding, indoor smoking, use of polluting cooking fuels, inadequate sanitation, and poor living conditions have been associated with increased risk of acute respiratory infections among young children. Evidence from Bangladesh is particularly relevant to the present study. A hospital-based case-control study in Dhaka found that overcrowding, unclean cooking fuels, household smoking, and unimproved sanitation were associated with increased odds of acute respiratory infection among children aged 6-59 months, while exclusive breastfeeding was associated with a lower risk (Islam et al., 2024). These findings demonstrate that childhood pneumonia prevention cannot depend solely on clinical treatment; household practices and the knowledge of caregivers also have an important role in reducing children's exposure to preventable risk factors.

Nutrition and breastfeeding are also important components of pneumonia prevention. A recent umbrella review of systematic reviews and meta-analyses found highly suggestive evidence that non-exclusive breastfeeding is associated with an increased risk of pneumonia among children under five years of age (Abate et al., 2025). Adequate nutrition and breastfeeding may therefore contribute to improved resistance to infection and better outcomes when respiratory illness occurs. Similarly, vaccination remains a central component of pneumonia prevention because several important bacterial and viral causes of severe childhood respiratory disease are vaccine-preventable (World Health Organization, 2024).

In addition to preventive practices, caregivers' ability to recognize symptoms and seek appropriate care is an important component of childhood pneumonia control. A systematic review of studies from low- and middle-income countries identified limited knowledge of pneumonia symptoms, risk factors, and appropriate healthcare-seeking as continuing barriers to effective pneumonia prevention and management (Selvi & Vaithilingan, 2024). Evidence from Bangladesh also indicates that healthcare-seeking for childhood respiratory illness is influenced by caregiver and household characteristics. Analysis of nationally representative Bangladesh Multiple Indicator

Cluster Survey data found that a proportion of caregivers did not seek treatment when children experienced acute respiratory infection symptoms, highlighting continuing gaps in appropriate healthcare utilization (Al Fidah et al., 2024). The Bangladesh Demographic and Health Survey 2022 further reported that advice or treatment was sought for 84% of children under five who had symptoms of acute respiratory infection, indicating that a meaningful proportion of affected children may still not receive professional care (National Institute of Population Research and Training (NIPORT, 2024).

Bangladesh has made considerable progress in improving child survival, with the national under-five mortality rate declining substantially over recent decades. However, pneumonia remains an important contributor to childhood morbidity and mortality, and persistent differences in household conditions, maternal education, health knowledge, and healthcare access may influence children's risk and outcomes. Recent evidence from Bangladesh also demonstrates that maternal and caregiver characteristics are relevant to healthcare-seeking and childhood respiratory health. In Chattogram, a cross-sectional study among parents of hospitalized children found substantial awareness of childhood pneumonia but also identified variation in knowledge, attitudes, and practices related to pneumonia prevention and management (Islam et al., 2023). Such findings support the need for context-specific assessment of caregivers' knowledge rather than assuming that national improvements in child health automatically translate into adequate household-level knowledge and preventive practices.

Mothers frequently play a central role in recognizing childhood illness, implementing preventive practices, and deciding when and where to seek healthcare. Their knowledge regarding the causes, symptoms, danger signs, immunization, breastfeeding, hygiene, environmental exposures, and appropriate care-seeking for pneumonia may therefore influence the timeliness and appropriateness of responses to childhood respiratory illness. Assessing maternal knowledge at the point of contact with pediatric health services can help identify specific information gaps that may be addressed through targeted health education and counselling.

Despite improvements in childhood health indicators in Bangladesh, evidence regarding

mothers' knowledge of pneumonia prevention remains limited and geographically uneven. Local evidence is particularly important because knowledge, health beliefs, household practices, and access to health information may vary across communities. Therefore, assessing mothers' knowledge in a pediatric hospital setting can provide useful information for developing focused educational interventions and strengthening preventive child-health services.

The present study was conducted to assess maternal knowledge regarding childhood pneumonia prevention among mothers of children under five years of age attending Khulna Shishu Hospital, Khulna, Bangladesh. The assessment included mothers' knowledge of pneumonia, its common symptoms and danger signs, appropriate initial management, and measures for prevention, as these aspects represent important components of knowledge relevant to the recognition and prevention of pneumonia and timely care-seeking.

2. Materials and methods

2.1. Study design and setting

A descriptive cross-sectional study was conducted at Khulna Shishu Hospital, K.D. Ghos Road, Khulna, Bangladesh. The hospital was described in the thesis as a specialized pediatric facility and a referral center serving children from the surrounding region.

2.2. Study period and population

The study was conducted from January to December 2025 at Khulna Shishu Hospital, Khulna, Bangladesh. The study population comprised mothers of children aged 0-59 months who attended Khulna Shishu Hospital during the study period and met the predefined eligibility criteria. Mothers who were willing to participate and available during the data-collection period were considered eligible for participation.

2.3. Sampling and sample size

A non-probability purposive sampling technique was used to recruit mothers of children under five years of age who met the eligibility criteria and were available during the study period. The initial sample size was estimated using the single-population proportion formula:

$$n = Z^2pq/d^2$$

where n is the required sample size, Z is the standard normal deviate corresponding to a 95% confidence level (1.96), p is the anticipated proportion, $q = 1 - p$, and d is the desired margin of error (0.05). Because no reliable prior estimate of the proportion of mothers with adequate knowledge regarding pneumonia prevention was available for the study setting, p was set at 0.50 and q at 0.50 to obtain the maximum required sample size.

Using these assumptions, the calculated sample size was 384 participants. However, because of practical constraints, including the available time and study budget, the investigators were able to recruit 250 eligible mothers during the study period. Therefore, 250 participants constituted the final sample analyzed in this study.

The final sample should be considered a feasibility-based sample rather than a statistically representative sample of all mothers of under-five children in Khulna or Bangladesh. Given the single-center setting and purposive sampling approach, the findings should be interpreted within the context of the study population and should not be generalized to the wider population without caution.

2.4. Eligibility criteria

Mothers of children aged 0-59 months who attended Khulna Shishu Hospital during the study period, were available at the time of data collection, and were willing to participate were included in the study. Mothers who refused participation, were unavailable during data collection, or were ill at the time of the interview were excluded.

2.5. Data collection instrument and procedure

Data were collected using a structured, interviewer-administered questionnaire developed for the purpose of assessing mothers' knowledge regarding pneumonia and its prevention among children under five years of age. The questionnaire was administered face-to-face in Bangla. The English version was translated into Bangla and subsequently back-translated to English to maintain consistency of meaning. Before the main data collection, the questionnaire was pretested among 25 mothers with characteristics similar to

those of the study participants. Feedback obtained during the pretest was considered in finalizing the questionnaire. The questionnaire was also reviewed by teachers and subject experts for clarity, relevance, and appropriateness of the items. The questionnaire included questions addressing mothers' knowledge of pneumonia, including its definition, common symptoms, danger signs, immediate management, immunization, breastfeeding and nutrition, environmental risk factors, and preventive measures. Responses such as "don't know" were retained as response options during data collection.

No previously validated standardized questionnaire or established psychometric instrument was documented in the source materials. In addition, a numerical reliability coefficient, such as Cronbach's alpha, was not calculated or reported for the questionnaire. Therefore, the instrument should be considered a study-specific questionnaire that underwent pretesting and expert review rather than a formally validated knowledge scale.

2.6. Assessment of maternal knowledge

Maternal knowledge regarding pneumonia prevention was assessed using the knowledge-related items included in the study questionnaire. The manuscript originally classified participants into five categories according to percentage scores: excellent (90–100%), very good (80–89%), good (70–79%), average (60–69%), and below average (<60%).

However, the source materials do not provide sufficient documentation of the number of knowledge items, the score assigned to each individual response, the maximum possible score, or the exact formula used to derive the percentage score. Consequently, these methodological details could not be independently verified from the study records available for manuscript preparation. The five categories are therefore reported as the categories used in the original study rather than as a validated or standardized knowledge classification system.

Because the questionnaire was not documented as a previously validated instrument and no numerical reliability coefficient was reported, the knowledge classification should be interpreted cautiously. The assessment reflects the responses obtained using the study-specific questionnaire and should not be

considered a formally validated psychometric measure.

The knowledge assessment covered several domains relevant to childhood pneumonia, including the definition of pneumonia, common symptoms, danger signs, appropriate initial management, and preventive measures. Knowledge of symptoms and danger signs was included because recognition of pneumonia-related illness is relevant to timely care-seeking, while knowledge of appropriate management and preventive measures reflects mothers' understanding of actions relevant to reducing the potential consequences and risk of pneumonia. These domains were therefore considered components of the broader maternal knowledge construct assessed in the study.

2.7. Statistical analysis

Data were entered, coded, and analyzed using IBM SPSS Statistics version 21. Descriptive statistics were used to summarize the characteristics of the participants and their responses. Categorical variables were presented as frequencies and percentages. Maternal age was summarized using the mean, as reported in the original study. No inferential statistical tests were performed because the study objective was descriptive and focused on assessing maternal knowledge regarding childhood pneumonia prevention.

The available study documentation does not specify a formal assessment of the distribution of maternal age, the use of median and interquartile range, or a predefined procedure for handling missing data. Therefore, these procedures are not reported as having been performed. The completeness of the dataset and any missing observations should be verified against the original data file before final submission.

2.8. Ethical considerations

Ethical approval for the study was obtained from the Ethical Committee/Institutional Review Board of Khulna Nursing College (No.). Official permission was also obtained from the relevant authority of Khulna Shishu Hospital before data collection. Written informed consent was obtained from each participant after explaining the purpose and procedures of the study. Participation was voluntary, and participants were informed that they could decline to participate. Confidentiality and

privacy of the information provided by participants were maintained throughout the study.

The ethics approval number and date were not documented in the study materials available for manuscript preparation. If available in the original ethics approval document, these details should be added to the manuscript, together with the committee's exact official name.

3. Results

A total of 250 mothers of children under five years of age were included in the final analysis. The findings are presented according to maternal sociodemographic characteristics, child-related characteristics, maternal knowledge of childhood pneumonia and its recognition and initial management, knowledge of pneumonia-prevention measures, and the reported overall knowledge categories

3.1. Maternal sociodemographic characteristics

The mean age of the mothers was 26.72 years. More than half of the participants (53.2%) were aged 21–30 years, followed by 23.2% aged 31–40 years and 22.4% aged below 20 years. Only 1.2% of mothers were older than 40 years.

Most participants were Muslim (68.8%), while 29.2% were Hindu and 2.0% were Christian. Regarding educational attainment, 48.8% had completed secondary education, 24.8% had primary education, 15.6% had higher secondary education, and 10.8% had higher education. The majority of mothers were housewives (81.2%), while 12.8% were engaged in service, 2.4% in business, and 3.6% reported other occupations.

Regarding monthly family income, 44.4% of participants reported an income of BDT 10,000–19,999, followed by 20.8% reporting BDT 20,000–29,999, 19.2% reporting less than BDT 10,000, and 16.0% reporting BDT $\geq$ 30,000. In terms of housing material, 44.8% lived in semi-pucca houses, 28.0% in pucca houses, and 27.2% in kutcha houses (Table 1).

Table 1. Maternal sociodemographic characteristics (N=250).

Characteristic	Category	n	%
Maternal age	<20 years	56	22.4
	21–30 years	133	53.2
	31–40 years	58	23.2
	>40 years	3	1.2
Religion	Muslim	172	68.8
	Hindu	73	29.2
	Christian	5	2
Education	Primary	62	24.8
	Secondary	122	48.8
	Higher secondary	39	15.6
	Higher education	27	10.8
Occupation	Housewife	203	81.2
	Service	32	12.8
	Business	6	2.4
	Other	9	3.6
Monthly family income	<10,000 BDT	48	19.2
	10,000–19,999 BDT	111	44.4
	20,000–29,999 BDT	52	20.8
	$\geq$ 30,000 BDT	39	16
Housing material	Pucca	70	28
	Semi-pucca	112	44.8
	Kutcha	68	27.2

3.2. Child-related characteristics and reported feeding and smoke exposure

Among the children, 30.0% were aged 13–24 months, 28.0% were aged 0–6 months, 28.0% were

aged 7–12 months, and 14.0% were aged 25–60 months. Regarding sex, 56.0% of the children were male, 43.6% were female, and 0.4% were reported in the other category.

Regarding immunization status, 46.8% of children were reported as fully immunized, 41.2% as partially immunized, and 10.8% as not immunized; 1.2% of mothers did not know the child's immunization status. With regard to feeding, 46.8% of children were reported to receive exclusive breastfeeding, 32.8% mixed feeding,

11.2% exclusive formula feeding, and 9.2% complementary feeding.

Indoor smoke exposure was reported for 38.0% of children, while 62.0% were reported not to have indoor smoke exposure (Table 2).

Table 2. Child-related characteristics and reported feeding/smoke exposure (N=250).

Child characteristic	Category	n	%
Age	0–6 months	70	28.0
	7–12 months	70	28.0
	13–24 months	75	30.0
	25–60 months	35	14.0
Sex	Female	109	43.6
	Male	140	56.0
	Other	1	0.4
Immunization	Fully immunized	117	46.8
	Partially immunized	103	41.2
	Not immunized	27	10.8
	Don't know	3	1.2
Feeding	Exclusive breastfeeding	117	46.8
	Mixed feeding	82	32.8
	Exclusive formula feeding	28	11.2
	Complementary feeding	23	9.2
Indoor smoke exposure	Yes	94	38
	No	156	62

3.3. Maternal knowledge of Pneumonia, symptoms, danger signs, and initial management

Health workers were the most frequently reported source of information about pneumonia (44.0%), followed by family members (24.0%) and media sources (24.0%); 8.0% reported other sources.

Regarding the definition of pneumonia, 70.0% of mothers identified it as a lung infection. However, 18.0% identified it as a type of fever, 2.8% as a stomach disease, and 9.2% did not know the definition.

Cough with chest indrawing was identified as a common symptom by 82.0% of mothers. Other responses included high fever (13.0%), diarrhea (2.0%), and “don't know” (3.0%). Overall, 71.0% of mothers reported recognizing danger signs of pneumonia, whereas 29.0% did not.

When asked about the first management action for a child with pneumonia symptoms, 89.0% selected taking the child to a hospital immediately. Smaller proportions selected waiting and seeing (6.0%), using home remedies or consulting a traditional healer (4.0%), or visiting a pharmacy/medicine shop (1.0%) (Table 3).

Table 3. Maternal knowledge of pneumonia, symptoms, danger signs, and initial management (N=250).

Knowledge domain	Response	n	%
Source of information	Health worker	110	44
	Family	60	24
	Media	60	24
	Other	20	8
Definition of pneumonia	Lung infection	175	70
	Type of fever	45	18
	Stomach disease	7	2.8
	Don't know	23	9.2

Common symptom	Cough with chest indrawing	205	82
	Diarrhea	4	2
	High fever	33	13
	Don't know	8	3
Danger signs recognized	Yes	177	71
	No	73	29
First management action	Take to hospital immediately	223	89
	Home remedies/traditional healer	10	4
	Wait and see	14	6
	Pharmacy/medicine shop	3	1

3.4. Maternal knowledge of pneumonia-prevention measures

Knowledge of selected pneumonia-prevention measures varied across individual items. Regarding immunization, 57.0% of mothers identified complete immunization as a measure that can prevent pneumonia, whereas 20.0% responded “no” and 23.0% did not know.

Regarding feeding and nutrition, 63.0% recognized that exclusive breastfeeding and a balanced diet can help prevent pneumonia, while 18.0% responded “no” and 19.0% did not know.

For specific pneumonia-prevention measures, 24.0% identified handwashing with soap, 60.0%

identified keeping the child warm, and 11.0% identified avoiding tobacco smoke or indoor pollution. Five percent did not know the relevant preventive measure.

Furthermore, 64.0% of mothers recognized that avoiding overcrowded and poorly ventilated living conditions could reduce the risk of pneumonia. Eighteen percent were unsure and 18.0% did not know.

These findings represent maternal knowledge or recognition of pneumonia-prevention measures and do not indicate whether the mothers actually practiced these measures in their households.

Table 4. Maternal knowledge of pneumonia-prevention measures among mothers of under-five children (N = 250)

Preventive knowledge item	Response	n	%
Complete immunization can prevent pneumonia	Yes	142	57
	No	50	20
	Don't know	58	23
Exclusive breastfeeding and balanced diet help prevent pneumonia	Yes	157	63
	No	45	18
	Don't know	48	19
Knowledge of pneumonia-prevention measures	Handwashing with soap	60	24
	Keeping child warm	150	60
	Avoiding tobacco smoke/indoor pollution	27	11
	Don't know	13	5
Avoiding overcrowded/poorly ventilated living conditions reduces risk	Yes	160	64
	Not sure	45	18
	Don't know	45	18

Willing to participate in pneumonia-prevention education	Yes	237	94.8
	No	13	5.2

3.5. Overall maternal knowledge category

The reported overall maternal knowledge distribution was as follows: 6.0% of mothers were classified as having excellent knowledge (90–100%), 15.0% as very good (80–89%), 31.0% as good (70–79%), 22.0% as average (60–69%), and 26.0% as below average (<60%).

Thus, 52.0% of mothers were classified within the good, very good, or excellent categories, while 48.0% were classified as average or below average. Because the original study documentation does not provide the individual scoring algorithm, maximum possible score, or raw knowledge scores, these categories are reported as documented in the original study and were not independently recalculated (Table 5).

3.6 Willingness to receive pneumonia-prevention education

Most mothers (94.8%) expressed willingness to participate in pneumonia-prevention education, whereas 5.2% reported that they were not willing to participate (Table 4).

Table 5. Overall maternal knowledge category as reported in the thesis (N=250).

Knowledge category	% of mothers
Excellent (90–100%)	6
Very good (80–89%)	15
Good (70–79%)	31
Average (60–69%)	22
Below average (<60%)	26

4. Discussion

This study assessed maternal knowledge regarding childhood pneumonia prevention among 250 mothers of children under five years of age attending Khulna Shishu Hospital, Bangladesh. Overall, the findings demonstrate a mixed pattern of knowledge. Mothers showed relatively high recognition of pneumonia-related symptoms, danger signs, and the need for professional care, whereas recognition of several household-level preventive measures was considerably lower. This

pattern suggests that mothers may recognize pneumonia as an illness requiring treatment more readily than they recognize the broader range of measures that can contribute to its prevention.

Health workers were the most frequently reported source of pneumonia-related information (44%), followed by family members and mass media. This finding highlights the potential importance of health professionals as a source of maternal health education. Previous work from Bangladesh has also demonstrated the contribution of organized health education to maternal knowledge of acute respiratory infections. A large cross-sectional study of mothers in rural Bangladesh reported that an acute respiratory infection control programme was associated with improved maternal knowledge of clinical signs and preventive measures. The high proportion of mothers in the present study identifying health workers as their information source, together with the 94.8% willingness to participate in pneumonia-prevention education, therefore suggests an important opportunity for strengthening education through routine child-health services. However, because the present study was descriptive and did not evaluate the effectiveness of different information sources, no causal relationship between health-worker contact and knowledge can be established.

Seventy percent of mothers correctly identified pneumonia as a lung infection, while 82% identified cough with chest indrawing as a common symptom and 71% recognized that pneumonia has danger signs. These findings indicate relatively substantial recognition of clinically important features among the participating mothers. However, evidence from other Bangladesh studies indicates that maternal recognition of pneumonia can vary considerably according to population and study setting. In a qualitative study among rural Bangladeshi mothers of children with pneumonia, most participants had difficulty identifying whether their child had pneumonia, and only a minority could describe relevant clinical signs and symptoms before the child's illness. Differences between those findings and the present study may partly reflect differences in study population, setting, questionnaire approach, and timing of assessment. The present

study was conducted among mothers attending a pediatric hospital, whereas the earlier Bangladesh study focused on rural mothers whose children had experienced pneumonia. Hospital attendance may provide greater exposure to health professionals and health information. In addition, differences in measurement instruments and definitions of knowledge may influence the observed proportions.

A particularly notable finding was that 89% of mothers selected immediate hospital care as the first response to pneumonia symptoms. This finding suggests a relatively strong reported intention or knowledge of the appropriate response among participants. It should not, however, be interpreted as evidence that 89% of mothers actually sought timely professional care when their children developed pneumonia. Research from rural Bangladesh has shown that actual care-seeking can be affected by factors including perceptions of illness severity, financial constraints, distance to health facilities, family decision-making, and reliance on non-formal providers. Therefore, the high proportion selecting immediate hospital care in the present study should be interpreted as a response to a hypothetical or knowledge-based questionnaire item rather than as a direct measure of observed healthcare-seeking behavior.

The findings concerning prevention reveal a different pattern. Although 57% of mothers recognized complete immunization as protective against pneumonia and 63% recognized the importance of exclusive breastfeeding and balanced nutrition, only 24% identified handwashing with soap and 11% identified avoidance of tobacco smoke or indoor air pollution as preventive measures. Similarly, 64% recognized that avoiding overcrowded and poorly ventilated environments could reduce pneumonia risk. These findings suggest that recognition of specific preventive measures was uneven. This is consistent with evidence from Bangladesh showing that maternal knowledge of childhood respiratory illness prevention and management can be influenced by exposure to organized health education and community-based programmes.

The contrast between individual knowledge items is particularly important. Recognition of cough with chest indrawing (82%) and selection of immediate hospital care (89%) were substantially higher than recognition of handwashing with soap (24%) and avoidance of tobacco smoke or indoor

pollution (11%). This may indicate that respondents were more familiar with signs of illness and the need for treatment than with the broader set of preventive measures applicable within the household. However, because the study was descriptive and the questionnaire was not documented as a formally validated instrument, this interpretation should be considered a possible explanation rather than a demonstrated causal pattern. Differences in question wording, respondents' previous exposure to health messages, and the relative prominence of different health messages may also contribute to variation between individual items.

Importantly, the preventive findings represent maternal knowledge and recognition of preventive measures rather than actual preventive practices. For example, identifying handwashing, keeping the child warm, avoiding tobacco smoke or indoor air pollution, and avoiding overcrowded or poorly ventilated environments does not establish that these measures were routinely implemented in the household. The study did not include direct observation or a sufficiently detailed behavioral assessment to determine actual preventive practices. Therefore, the present findings should not be interpreted as estimates of the prevalence of pneumonia-prevention behaviors.

The overall knowledge distribution also demonstrates this mixed pattern. In the present study, 6% of mothers were categorized as having excellent knowledge, 15% as very good, 31% as good, 22% as average, and 26% as below average; thus, 52% were classified as good or above, while 48% were classified as average or below. Comparisons with previous studies should be made cautiously because studies of maternal pneumonia or acute respiratory infection knowledge in Bangladesh have used different populations, study designs, instruments, outcome definitions, and scoring systems. For example, qualitative rural studies have identified substantial gaps in mothers' recognition of pneumonia severity and danger signs, whereas community-based health education programmes have demonstrated improvements in maternal knowledge. These differences illustrate why variation in reported knowledge levels across studies cannot necessarily be attributed to differences in mothers' underlying knowledge alone. Hospital versus community setting, maternal educational composition, questionnaire design, scoring criteria, study period, and sampling method may all contribute to observed differences.

The findings also have implications for nursing and child-health services. Because health workers were the most frequently reported source of information and most mothers expressed willingness to participate in further education, routine counseling could emphasize both recognition and prevention. Educational messages may include recognition of fast or difficult breathing and chest indrawing, appropriate and timely care-seeking, immunization, breastfeeding and adequate nutrition, hand hygiene, avoidance of tobacco smoke and indoor air pollution, and improvement of household ventilation and crowding conditions. Evidence from Bangladesh indicates that community-based and organized health education can improve maternal knowledge and selected child-health practices. Nevertheless, the present study did not evaluate an educational intervention and therefore cannot demonstrate that such counseling would improve knowledge or behavior in this population.

Finally, the findings should be interpreted in light of the study design and measurement limitations. The study used purposive sampling at a single pediatric hospital, limiting generalizability to mothers of under-five children in the wider Bangladeshi population. In addition, the knowledge questionnaire was study-specific, and the available documentation does not establish it as a formally validated psychometric instrument. The detailed item-level scoring procedure was also not sufficiently documented. Consequently, the reported overall knowledge categories should be interpreted cautiously. Further multicenter studies using clearly defined and validated knowledge instruments, together with separate measures of reported or observed preventive practices and actual healthcare-seeking behavior, would provide a more comprehensive assessment of maternal knowledge and its relationship with child-health behaviors.

5. Conclusion

The study found varying levels of maternal knowledge regarding pneumonia and its prevention among mothers of under-five children attending Khulna Shishu Hospital. Although many mothers recognized important symptoms, danger signs, management approaches, and selected preventive measures, gaps in knowledge were also identified. The findings represent maternal knowledge and recognition of pneumonia-prevention measures and

should not be interpreted as evidence of actual preventive practices. Strengthening health education may help improve mothers' understanding of pneumonia prevention; however, further studies are needed to determine whether improved knowledge translates into sustained preventive behaviors and appropriate care-seeking practices.

6. Study limitations

This study has several limitations that should be considered when interpreting the findings. First, a non-probability purposive sampling technique was used at a single hospital, which limits the generalizability of the findings to mothers of under-five children in other healthcare settings and the wider community. Second, maternal knowledge was assessed using a study-specific questionnaire. Although the instrument was pretested among 25 mothers and reviewed by teachers and subject experts, no numerical reliability coefficient was calculated, and documentation of formal instrument validation was not available. Furthermore, the detailed item-level scoring procedure, including the number of scored knowledge items, maximum possible score, and exact calculation of the percentage score, was not sufficiently documented. Therefore, the reported knowledge categories should be interpreted cautiously and should not be considered a formally validated knowledge scale.

Third, the cross-sectional design provides a snapshot of maternal knowledge at the time of data collection and does not allow causal relationships or changes in knowledge over time to be established. In addition, the study primarily assessed maternal knowledge and recognition of pneumonia-prevention measures rather than actual preventive practices. Thus, the findings cannot determine whether mothers routinely implemented the preventive measures they identified. No direct observation or sufficiently detailed behavioral assessment was undertaken to establish actual household practices.

Finally, the analysis was limited to descriptive statistics, and no inferential analyses were conducted to examine associations between maternal knowledge and maternal or child-related characteristics. Consequently, the study does not identify factors associated with or predictors of maternal knowledge. The available study documentation also does not provide sufficient

information regarding the assessment of the distribution of continuous variables or the handling of missing data; these aspects should be verified against the original dataset before final publication.

7. Implications for practice and future research

- Integrate brief, standardized pneumonia-prevention counseling into pediatric outpatient and inpatient services.
- Emphasize danger signs and urgent care-seeking, alongside immunization, exclusive breastfeeding, adequate nutrition, hand hygiene, and smoke avoidance.
- Use community and health-worker education to reinforce prevention messages beyond the hospital setting.
- Future studies should use probability sampling where feasible and report sample-size assumptions, response rate, instrument reliability, scoring procedures, and inferential analyses when appropriate.
- Future research should examine whether maternal knowledge translates into actual preventive practices and timely care-seeking behavior.

8. Declarations

Ethics approval: The thesis reports approval by the Ethical Committee/Institutional Review Board of Khulna Nursing College and permission from the study hospital.

Informed consent: Written informed consent was reported as obtained from participating mothers.

Funding: Not reported in the thesis.

Competing interests: Not reported in the thesis.

Data availability: The thesis does not report a data-sharing statement. Raw data availability should be confirmed by the authors before submission.

Author contributions: To be completed by the authors according to the journal's required contribution taxonomy.

References

Abate, B. B., Tusa, B. S., Sendekie, A. K., Araya, F. G., Bizuayehu, M. A., Walle, G. T., Kitaw, T. A., Tilahun, B. D., Alamaw, A. W., Zemariam, A. B., Kassaw, A., Kassie, A. M., Yilak, G., Bizuneh, F.

K., & Dachew, B. (2025). Non-exclusive breastfeeding is associated with pneumonia and asthma in under-five children: An umbrella review of systematic review and meta-analysis. *International Breastfeeding Journal*, 20(1), 18. <https://doi.org/10.1186/s13006-025-00712-w>

Akand, N., Sarkar, P. K., Alam, M. J., Kamruzzaman, M., Hossain, M. M., Islam, M. A., Akter, J., & Shima, K. (2020). Mothers' knowledge related to preventive measure of pneumonia in hospitalized children under 5 years age: A tertiary care center experience. *IOSR Journal of Nursing and Health Science*, 9(2), 6–12.

Al Fidah, M. F., Nabin, A. A., & Efa, S. S. (2024). Factors associated with acute respiratory infection and healthcare-seeking behaviour among primary caregivers in Bangladesh: A study based on MICS 2019. *BMJ Public Health*, 2(1), e000576. <https://doi.org/10.1136/bmjph-2023-000576>

Campbell, H., Duke, T., Weber, M., English, M., Carai, S., & Tamburlini, G. (2008). Global initiatives for improving hospital care for children: State of the art and future prospects. *Pediatrics*, 121(4), e984–e992.

Eliyas, A., Badil, A., Nasir, A., Sherali, S., Khan, I., Khan, K., & Hashmi, F. (2018). Mothers' knowledge related preventive measure of pneumonia in slum community, Karachi, Pakistan. *Pakistan Journal of Public Health*, 8(3), 74–84. <https://doi.org/10.32413/pjph.v8i3.181>

Gaikwad, V., Jacob, J. E., & Nair, L. S. (2020). A study to assess the knowledge regarding pneumonia among parents of under five children in selected hospitals of Pune city. *European Journal of Molecular & Clinical Medicine*, 7(11), 6150–6157.

GBD (2023). Lower Respiratory Infections and Antimicrobial Resistance Collaborators. (2026). Global burden of lower respiratory infections and aetiologies, 1990–2023: A systematic analysis for the Global Burden of Disease Study 2023. *The Lancet Infectious Diseases*, 26(4), 343–361. [https://doi.org/10.1016/S1473-3099\(25\)00689-9](https://doi.org/10.1016/S1473-3099(25)00689-9)

Islam, M. J., Yeamin, C. A., & Jui, J. J. (2023). Knowledge, attitude and practices regarding childhood pneumonia among the parents: A cross-sectional study on childhood pneumonia admitted cases in selected hospitals of Chattogram city, Bangladesh. *International Journal of Scientific Reports*, 9(8), 243–247. <https://doi.org/10.18203/issn.2454-2156.IntJSciRep20232187>

Islam, M., Islam, K., Dalal, K., & Hossain Hawlader, M. D. (2024). In-house environmental factors and childhood acute respiratory infections in under-five children: A hospital-based matched case-control study in Bangladesh. *BMC Pediatrics*, 24(1), 38. <https://doi.org/10.1186/s12887-024-04525-4>

Naheed, A., Breiman, R. F., Islam, M. S., Saha, S. K., & Tabassum Naved, R. (2019). Disparities by sex in

- care-seeking behaviors and treatment outcomes for pneumonia among children admitted to hospitals in Bangladesh. *PLOS ONE*, 14(3). <https://doi.org/10.1371/journal.pone.0213615>
- Nakyongo, E., & Orishaba, G. (2023). Knowledge, attitude, and practices towards prevention of pneumonia among mothers of children below five years at Bweyogerere Health Centre III, Wakiso District: A cross-sectional study. *SJHRAFRICA*, 4(12), 1–15. <https://doi.org/10.51168/sjhrafrica.v4i12.559>
- Nasrin, S., Tariqujjaman, M., Sultana, M., Zaman, R. A., Ali, S., Chisti, M. J., Faruque, A. S. G., Ahmed, T., Fuchs, G. J., Gyr, N., & Alam, N.H. (2022). Factors associated with community-acquired severe pneumonia among under-five children in Dhaka, Bangladesh: A case-control analysis. *PLOS ONE*, 17(3), e0265871. <https://doi.org/10.1371/journal.pone.0265871>
- National Institute of Population Research and Training (NIPORT), International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b), & ICF. (2024). Bangladesh Demographic and Health Survey 2022. NIPORT and ICF.
- Pradhan, S. M., Rao, A. P., Pattanshetty, S. M., & Nilima, A. R. (2016). Knowledge and perception regarding childhood pneumonia among mothers of under-five children in rural areas of Udipi Taluk, Karnataka: A cross-sectional study. *Indian Journal of Health Sciences*, 9(1), 35–39.
- Rajalakshmi, R. (2022). Knowledge on pneumonia and its prevention among mothers of under five children. *International Journal of Research and Analytical Reviews*, 11(7), 86–126.
- Roux, D. M., & Zar, H. J. (2017). Community-acquired pneumonia in children: A changing spectrum of disease. *Pediatric Radiology*, 47, 1392–1398. <https://doi.org/10.1007/s00247-017-3827-8>
- Selvi, M., & Vaithilingan, S. (2024). Childhood pneumonia in low- and middle-income countries: A systematic review of prevalence, risk factors, and healthcare-seeking behaviors. *Cureus*, 16(4), e57636. <https://doi.org/10.7759/cureus.57636>
- UNICEF. (2021). Pneumonia and diarrhoea: Tackling the deadliest diseases for the world's poorest children. UNICEF.
- UNICEF. (n.d.). Pneumonia in children statistics. UNICEF Data.
- UNICEF/WHO. (2015). Pneumonia: The forgotten killer of children. UNICEF/WHO.
- World Health Organization. (2013). Pocket book of hospital care for children: Guidelines for the management of common childhood illnesses (2nd ed.). World Health Organization.
- World Health Organization. (2023). Pneumonia: Key facts. World Health Organization.
- World Health Organization. (2024). Guideline on management of pneumonia and diarrhoea in children up to 10 years of age. World Health Organization. <https://doi.org/10.2471/9789240103412>
- World Health Organization. (2025). Pneumonia. World Health Organization.
- Yanti, L., & Sari, F. (2022). Mom's knowledge and practice on prevention pneumonia in toddlers. *Indonesian Journal of Global Health Research*, 4(4), 769–774. <https://doi.org/10.37287/ijghr.v4i4.1254>