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RESEARCH ARTICLE

Epidemiological and Clinical Insights into Pediatric Lower Respiratory Tract Infections in Kirkuk City-Iraq

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ABSTRACT

Acute lower respiratory tract infection is the leading cause of mortality and one of the common causes of morbidity in children under-five years of age. The aim of the present study is to provide a comprehensive description of the pattern of lower respiratory tract infections (LRTIs) in children under 5 years of age attended Children Hospital in Kirkuk City including the investigation of the frequency, severity, and types of LRTIs prevalent. This descriptive epidemiologic-observational, cross-sectional hospital-based study was conducted in Kirkuk city from November 1, 2023, to March 31, 2024, involving 267 children under five years old with acute lower respiratory tract infections. The study included children with cough, rapid respiration, or difficulty breathing, as per WHO criteria. Patients with lower respiratory tract infections, such as bronchitis, bronchiolitis, and pneumonia were included. Children with congenital heart disease, hypotonia, cerebral palsy, peripheral circulatory failure, severe anemia, dehydration, and asthma were excluded. Clinical history included recurrent chest infections, asthma, drug or food allergies, steroid use, cow milk allergies, atopic conditions, family history of allergies and LRTIs, and vaccination history. Lower respiratory tract infections were diagnosed based on specific clinical signs such as tachypnea, chest wall indrawing, abnormal auscultatory findings, and abnormal chest X-rays. The study identified infants (0-12 months) as the most vulnerable to lower respiratory tract infections (LRTIs), representing 68.54% of cases, with decreasing rates as age increases (mean age 10.2 ± 2.1 months). Males (57.68%) and urban children (74.16%) had higher prevalence rates. Most mothers were illiterate (46.07%). Among the children, 14.61% were exclusively breastfed, 32.21% bottle-fed, 22.47% mixed-fed, and 30.71% on solid food. Smoking exposure was reported in 52.81% of families. The majority of cases (47.19%) lasted 4-7 days. A significant portion of children (77.53%) were vaccinated, with 50.94% experiencing recurrent chest infections. Family history of LRTIs was a strong predictor (43.82%) of occurrence. Common symptoms included productive cough (95.88%), wheezing (91.01%), and fever (83.52%). The study highlights the significant impact of age, gender, residence, maternal education, feeding practices, family history, and vaccination status on LRTI prevalence and duration in children.

INTRODUCTION

Acute lower respiratory tract infection is the primary cause of death and a frequent cause of illness in children under the age of five. Respiratory infections are a diverse and intricate collection of disorders caused by a wide array of pathogens, including viruses, bacteria, and fungus[1]. The lower respiratory tract comprises the trachea, bronchi, bronchioles, and alveoli. In 2015, pneumonia was responsible for the deaths of 9, 20,136 children under the age of 5, which accounted for 16% of all fatalities in this age group[2]. Untreated respiratory infections in young children can have life-threatening consequences. Acute respiratory infection is more prevalent in underdeveloped nations than to industrialized countries. The increased occurrence is ascribed to factors such as overcrowding, high HIV prevalence, low birth weight, and the absence of pneumococcal and measles vaccination[3]. Additionally, variables such as zinc and vitamin A insufficiency, low maternal education, and residing in locations with high pollution levels all contribute to the problem. While the exact cause of pneumonia is often unknown in a clinical setting, the primary culprits responsible for this condition in children are often Streptococcus pneumoniae, Hemophilus influenzae, and to a lesser degree, Staphylococcus aureus. Bronchiolitis is a significant contributor to child mortality. RSV is involved in the majority of cases. Additional viruses in this category are parainfluenza virus 1, 2, and 3, adenovirus, and influenza virus[4]. Research has demonstrated the significance of socioeconomic determinants in relation to mortality and morbidity caused by acute respiratory infections (ARI), such as the number of individuals in a household, level of education, and population density in the place of residence. Therefore, it is crucial to prioritize social elements while contemplating preventative interventions. According to reports, the prevalence of Acute Respiratory Infections (ARI) is higher in urban regions and slums compared to rural areas. The expenses associated with lower respiratory tract infection in both outpatient and hospital settings impose a significant financial burden on national healthcare budgets[5,6]. When dealing with instances of lower respiratory tract infections (LRTI), it is crucial to focus on modifiable risk factors including as breastfeeding, overcrowding, undernutrition, delayed weaning, and prelacteal feeding. IMNCI categorizes cases into four classifications based on respiratory rate, presence or absence of chest retraction, and general patient status: no pneumonia, pneumonia, severe pneumonia, and very severe pneumonia. Treatment options encompass the administration of oral antibiotics. Severe cases necessitate hospitalization and the use of intravenous antibiotics, as well as other supportive measures like as oxygen/ventilator support and ICD draining[7,8]. Respiratory infections pose a significant problem in children and adolescents. Recurrent respiratory illnesses impose both financial strain on parents and contribute to increased absenteeism from school. This study aimed to determine the distribution pattern of lower respiratory tract infection and its associated risk factors, as well as identify the bacterial pathogens responsible for it[9,10]. The aim of the present study is to provide a comprehensive description of the pattern of lower respiratory tract infections (LRTIs) in children under 5 years of age attended Children Hospital in Kirkuk City including the investigation of the frequency, severity, and types of LRTIs prevalent.

Patients and methods

This descriptive epidemiologic-observational, cross-sectional hospital based study was carried out in Kirkuk city from the period 1st November 2023 to the end of March 2024.

The study included 267 children with age below five years old who admitted with acute lower respiratory tract infections to the emergency department of and pediatric wards of Children Hospital in Kirkuk city. The sampling method employed was consecutive non-probability sampling, where patients meeting the selection criteria over the study period were included. The study encompassed one autumn and one winter season to capture potential seasonal variations in respiratory infections.

Inclusion criteria

Children younger than 5 years old who had a recent history of coughing and fast breathing or trouble breathing were included in the study based on WHO guidelines for ALRI[21]. Additionally, patients with indications of lower RTIs, such as bronchitis, bronchiolitis, and pneumonia, were included.

Exclusion criteria

Children with congenital heart disease, hypotonia, cerebral palsy, peripheral circulatory failure, severe anemia, dehydration and Asthma were excluded.

Ethical approval

- Approval of the council of College of Medicine/ Tikrit University was obtain for the proposal of the study.
- Approval permission was presented to the director of Kirkuk Health directorate
- Questionnaire was developed by the researcher for the purpose of the study to assess the domains related to LRTI children included Age, Gender, Residence, Clinical features
- Informed consent was obtained from guardians after thorough explanation of the study's objectives.

METHODS

Clinical history

History of recurrent chest infections, asthma, allergies to drugs or food, steroid use, cow milk allergies, atopic conditions, family history of allergies, family history of LRTIs, history of vaccinations, asthma, known allergies to drugs or food, history of steroids use, cow milk allergies, atopic conditions in the child or family members, family history of allergies and LRTIs, and following vaccination schedules.

Cases definitions

Some of the signs that helped doctors figure out that someone had a lower RTI were tachypnea, chest wall indrawing, abnormal auscultatory finds (like wheezes/crepitations or bronchial breath sounds), and abnormal chest X-rays.

Statistical Analysis

Data underwent meticulous scrutiny for completeness and logical consistency prior to analysis. Pre-coded data were entered into Microsoft Office Excel Software Program 2019 and later transferred to the Statistical Package for Social Science version 26 for comprehensive statistical analysis. Descriptive statistics were utilized to portray qualitative variables in terms of frequencies and percentages. The chi-square and Fisher exact tests were employed to ascertain significance levels ($p < 0.05$).

RESULTS

The study found that infants are highly vulnerable, with 68.54% of cases occurring between 0-12 months. As age increases, infection rates decrease with mean age 10.2 ± 2.1 moths. Males had a higher prevalence of 57.68% cases, while urban children had a higher prevalence of 74.16%, Table 1.

Table 1: Demographic characteristics of children with LRTI

Demographic characteristics of children with respiratory tract infection		No.	%
Age range (months)	0-12	183	68.54%
	13-24	49	18.35%

	25-36	23	8.61%
	37-48	12	4.49%
Gender	Male	154	57.68%
	Female	113	42.32%
Residence	Urban	198	74.16%
	Rural	69	25.84%
	Total	267	100%

The data reveal that the majority of mothers (46.07%) were classified as illiterate, followed by those with primary education (23.97%), secondary education (12.73%), and college education (17.23%), Figure 1.

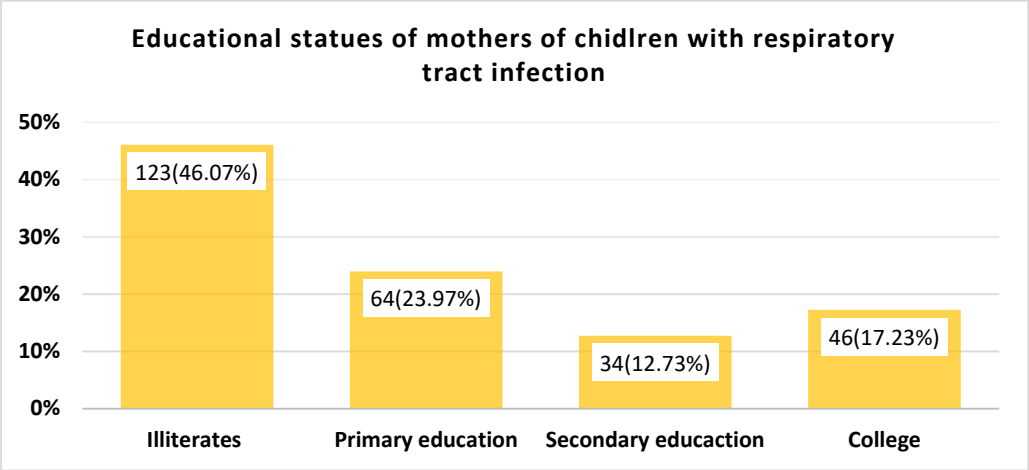

Figure 1: Distribution of LRTI children according to educational statues of mothers

The study revealed that out of LRTI children, 14.61% were exclusively breastfed, 32.21% received bottle feeding and 22.47% were mixed feeding Figure 2.

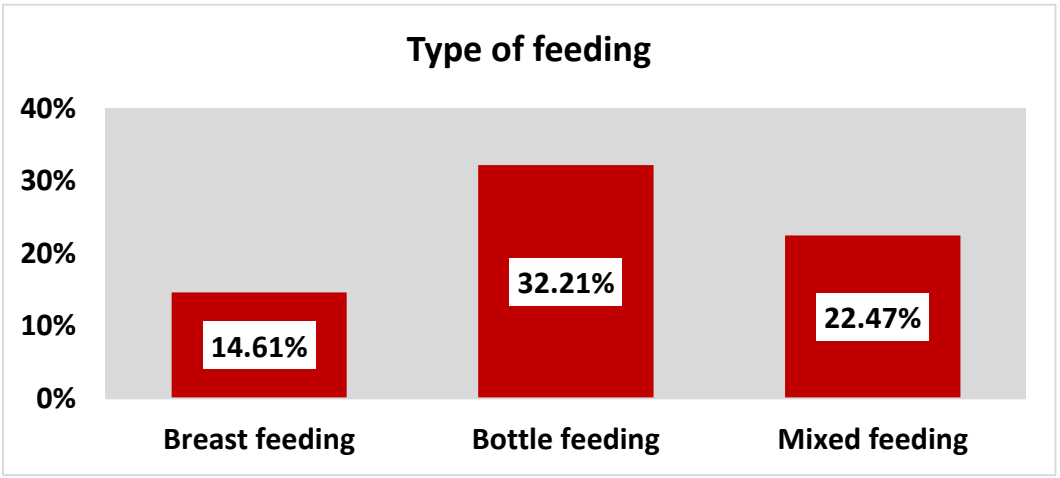

Figure 2: Distribution of LRTI children according to type of feeding

Table 2 presents the distribution of children with respiratory tract infections based on the presence of smoking within their families. The table indicates that out of the total sample of 267 children, 52.81% reported smoking within their families, while 47.19% did not.

Table 2: Distribution of children with respiratory tract infection according to Smoking in their families

Smoking in their families	No.	%
Yes	141	52.81%
No	126	47.19%
Total	267	100%

The data showed that the majority of cases (47.19%) had a duration of illness lasting between 4 to 7 days, followed by 1 to 3 days (17.98%) and 8 to 12 days (19.85%). A smaller proportion of cases were observed for durations of 12 to 17 days (10.86%) and more than 17 days (4.12%), Figure 3.

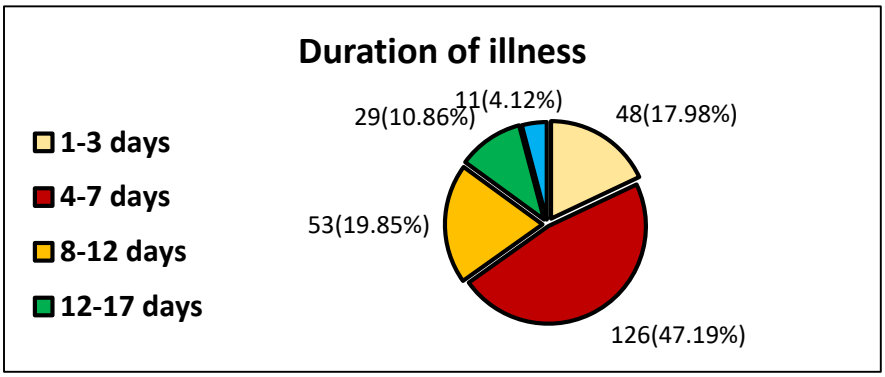

Figure 3: Distribution of LRTI children according to duration of illness

The study revealed that 77.53% of children with lower respiratory tract infections received a vaccine and 22.47% didn't received vaccine, while 50.94% had recurrent chest infections. The majority had a history of drug or food allergies, 13.48% asthma, and 8.99% using steroids (P-value: 0.011), Figure 4.

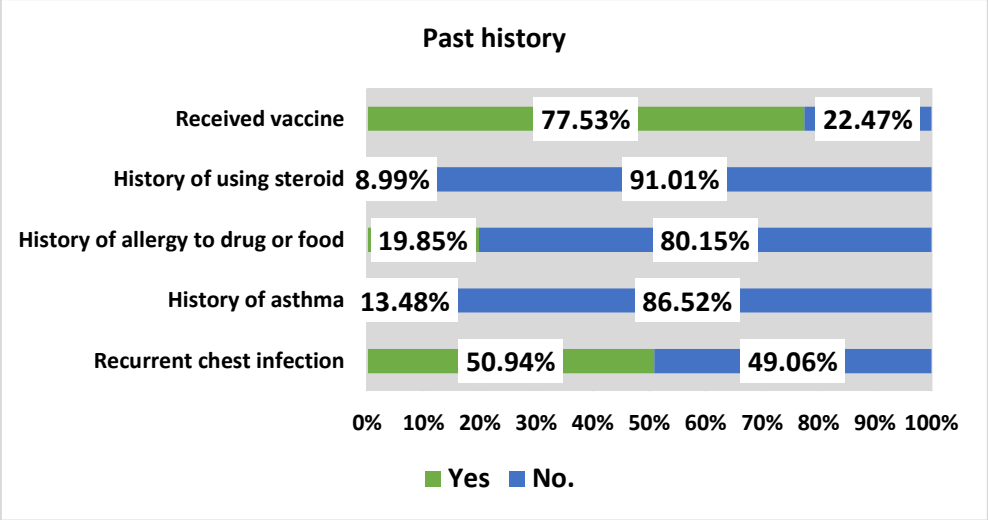

Figure 4: Distribution of LRTI children with according to Past history factors

The study showed that 43.82% of children with a family history of LRTIs themselves suffered from LRTIs, whereas only 56.18% of children without such a family history were affected, Figure 5.

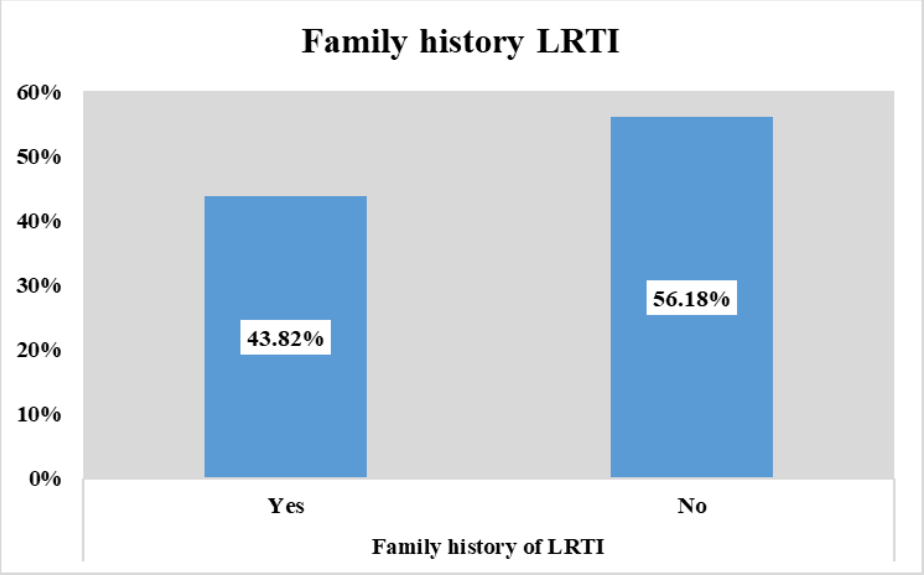

Figure 5: Correlation between LRTI incidence and family history of the disease

The study showed that 14.61% of children with a family history of allergies experienced LRTIs, compared to 85.39% who did not have such a family history, Figure 6.

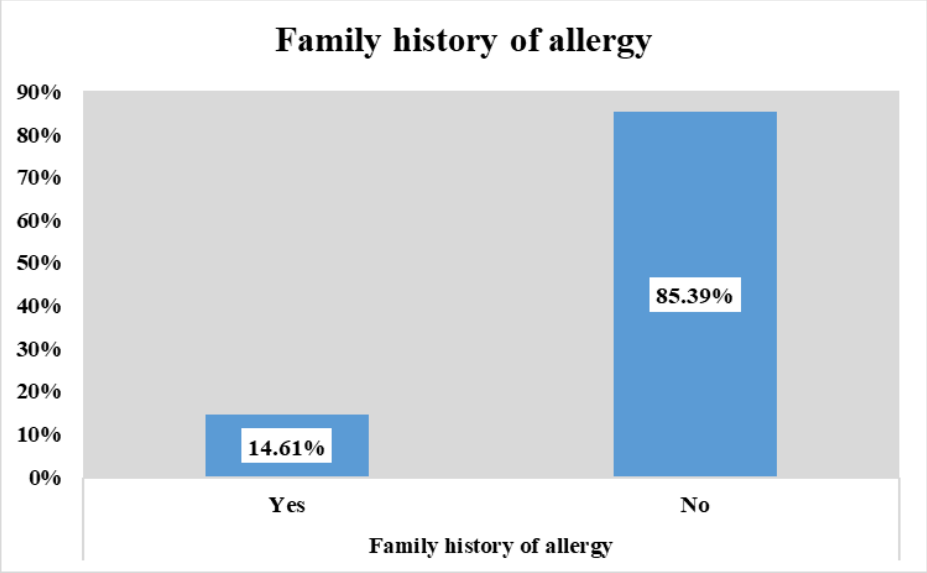

Figure 6: Correlation incidence of LRTI in children and family history of allergy

The study demonstrated that the most common symptoms are a productive cough, present in 256 children (95.88%), and wheezing, observed in 243 children (91.01%). Fever is reported in 223 children (83.52%), loss of appetite in 219 children (82.02%), and dyspnea in 217 children (81.27%). Tachypnea is also prevalent, affecting 212 children (79.40%). Other notable symptoms include a runny nose in 174 children (65.17%), vomiting in 172 children (64.42%), and cyanosis in 116 children (43.45%). In contrast, dry cough is a rare symptom, reported in only 4 children (1.5%). These findings underscore the predominance of respiratory and systemic symptoms in children with LRTIs, Figure 7.

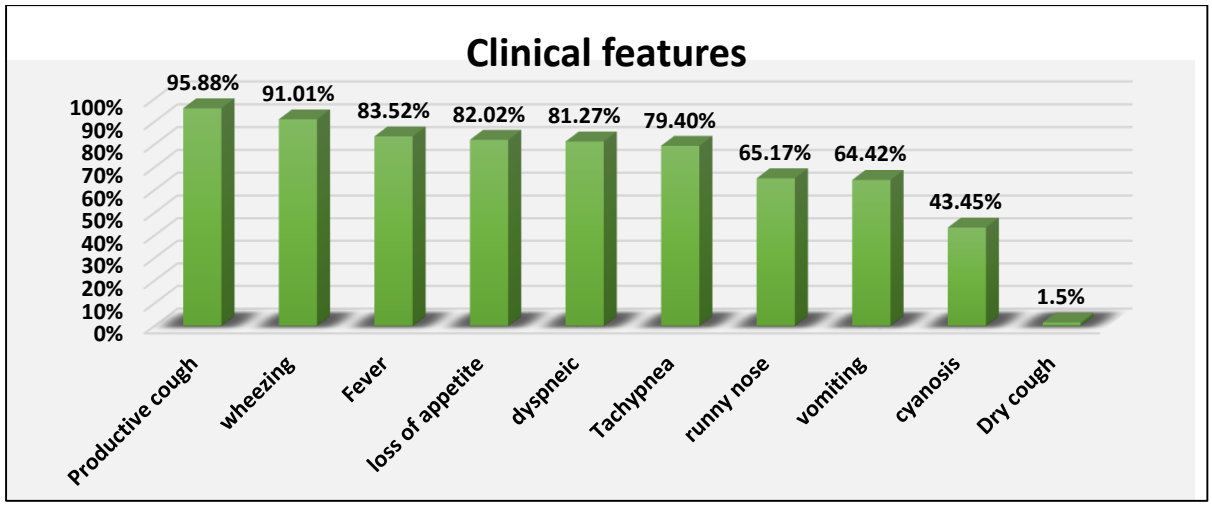

Figure 7: Distribution of children with LRTI according to their clinical features

DISCUSSION

The study found that infants are highly vulnerable, with 68.54% of cases occurring between 0-12 months. As age increases, infection rates decrease with mean age 10.2 ± 2.1 moths. Males had a higher prevalence of 57.68% cases, while urban children had a higher prevalence of 74.16%. In line with the current finding, Al-Dalfi et al [11] found that the ages of children with LRTI range from 2 months to 60 months, with a mean age 12.31 ± 2 months and the majority of children their study were infants (71.3%) with a males more frequently than females and resided in urban areas (63.7%). El-Koofy et al [12] indicated that the percentages of urban and rural residents were 68.7% and 31.3%, respectively and greatest predictor of lower RTI was revealed in children aged less than 2 years. Previous studies in indicated that rates of both lower and upper RTIs decreased as children aged beyond 2 years [13, 14]. This could change the number of cases of ARI because these kids are more likely to be exposed to the risk factors that are common during this time. As well, this shows the part that protective immunoglobulins play in keeping ARIs away from babies[15] . Immune immaturity in the first 2 years of birth explains the increased prevalence of RTIs [58] Male children were found to have a higher incidence of RTI in previous investigations in Bangladesh and Iraq [16,17] whereas female children were shown to have a higher incidence in an Indian study [18]. The current result agreed with the study conducted by Seramo et al. in Worabe Town, Ethiopia, in which it was mentioned that males had more pneumonia than females[19]. This could be owing to the family's preference for boy children[20]. Another explanation is that boys are more exposed to the outside environment, albeit under the age of five. Boys and girls are usually equally exposed[21]. Females exhibit more significant immune responses than males across all age groups, implying that the sex differences may be genetic. However, there are also sex-determined differences in response to prenatal nutrition, resulting in the epigenetic reprogramming of immune responses [11]. Breastfeeding benefits female infants more than males, since breastfed female newborns had a lower risk of neonatal RTI [12]. The LRTI was more common in urban areas in this study. Findings are consistent with the study conducted in Egypt, which reported that the majority of children in urban areas suffer from pneumonia[22]. This is because houses are typically close together in urban regions, with numerous occupants and less air ventilation. In contrast to rural regions, rural areas offer better housing conditions and cleaner air. However, there are still some homes with dirt floors. Pneumonia can result from these circumstances in everyone[23]. The result of this study is consistent with the study conducted by Abuka in Wondo Genet district, Sidama zone, SNNPR, Ethiopia, that more than half of the mothers who attended primary education had children with pneumonia[24]. Regarding the father's educational level, the results of this study indicate that about half of the participating fathers, 226 (47.4%), obtained a primary education. Thus, 180 (79.6%) of the children whose parents had primary education had

pneumonia, 14 (6.2%) had severe pneumonia, and 32 (14.2%) had very severe pneumonia. The descriptive statistics result agrees with the bivariate Probit regression, presenting a negative association between mothers' level of education and the prevalence of respiratory disorder in under five age children[25,26]. It means that the number of children with breathing problems goes down as their moms get more schooling. The negative link between a child's breathing problem and her mother's level of education stays the same in multivariate Probit regression that includes the wealth index and the place of living. This answer is in line with what was found before[27,28]. It's possible that this link exists because women with a lot of education usually have well-paying jobs, live in cities with nice homes, and know how to keep their children from getting respiratory disorders. In other words, these moms have the money to meet their kids' medical and food needs, keep them in a safe place that doesn't have anything that could make them sick, and know how to keep them from getting lung problems. Children are more likely to get pneumonia if their parents don't have a lot of schooling or don't know how to keep their kids clean. Poor eating, not being able to afford medical care, and not knowing about ways to avoid getting sick like getting vaccinated are some of the things that can make this happen[29,30]. Studies have shown over and over that how babies are fed has a big effect on how often kids get lower respiratory tract infections (LRTIs). A close study of the feeding habits of kids who have LRTIs shows that different babies were more or less susceptible depending on how they were fed. 14.61% of the children who were studied were only fed breast milk. Many people know that exclusive nursing can help keep babies from getting illnesses because breast milk has antibodies and immune cells in it[31]. Research by Sereme et al.[32] emphasizes that nursing exclusively for the first six months greatly lowers the risk of pneumonia and other respiratory illnesses. This shows how important antibodies from the mother are for strengthening an infant's immune system. Piloquet et al.[33], and Mineva et al. [34], have demonstrated that formula-fed infants are more prone to infections, including LRTIs, because they do not receive the same protective antibodies and indicate that potential for contamination if bottles are not properly sterilized further increases the risk of infections in bottle-fed infants. In agreement with our finding, Phetruang et al[35] found that 68.8 % of children belonged to smoker families experienced respiratory diseases and the reported symptoms were nasal congestion, sneezing, and a runny nose. Other studies highlighted that child caregivers who smoke have a direct impact on the respiratory health of children, leading to symptoms such as nasal congestion, runny nose, coughs, and sneezes [36,37]. This is because children's breathing systems have more Type-II rapid-twitch muscle fibers than Type-I slow-twitch muscle fibers. Because of this, their breathing system is less flexible and resistant. This imbalance in the respiratory system can show up as stuffy nose, irritated nose, runny nose, coughs, sneezes, sore throat, shortness of breath, and illnesses[38]. Furthermore, it increases the risk of chronic coughs, suffocation, and bronchitis. These findings align with the research conducted by Lanyero et al [39], which revealed that children living in smoking households have a higher likelihood of developing upper and lower respiratory tract issues compared to those living in non-smoking households.

The study highlights the prevalence of various symptoms in children with lower respiratory tract infections (LRTIs), demonstrating a pattern consistent with the clinical manifestations reported in the literature. The most common symptom identified is a productive cough, present in 256 children (95.88%), which aligns with findings from studies by Dangor et al.[40] and Little et al.[41], where productive cough is frequently noted as a primary symptom in pediatric LRTIs due to the accumulation of mucus in the airways. Moreover, van Wijhe et al.[95] found a that, cough and wheezing frequently noted as a primary symptom in pediatric LRTIs. In the current study, fever is reported in 223 children (83.52%), indicating a systemic response to infection. Fever is a common symptom in bacterial and viral respiratory infections as the body attempts to fight off the pathogens. Moreover, Menezes et al [43] indicated most of LRTI infants were presented with cough, respiratory discomfort, fever, and desaturation. The symptoms seen in children with lower respiratory tract infections (LRTIs) are mostly a result of the body's immune response to infection and the direct effects of bacteria on the respiratory system[44]. A productive cough occurs as the body tries to remove mucus

and harmful microorganisms from the airways, while wheezing is caused by inflammation and constriction of the airways, typically triggered by viruses like RSV or influenza[41]. Fever is a physiological reaction to infection that affects the entire body, while loss of appetite is a result of the body's energy being focused on combating the illness[39,38]. Dyspnea and tachypnea result from inflammation, heightened mucus production, and airway blockage, leading to respiratory difficulty and requiring an elevated breathing rate to fulfill oxygen requirements[37]. Nasal mucosa inflammation leads to a runny nose, systemic infection or mucus draining into the stomach can cause vomiting, and cyanosis suggests a serious respiratory distress with decreased blood oxygen levels[44]. While infrequent, a dry cough may manifest during the early phases of viral or bacterial illnesses. Gaining comprehension of these symptoms facilitates the prompt identification and suitable treatment of lower respiratory tract infections (LRTIs) in children [38,39,40].

CONCLUSIONS

Infants, particularly those aged 0-12 months, constitute the majority of cases of lower respiratory tract infections (LRTIs), with males and urban residents exhibiting higher prevalence rates. This suggests demographic factors such as gender and urban living may increase the risk for LRTIs. Additionally, many mothers of children with LRTIs have lower education levels, with illiteracy being notably prevalent. These findings underscore the predominance of respiratory and systemic symptoms in children with LRTIs, emphasizing the need for focused healthcare interventions and preventive measures to mitigate the incidence and impact of LRTIs in pediatric populations

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