The severity of pneumonia and its association with socio-demographic factors among children under five years old in Wasit governorate hospitals, Iraq

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Abstract

Background. Pneumonia is the leading infectious cause of death among children under five globally.

Objective. The study aims to determine socio-demographic factors associated with the severity of pneumonia among children under five in Wasit Governorate.

Methods. A cross-sectional study and convenience sampling (non-probability) were conducted among 477 children admitted to Wasit governorate hospitals. This sample was distributed throughout five hospitals selected using convenience sampling techniques, including AL-Zahra Hospital, AL-Numaniyah General Hospital, AL-Karama Teaching Hospital, Martyr Fairouz General Hospital, and AL-Kut Gynecology Hospital. It was conducted from October 1st, 2022, to May 1st, 2023. Through questionnaires, data were collected and analyzed through descriptive and inferential statistics.

Results. The results showed that the participants' distribution according to pneumonia severity was such that the majority of children (81%) included in the study suffered from pneumonia. 14% of children suffered from very severe pneumonia, and 5% suffered from severe pneumonia. The children at risk of developing pneumonia were within the age group of 1-11 months (55.6%), were male (60.6%), and resided in urban areas (63.7%). Both the mother and the father had completed their primary education (50.9% and 47.4%, respectively), and 99.4% and 97.5% of the mothers were married and housewives. More than half of the fathers, 59.5%, were self-employed, and 25.6% suffered from house overcrowding. In addition, 65% had low socioeconomic status. There was a significant relationship between pneumonia severity and the father's occupation and socioeconomic status.

Conclusions. This study concludes that pneumonia was the most common diagnosis at admission. Among the risk factors studied, low socioeconomic status and the father's occupation were significant risk factors for pneumonia in children.

Introduction

Pneumonia is a severe form of acute lower respiratory infection that causes high morbidity and mortality rate among children under five; it constitutes a significant danger to global public health.[1] The long-term effect of pneumonia in children under five is a decline in lung function, which will become apparent in adulthood.[2] The infection 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.[3,4] Fungi, bacteria, and viruses cause this infectious illness. In newborns, the most frequent pathogens are group B Streptococcus and gram-negative bacteria; in infants, the most frequent pathogen is typically a virus.[5]

Human metapneumovirus, respiratory syncytial virus, adenovirus, rhinovirus influenza, parainfluenza, and SARS-CoV-2 are common causes of viral pneumonia.[6,7] In contrast, Streptococcus pneumoniae (Pneumococcus) is a frequent cause of bacterial pneu-

monia.[8] In addition, *Coccidioidomycoses* is a common cause of fungal pneumonia.[9,10] Pneumonitis is diagnosed by imaging tests like a computed tomography scan and a chest X-ray, blood tests, pulmonary function testing using an oximeter or spirometer, surgical lung biopsies, and bronchoscopy.[11] When pneumonia in children under the age of five years is improperly or tardily treated, the condition worsens and can result in mortality. Most pneumonia-related fatalities occur in infants and children under the age of five.[12] In 2019, 740,180 children under the age of five worldwide died of pneumonia. Children under five made up 14% of all fatalities, whereas children ages 1 to 5 made up 22% of all fatalities.[13] Low-income and middle-income countries have a disproportionately high mortality rate.[14] Only five countries have been responsible for more than half of all pediatric pneumonia deaths: Nigeria 162,000, India 127,000, Pakistan 58,000; the Democratic Republic of the Congo 40,000; and Ethiopia 32,000.[15]

Every year, pneumonia kills over 800,000 children under five, including more than 153,000 newborns, especially susceptible to infection. Therefore, a kid passes away from pneumonia every 39 seconds, and most of these fatalities may be avoided.[16] Worldwide, there are about 1,400 cases of pneumonia per 100,000 children, or one case every 71 children per year, with South Asia having 2,500 cases per 100,000 children and West and Central Africa having the highest prevalence, 1,620 cases per 100,000 children.[17]

In 2021, the number of deaths from pneumonia among children under five years in Iraq, excluding the Kurdistan region, reached 758 deaths. In Wasit Governorate, in particular, the number of deaths reached 28 deaths.[18] In developing countries, the risk factors for childhood pneumonia vary. Pneumonia risk factors include socio-demographic status (age, residence, educational level, occupation, monthly income, and family size).[19,20]

Pneumonia may affect everyone, regardless of age.[21] Babies and toddlers under two are more vulnerable due to their weak immune systems and immature respiratory systems, which predispose them to develop serious illnesses.[22] Family income influences the risk of children experiencing pneumonia through healthy physical home quality, nutritional status, and complete immunization status.[23] Although overcrowding among family members is considered a risk factor for illness, few studies have assessed the mechanism of respiratory infection transmission in children living in overcrowded households.[24,25] Education influences mothers' preventative, health care, and treatment behaviors. For example, mothers with limited education often misdiagnose pneumonia as a common cold.[26] Therefore, this study aims to identify the distribution of the proportion of pneumonia according to the severity and to determine socio-demographic factors associated with the severity of pneumonia among children under five years in Wasit Governorate.

Materials and Methods

Study period
This study was conducted from October 1st, 2022, to May 1st, 2023.

Study design
An institutional-based cross-sectional study was employed among under-five-year children at Wasit Governorate Hospitals.

Study population
The population of this study was all children under five years old who were admitted to the pediatric ward and diagnosed with pneumonia in the selected hospitals in Wasit province during the study period.

Inclusion criteria
This study included children admitted to the children's ward and diagnosed with pneumonia under five years of age in Wasit governorate hospitals.

Exclusion criteria
This study excluded children with health problems such as congenital lung malformations, the common cold, and pharyngitis. Children older than five years and mothers who refused to participate in the study.

Sample size and sampling techniques
Thompson's statistical equation was used to calculate the sample size,[27] considering the following assumptions:

$$n = \frac{N \times p(1-p)}{\left[\left[N-1 \times (d^2 \div z^2)\right] + p(1-p)\right]}$$

n= the minimum sample size; N= community size 258449; Z= standard degree = 1.96; P= rate of availability of property = 0.50; d= error ration = 0.05.

A Thompson formula determined the minimum sample size of 281. By adding a 25% sample for the non-respondents rate, the final sample size was 477. From eight public hospitals, five hospitals were selected using convenience sampling techniques. The individual study participant was selected using convenience sampling techniques.

Variables of the study
Dependent variables
This study used patient statuses of pneumonia severity (pneumonia, severe pneumonia, and very severe pneumonia) as a dependent variable. The specialist physician determined the severity of pediatric pneumonia, and the WHO guidelines on clinical pneumonia were used.[28]

Independent variables
The independent variables are the age of the child, sex, the educational level of the mother, the educational level of the father, the mother's marital status, the father's occupation, the mother's occupation, monthly income, place of residence, and crowding index.

Socio-economic status
The social and economic situation was divided according to the World Health Organization (WHO - Scale) scale.[29,30] This scale contains four domains to assess social and economic status: occupation, educational level, overcrowding index, and ownership. Each got the maximum score (25) and the lowest (9). Except for the educational level, the lowest score was (0). In addition, the Tiwari scale was also relied upon to divide social and economic status, and the scale contains three levels: high, medium, and low. In addition, the crowding index was calculated by dividing the number of family members by the number of rooms, Except for the bathroom and kitchen rooms.

Data collection method
Data was collected using a questionnaire and from the child's medical record. A questionnaire was developed through a comprehensive review of relevant literature and used as a data collection

tool by the mother of the sick child interviewed. Each interview lasted about 15-20 minutes. The questionnaire was presented to 10 university experts in the area of competence to check the validity of the study instrument.

Statistical analyses

Data analysis was done using the available statistical package, SPSS-27 (Statistical Packages for Social Sciences, version 27). Data were analyzed through a descriptive statistical approach (frequency, percentage, mean, and standard deviation, tables, pies, and bar charts) and an inferential statistical approach (Categorical test (Chi-square test, Fisher's exact test)). Statistical significance was considered whenever the P value was equal to or less than 0.05.

Ethical considerations

Before conducting the study and collecting data, approval was obtained from the ethical research committee at the Southern Technical University/Faculty of Graduate Studies/Basra, according to Book No. 630 on 6/14/2022. Furthermore, official permissions were obtained from the Wasit Health Directorate (Training and Human Development Center) to formally access the hospitals in Wasit Governorate, according to Book No. 628 on 7/7/2022. Besides that, Oral consent was obtained from the parents, confirming their willingness to participate after explaining the purpose of the study. In addition, they were informed that their participation in the study was voluntary.

Results and Discussion

Four hundred seventy-seven children under five were included in the study. The mean and standard deviation for the age of the children was 16.25±17.25. The highest percentage of children in the study was 55.6% in the age group 1-11 months. Children aged 36-47 months constitute the smallest percentage, 4.2%. Approximately sixty-one were 60.6% male, and 39.4% were females. More than two-thirds of the study participants, 63.7%, were urban residents. Most mothers and fathers had completed the primary graduate 50.9% and 47.4%, respectively. Most mothers interviewed were married and unemployed (housewives), 99.4% and 97.5%, respectively. More than half of the fathers, 59.5%, were self-employed. A quarter of the participants' families, 25.6%, suffered from overcrowding. as shown in Table 1.

In terms of age, the results indicate more than half of the 265 (55.6%) participating children were within the age group 1-11 months, 213 (80.4%) of them had pneumonia, 13 (4.9%) had severe pneumonia, and 39 (14.7%) had very severe pneumonia as showed in Table 2. However, there was no statistically significant relationship 0.855 P-value. In this study, pneumonia was more common among the 1-11-month age group. This result is in line with the study conducted by Fadl *et al.* in Alexandria, Egypt, which mentioned that children under 12 months of age are one factor independently associated with pneumonia.[31] This is due to the immature immune system: Infants and young children have less developed immune systems than adults, which makes them more vulnerable to infections like pneumonia. In addition, infants' symptoms may be more subtle and difficult to notice at an early stage, which could cause the appropriate therapy to be delayed and

Table 1. Distribution of the participants according to sociodemographic variables.

SDGVs	Categories	F.	%
Age group by months	1-11	265	55.6
	12-23	104	21.8
	24-35	36	7.5
	36-47	20	4.2
	48-59	52	10.9
	Mean±Std. deviation	16.25±17.25	
Sex	Boy	289	60.6
	Girl	188	39.4
Residence	Rural	173	36.3
	Urban	304	63.7
Mother education	Illiterate	107	22.4
	Primary graduate	243	50.9
	Intermediate graduate	94	19.7
	Secondary graduate	8	1.7
	College graduate	25	5.2
Mother employment	Unemployed (Housewife)	465	97.5
	Governmental employed	12	2.5
'Mothers' marital status	Married	474	99.4
	Divorced	3	0.6
Father education	Illiterate	69	14.5
	Primary graduate	226	47.4
	intermediate graduate	113	23.7
	Secondary graduate	17	3.6
	College graduate	52	10.9
Father employment	Unemployed	72	15.1
	Self-employed	284	59.5
	Governmental employed	121	25.4
Crowding index	2.1-4	122	25.6
	0-2	355	74.4
Total		477	100.0

SDGVs, sociodemographic variables.

result in the development of a severe illness.[22]

Regarding sex, the results showed that nearly two-thirds of the children included in the study were boys: 289 (60.6%), 242 (83.7%) were diagnosed with pneumonia, 12 (4.2%) with severe pneumonia, and 35 (12.1%) with very severe pneumonia. Of these children, 188 (39.4%) were girls, 144 (76.6%) had pneumonia, 11 (5.9%) had severe pneumonia, and 39 (12.8%) had very severe pneumonia. With this, there was no statistically significant relationship P-value 0.149. There were more males diagnosed with pneumonia than females. This result agrees with the study conducted by Seramo et al. in Worabe Town, Ethiopia, in which it was mentioned that males had more pneumonia than females.[32] This could be owing to the family's preference for boy children.[33] 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.[34]

As for residence, the results showed that nearly two-thirds of the participants were urban residents, 304 (63.7%), because hospitals are located in urban areas, and most of the participants in the study were from those areas. 250 (82.2%) had pneumonia, 15 (4.9%) had severe pneumonia, and 39 (12.8%) had very severe pneumonia. However, there was no significant relationship P-value 0.521. Pneumonia 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.[31] 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 every-

one.[35] Regarding the mother's educational level, this study's results indicate that more than half of the participating mothers, 243 (50.9%), obtained a primary education. Thus, 200 (82.3%) of the children whose mothers obtained a primary education had pneumonia, 15 (4.9%) had severe pneumonia, and 39 (12.8%) had very severe pneumonia. However, no significant association was found P-value 0.782. In this study, pneumonia was more common in children whose mothers had primary education as showed in the Table 2. 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.[19] 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. However, no significant association was found P-value of 0.873. Our study found pneumonia most common in children whose parents had primary education. The result of this study is consistent with the study conducted in the town of Warabi in Ethiopia showed that half of the parents who completed primary education had children with pneumonia.[32] Parents with lower education levels may have limited knowledge about maintaining good hygiene, inadequate nutrition, financial barriers to accessing healthcare, and lack of awareness about preventive measures such as vaccination are some factors that increase the risk of pneumonia in children.

As for the mother's occupation, our study showed that the vast majority of unemployed mothers (housewives), 465 (97.5%) of the children whose mothers are unemployed had pneumonia, and 23

Table 2. Factor associated with severity of pneumonia in children under five years based on sociodemographic variables.

Sociodemographic variables	Categories	Severity of pneumonia			P
		Pneumonia F. (%) 386. (38)	Severe pneumonia F. (%) 23. (23)	Vere severe pneumonia F. (%) 68. (68)	
Age group by months	6-11	213 (80.4)	13 (4.9)	39 (14.7)	0.855
	12-23	86 (82.7)	5 (4.8)	13 (12.5)	
	24-35	28 (77.8)	3 (8.3)	5 (13.9)	
	36-47	15 (75.0)	-	-	5 (25.0)
	48-59	44 (84.6)	2 (3.8)	6 (11.5)	
Sex	Boy	242 (83.7)	12 (4.2)	35 (12.1)	0.149
	Girl	144 (76.6)	11 (5.9)	33 (17.6)	
Residence	Rural	136 (78.6)	8 (4.6)	29 (16.8)	0.521
	Urban	250 (82.2)	15 (4.9)	39 (12.8)	
Mother education	Illiterate	81 (15.7)	6 (5.6)	20 (18.7)	0.782
	Primary graduate	200 (82.3)	10 (4.1)	33 (13.6)	
	Intermediate graduate	77 (81.9)	6 (6.4)	11 (11.7)	
	Secondary graduate	8 (100.0)	-	-	- -
	College graduate	20 (80.9)	1 (4.0)	4 (16.0)	
Mother employment	Unemployed (Housewife)	375 (80.6)	23 (4.9)	67 (14.4)	1.000
	Governmental employed	11 (91.7)	-	-	1 (8.3)
'Mothers' marital status	Married	383 (80.2)	23 (4.9)	68 (14.3)	1.000
	Divorced	3 (100.0)	- -	- -	
Father education	Illiterate	56 (81.2)	2 (2.9)	11 (15.9)	0.873
	Primary graduate	180 (79.6)	14 (6.2)	32 (14.2)	
	Intermediate graduate	96 (85.0)	4 (3.5)	13 (11.5)	
	Secondary graduate	14 (82.4)	-	-	3 (17.3)
	College graduate	40 (76.9)	3 (5.8)	9 (17.3)	
Father employment	Unemployed	50 (69.4)	10 (13.9)	12 (16.7)	0.002
	Self-employed	231 (81.3)	12 (4.2)	41 (14.4)	
	Governmental employed	105 (86.8)	1 (0.8)	15 (12.4)	
Crowding index	2.1-4	98 (80.3)	8 (6.6)	16 (13.1)	0.554
	0-2	288 (81.1)	15 (4.2)	52 (14.6)	

(4.9%) had severe pneumonia. And 67 (14.4%) had very severe pneumonia. However, there was no significant correlation P-value 1,000. Our results showed that pneumonia was more common in children whose mothers were unemployed (housewives). The result of this study is consistent with the study conducted by Andualem *et al.* in Northwest Ethiopia, who stated that 68.3% of the respondents' occupation was a housewife.[36] As for the father's occupation, our results indicate that more than half of the fathers were self-employed, 284 (59.5%). Of the children whose parents were self-employed, 231 (81.3%) had pneumonia, 12 (4.2%) had severe pneumonia, and 41 (14.4%) had very severe pneumonia. However, a statistically significant association P-value 0.002 was found. Results indicate that pneumonia was more common in children whose parents were self-employed. Contradictory results were obtained in a case-control study in Adama, Ethiopia, which reported children with pneumonia whose fathers were farmers.[37] Another study in Este town and the surrounding rural kebeles in northwest Ethiopia showed that nearly three-quarters of parents were farmers who had children with pneumonia.[38] Certain occupations, such as housewives or self-employed, may be associated with lower socioeconomic status; besides, self-employed and housewives' parents may not have access to paid sick leave or health insurance, which may lead to a delay in seeking healthcare and receiving proper treatment, poor housing conditions, and limited access to adequate nutrition.

The study showed that most mothers were married, 474 (99.4%). And 383 (80.2%) of the children whose mothers were married had pneumonia, 23 (4.9%) had severe pneumonia, and 68

(14.3%) had very severe pneumonia. However, there was no statistically significant relationship P-value 1.000. Our study indicates that pneumonia is more common in children whose mothers were married. This result is consistent with a study conducted in northeast Ethiopia, which showed that nearly three-quarters of married mothers had children with pneumonia.[39] In addition, a mother's marital status may indirectly affect the risk of pneumonia. For example, married mothers may face more socioeconomic challenges, making it difficult to afford healthcare or access healthcare services. As for the overcrowding index, our results indicate that a quarter of the participants' families, 122 (25.6%), do suffer from overcrowding. Of the participants' families who suffered from crowding, 98 (80.3%) had children with pneumonia, 8 (6.6%) with severe pneumonia, and 16 (13.1%) with very severe pneumonia. However, there is no statistically significant relationship P-value 0.554, where pneumonia was more common in children whose families did not suffer from crowding as shown in Table 2. The result of this study was opposite to the study conducted by Keleb *et al.* in peri-urban areas of north-eastern Ethiopia, who stated that 42.9% of household overcrowding was a predictor of childhood pneumonia.[40] Population density influences illness spread because the transfer of germs and viruses that cause pneumonia is more easily and swiftly transmitted by breathing. The greater the population density, the more likely to come into contact with pneumonia patients.[41]

Regarding the pneumonia severity. The majority of children included in the study suffered from pneumonia, 81%. And 14% of children suffer from very severe pneumonia, and the lowest per-

Table 3. Factor associated with severity of pneumonia in children under five years based on socioeconomic status level.

| | Categories | Socioeconomic status level | | | | | | Mean & SD | P |
| | | Low | | Moderate | | High | | | |
		F.	%	F.	%	F.	%		
Severity of pneumonia	Pneumonia	248	64.2	122	31.6	16	4.1	85.82 & 18.003	0.049
	Severe pneumonia	16	69.6	7	30.4	-	-	78.17 & 15.888	0.049
	Very severe pneumonia	47	69.1	20	29.4	1	1.5	82.75 & 17.928	0.049
Total		311	65.2	149	31.2	17	3.6	85.01 & 17.961	0.049
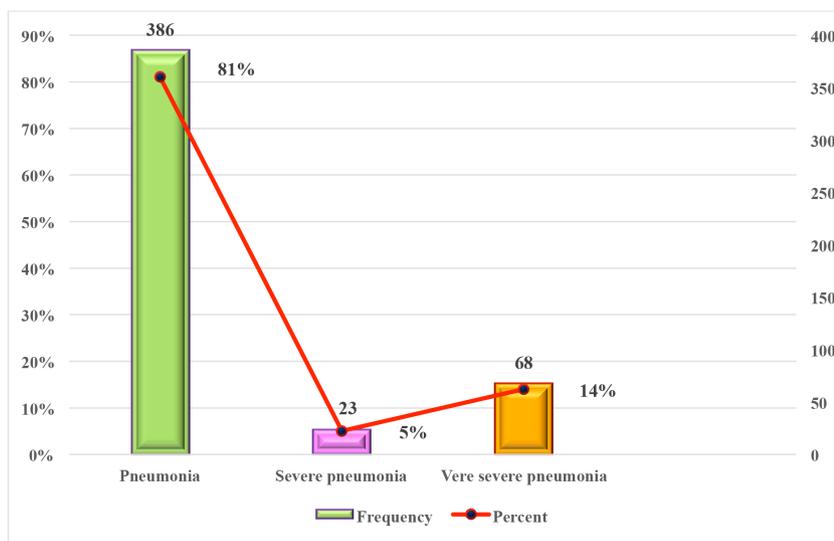
Figure 1. The participants' distribution according to the severity of pneumonia among children under five years.

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centage of children suffering from severe pneumonia was 5%, as shown in Figure 1.

Regarding the socioeconomic situation, the results showed that more than two-thirds of the participants in the study, 65%, were from low monthly income, 31% were from middle income, and 4% were from high income, as shown in Figure 2.
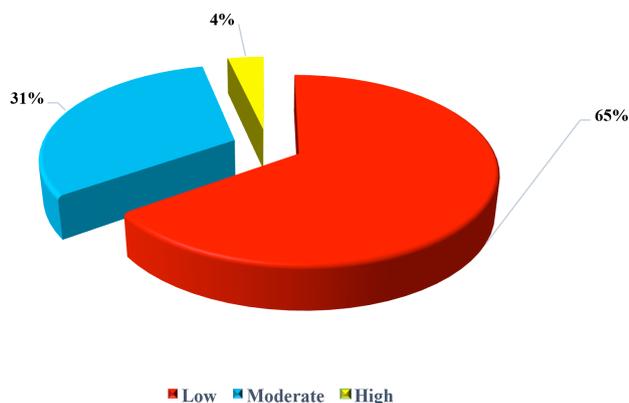
The results of this study indicate that about two-thirds of the participants, 311 (65.2%), were of low income, 248 (64.2%) had pneumonia, 16 (69.6%) had severe pneumonia, and 47 (69.1%) had very severe pneumonia. A statistically significant correlation was found P. Value 0.049. The results of this study indicate that pneumonia is more common among participants with low incomes, and this indicates that participants with a low economic level are at greater risk of developing pneumonia as appeared in Table 3. This finding agreed with Sriram and Satyanarayana, who stated that low socioeconomic status was a significant risk factor for pneumonia.[33] Also, another study in Sudan showed that pneumonia was higher among families with a lower income 26 (65%), and there was a relation between family income and pneumonia.[20] Low income may result in inadequate housing, poor nutrition, and little to no preventive medical care, such as immunization, all of which can dramatically increase the risk of contracting infectious diseases.

Conclusions

Based on the results, it can be concluded that pneumonia is a significant health issue among children, with a vast majority (81%) suffering from the condition. The findings also indicate that children within the age group of 1-11 months, males, and those residing in urban areas, whose parents had completed primary education are more susceptible to pneumonia. Furthermore, children whose fathers were self-employed, and those from low socioeconomic status and overcrowded houses, were also more likely to develop pneumonia. Therefore, the father's occupation and socioeconomic status significantly determine pneumonia severity in children.

Recommendations

Increase awareness and education about pneumonia risk factors in children under five years old, especially among parents who finished primary graduate. Regardless of their socioeconomic sta-

tus, further studies to investigate the relationship between pneumonia and other socioeconomic factors, such as access to healthcare, housing conditions, and environmental pollution.

Figure 2. Distribution of the participants according to socioeconomic status.

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