

## Evaluating the Outcomes of Bronchiolitis in Iraqi Children and Identifying Complications Associated with Bronchiolitis

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**Abstract:** Background: Bronchiolitis is the most frequent acute respiratory infection of the lower respiratory tract in children under one year and accounts for 20% of all pediatric hospitalizations. Objective: This study was contributed to evaluate and analyse clinical outcomes related to Iraqi children with bronchiolitis and determine complications and risk factors. Patients and methods: Clinical data were collected from different hospitals in Iraq for a period ranging from February 14, 2022, to August 28, 2023, which included 80 children with bronchiolitis, whose ages ranged between 0 - 11 years, and each body mass index classification was underweight, normal weight, overweight, and obesity. Moreover, all children underwent clinical diagnostics, which included chest X-ray, pulse oximetry, and nasopharyngeal swab to determine the severity of bronchiolitis, its spread, and impact, and to determine the clinical outcomes in the hospital and the therapeutic and developmental results of children with bronchiolitis. This study determined complications, mortality rates, therapeutic outcomes, and the impact of risk factors on pediatric. Results: Our enrolled clinical of children who were admitted into hospitals which found 41.25% of total patients were children within ages (0 – 3) years; most symptoms prevalence at children were difficulty breathing with 25 cases and fever with 20 cases, as well as the common comorbidities had hypertension had five children, asthma had five children, and HIV had ten children, where paternal smoking got 32 cases while past history of admission got 24 cases, rate of children was 20% had mild bronchiolitis, 40 % had moderate bronchiolitis, and 24% had a severe, length of stay in hospital with less than nine days were 72 children while the length of stay in hospital with greater than nine days were eight children, as well rate of cured included 85% while rate of death included 15%. Conclusion: The current study indicates that bronchiolitis is a common disease that is widespread among children in our country, which reinforces the risk factors and the lack of early treatment resulting in risky cases of hospitalization, the danger of which lies in the high rate of complications that lead to death

**Keywords:** Bronchiolitis; Complications; risk factors; and Pediatric hospitalizations.

### INTRODUCTION

The American Academy of Pediatrics considers severe bronchiolitis to be the first wheezing episode because of viral infection in a child under two years of age, in whom the disease also manifests itself with poor nutrition and respiratory stress characterized by Tachypnea, nasal fluttering, and hypoxemia. [American Academy of Pediatrics, 2006]

This group of patients has a high probability of requiring hemodynamic support, supplemental oxygen, and, in some cases, mechanical ventilation given the massive obstruction of the small airway, of course involving management in the Pediatric Intensive Care Unit [Nair, H. *et al.*, 2010]. Worldwide, bronchiolitis is usually a seasonal infection characteristic of the winter and spring seasons, representing the most frequent cause of hospital consultation during this time [Marcdante, K. *et al.*, 2011]. It is the most common respiratory infection in infants, affecting about 12% of them. The peak incidence of the disease is between the

ages of 3 and 6 months in 50% of cases. [Kabir, A. R. M. L., 2020]

In the United States, about 1% of hospitalizations in children are for bronchiolitis, triggering annual costs that exceed 800 million dollars. American statistics show that the respiratory syncytial virus causes approximately 700,000 cases of bronchiolitis in infants per year, of which about a third require hospitalization. [Cangiano, G. *et al.*, 2016; Meissner, H. C., 2016]

In 2015, at the National Hospital Discharge Survey, approximately a quarter of the 2.4 million hospitalizations of children under the age of 15 were for respiratory diseases. Of these hospitalizations, 31% were for pneumonia, 25% for asthma, 25% for bronchiolitis, and 19% for other respiratory diseases. [Nagayama, Y. *et al.*, 2006]

During the winter months, an epidemic of bronchiolitis annually affects children under two

years of age, increasing medical consultation and congesting pediatric emergency services, increasing the number of hospitalizations and mortality in this group of patients. Since the infection has a viral etiology, mainly due to the respiratory syncytial virus, it spreads so quickly and so easily, harming the health and well-being of the susceptible population, especially when these children have some or some previously identified risk factors. Less than 3% of patients without risk factors require hospitalization, but if there is at least one of these, the percentage may rise significantly. [Glezen, W. P. *et al.*, 1986 – Smith, D. K. *et al.*, 2017]

The mortality of hospitalized children is estimated between 1 and 2%. A study by Ucrós *et al.* showed that the peak of respiratory Syncytial Virus bronchiolitis in Bogotá occurs during times of higher rainfall during the months of April, May, and June [Figueras-Aloy, J. *et al.*, 2004; Grimwood, K. *et al.*, 2008]. Bronchiolitis has a high hospital cost. Etiological research is low in some hospitals, which leads to underestimating the economic impact of RSV on society. By the end of the first year of life, 25–50% of infants have been infected with RSV; by the age of 5, 95%; and in adulthood, 100%. Reinfection occurs frequently, although the clinical severity decreases because infants have some acquired immunity from previous exposures. [Lacaze-Masmonteil, T. *et al.*, 2004]

The presence of risk factors that favor the development of severe bronchiolitis has been identified in different studies [Eriksson, M. *et al.*, 2002]. These factors can double the incidence of severe bronchiolitis compared to patients who do not present it; therefore, their detection could benefit this group of pediatric patients to prevent complications, reduce morbidity and mortality, shorten hospital stays, and, likewise, improve cost-effectiveness [Bulkow, L. R. *et al.*, 2002]. Other risk factors, such as overcrowding and exposure to cigarette smoke, constitute a risk for children, increasing the incidence of respiratory infections when both parents smoke, with reporting averages of 12.1% in consultations and 1.6 admissions per year. [Boyce, T. G. *et al.*, 2000]

The risk factors associated with severe bronchiolitis are varied, with prematurity being a predominant factor at 10.7%. Other reports indicate that the need for hospitalization for bronchiolitis can increase by up to 45% in premature infants with bronchopulmonary

dysplasia and that mortality can reach 37% in those with congenital heart disease [Thorburn, K, 2009]. It is known that children who receive breastfeeding as an exclusive food in the first months of life have specific antibodies against the respiratory syncytial virus, passively acquired from their mother; the antibody titer is similar to maternal levels but gradually declines in the first six months of life. From then on, any detectable antibody titer for respiratory syncytial virus will be the result of a natural infection. [Welliver, R, 2003]

The Occidente de Kennedy Hospital in Bogotá has a high-quality pediatric intensive care unit, which provides coverage to the population of Occidental de Bogota and is a reference center for populations affiliated with the subsidized regime [Faro, A. *et al.*, 2015]. Most of the population with socioeconomic status attends, caring for a significant number of children, many of whom are vulnerable to respiratory infections due to overcrowding, a lack of prenatal controls that favor prematurity, exposure to cigarette smoke, environmental pollution, and malnutrition. [Schnapf, B. M, 1991]

## PATIENTS AND METHODS

We conducted a cross-sectional study for a period ranging from February 14, 2022, to August 28, 2023, which was conducted on children with bronchiolitis whose ages ranged between 0-11 years. Clinical and demographic data were collected for pediatric patients from different hospitals in Iraq, which included age, sex, and body mass index classification, which included underweight, normal weight, overweight, obesity, symptoms, comorbidities, ASA classification, economic aspect factor, and other data such as previous history of admission and parental smoking.

All the children underwent tests and diagnostics that determined the severity of the bronchiolitis, the causes of the infection (bacterial or viral), blood tests, oxygen saturation rate, and respiratory rate. The children underwent diagnostic techniques and examinations such as chest X-rays, physical examinations, pulse oximetry, and nasopharyngeal swabs.

This study recorded data on the therapeutic and developmental outcomes of children with bronchiolitis during their admission to hospital, emergency interventions, specific management, length of hospital stay, and level of progression

(recovery and death). This study was conducted to determine the rate of complications and risk factors associated with bronchiolitis in pediatric patients.

This study was designed and analyzed clinical outcomes associated with children by SPSS, version 22.0 program. This study recorded input and output data for pediatric patients suffering from bronchiolitis. The admission data included patients with pediatric patients who were diagnosed and admitted to the intensive care unit, while the discharge criteria included data for patients who had undergone other operations or had serious illnesses.

Our study were shown demographic and clinical data of children with bronchiolitis which found children with ages (0 – 3) years where highest with 41.25%, followed by children with 37.5%, males had 52 patients, and females were 28 patients, BMI classifications included underweight included 8 cases, normal weight included 40 cases, overweight included 20 cases, and obesity included 12 cases, most symptoms prevalence at children were difficulty breathing with 25 cases and fever with 20 cases, as well as the common comorbidities had hypertension had five children, asthma had five children, and HIV had ten children, where paternal smoking got 32 cases while past history of admission got 24 cases.

## RESULTS

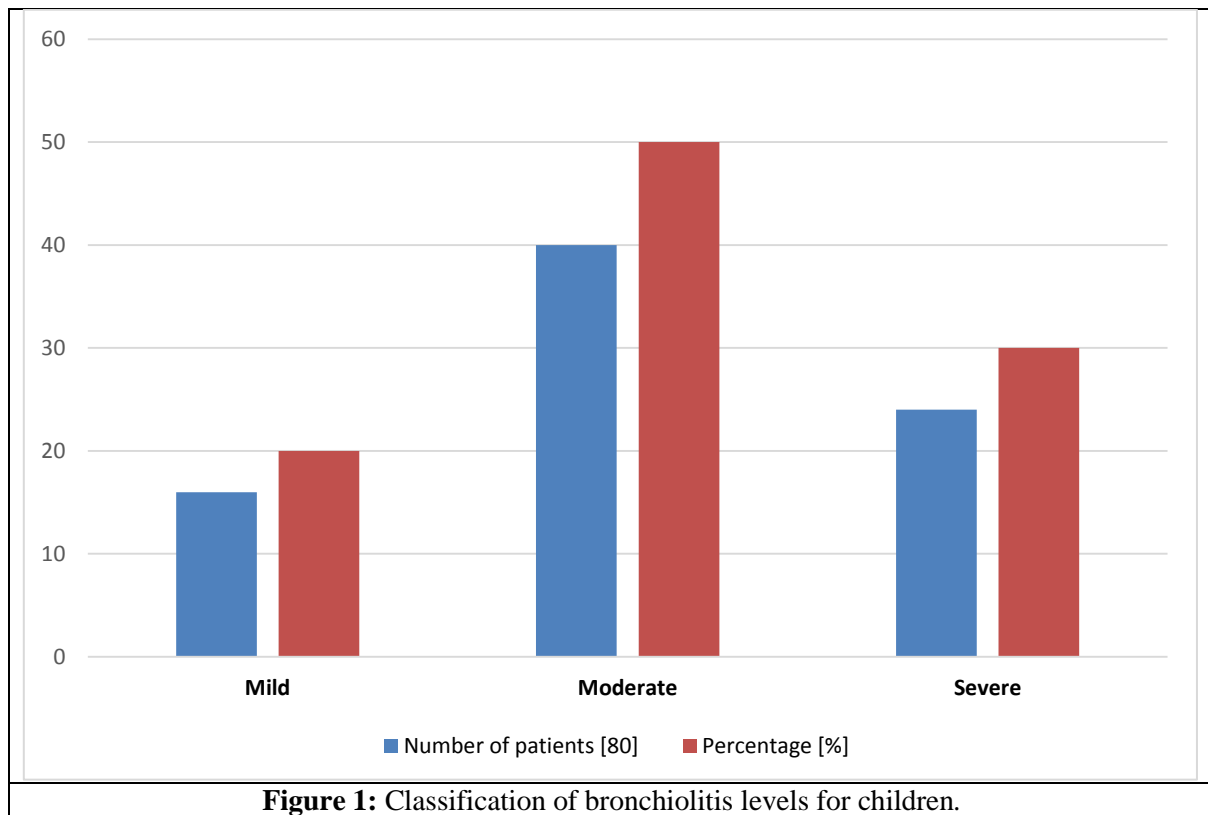
**Table 1:** Demographic and clinical characteristics outcomes of children

Characteristics	Number of patients [80]	Percentage [%]
<b>Age, years</b>		
0 - 3	33	41.25%
4 – 7	30	37.5%
8 – 11	17	21.25%
<b>Sex</b>		
Males	52	65%
Female	28	35%
<b>Classification of BMI, [kg/m2]</b>		
Underweight	8	10%
Normal weight	40	50%
Overweight	20	25%
Obesity	12	15%
<b>Symptoms</b>		
Coughing	11	13.75%
Wheezing	8	10%
Difficulty breathing	25	31.25%
Fever	20	25%
Runny nose	3	3.75%
Rapid breathing	6	7.5%
Reduced appetite	7	8.75%
<b>Comorbidities</b>		
Yes	24	30%
No	56	70%
Hypertension	5	6.25%
Diabetes	4	5%
Asthma	5	6.25%
Chronic lung disease	2	2.5%
Heart diseases	1	1.25%
Neuromuscular disorders	3	3.75%
HIV	10	12.5%
<b>ASA Class, (%)</b>		
I	8	10%
II	36	45%

III	24	30%
IV	12	15%
<b>Housing Condition</b>		
Housing full	60	75%
Not	20	25%
<b>Paternal Smoking</b>		
Yes	32	40%
No	48	60%
<b>Past History of Admission</b>		
Yes	24	30%
No	56	70%
<b>Education level of parents</b>		
Primary	12	15%
Secondary	20	25%
College/university	48	60%
<b>Occupation</b>		
Married	72	90%
Divorced	8	10%
<b>Economic status, \$</b>		
≤ 700	16	20%
701 – 900	40	50%
> 900	24	30%

In Figure 1, our study presented bronchiolitis levels for children, which indicate that the rate of

children was 20% had mild bronchiolitis, 40 % had moderate bronchiolitis, and 24% had severe.



**Figure 1:** Classification of bronchiolitis levels for children.

We conducted clinical diagnoses for children with bronchiolitis, where the rate of children has respiratory syncytial virus (RSV) got 42 cases, and influenza got 13 cases, temperature of admission

(36 - 37.5) Celsius was 55% of patients, and 37.6 - 38.4 Celsius was 25%, clinical outcomes enrolled classification of respiratory rate which found low (30-49/min) with 52 cases, moderate (50-59/min)

with 16 cases, and high ( $\geq 60$  /min) with 12 cases, oxygen Saturation included normal (More than

95%) was 52 cases, moderate (92%-94%) was 8 cases, and low (Less than 92%) was 20 cases.

**Table 2:** Identifying clinical presentations of diagnoses for children with bronchiolitis

Variables	Number of patients [80]	Percentage [%]
<b>Types of infections</b>		
Viral infection	70	87.5%
- Respiratory syncytial virus (RSV)	42	52.5%
- Human rhinovirus	7	8.75%
- Adenovirus	5	6.25%
- Influenza	13	16.25%
- Human metapneumovirus	3	3.75%
- Bacterial infection	10	12.5%
<b>Temperature on admission (in degrees Celsius)</b>		
36 - 37.5	44	55%
37.6 - 38.4	20	25%
38.5 - 39	10	12.5%
>39	6	7.5%
<b>Respiratory Rate</b>		
Low (30-49/min)	52	65%
Moderate (50-59/min)	16	20%
High ( $\geq 60$ /min)	12	15%
<b>Fever</b>		
Normal (36.5-37.5)	56	70%
Low- Grade (37.6-38.9)	16	20%
High- Grade (More than 38.9)	8	10%
<b>Oxygen Saturation</b>		
Normal (More than 95%)	52	65%
Moderate (92%-94%)	8	10%
Low (Less than 92%)	20	25%

Our results shown emergency intervention where nasopharyngeal clearing had distributed with the rate of children 87.5%, antibiotic therapy with 70 cases, oxygen therapy with 62 cases, length of stay in hospital with less than nine days were 72

children while the length of stay in hospital with greater than nine days were eight children, as well rate of cured included 85% while rate of death included 15%.

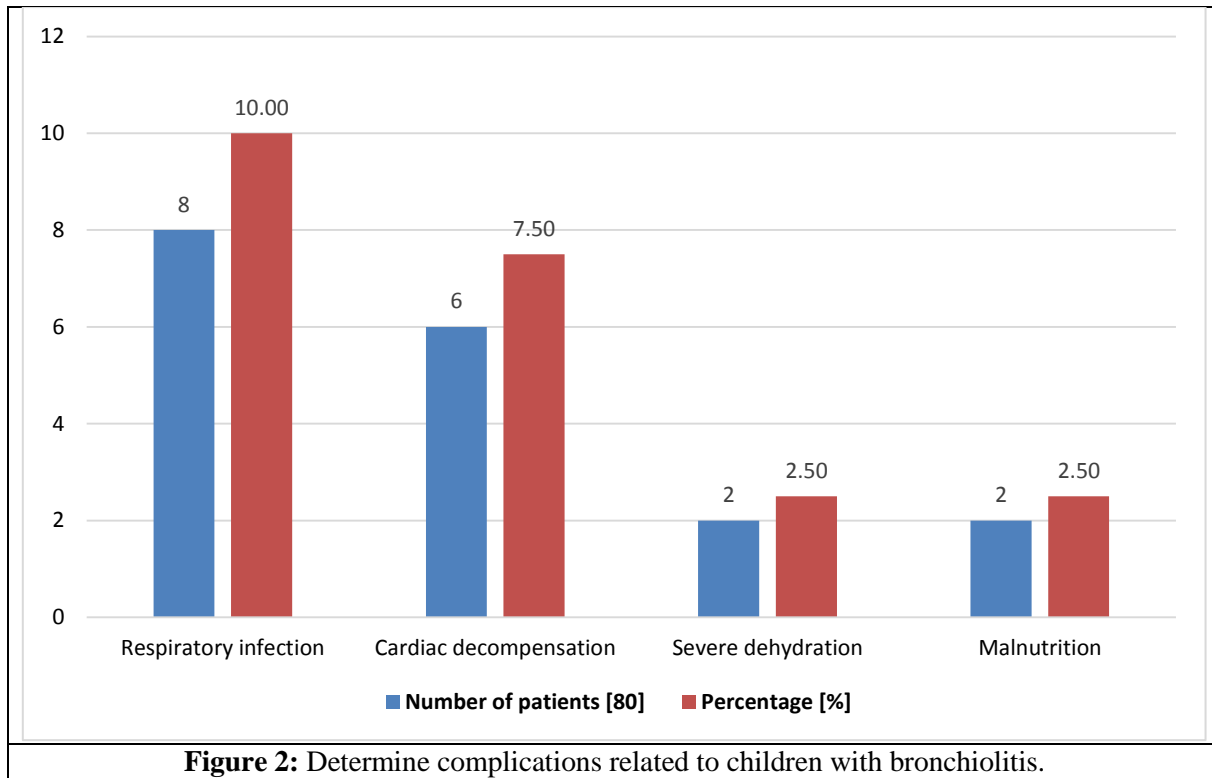
**Table 3:** Therapeutic and evolutionary data for children with bronchiolitis

Parameters	Number of patients [80%]	Percentage [%]
<b>Emergency interventions</b>		
Nasopharyngeal clearing	70	87.5%
Manual ventilation	6	7.5%
Cardiac massage	4	5.0%
<b>Specific management</b>		
Respiratory physiotherapy	35	43.75%
Nebulisation with $\beta 2$ mimetic	60	75.0%
Nebulisation with corticosteroid	42	52.5%
Parenteral corticosteroid	45	56.25%
Oral corticosteroid	26	32.5%
Antibiotic therapy	70	87.5%
Oxygen therapy	62	77.5%
Infusion of solute	60	75.0%
<b>Length of hospital stay</b>		
< 9 days	72	90.0%

> 9 days	8	10.0%
<b>Evolution</b>		
Cured	68	85.0%
Died	12	15.0%

Our findings were identified complications of children with bronchiolitis, which included respiratory infection was 10%, cardiac

decompensation was 7.5%, severe dehydration was 2.5%, and malnutrition was 2.5%.



**Figure 2:** Determine complications related to children with bronchiolitis.

According to the Findings in Table 4, we conducted a multivariate analysis to determine risk factors that effect on children with bronchiolitis,

where indicate paternal smoking, past history of admission, respiratory syncytial virus (RSV), and HIV.

**Table 4:** Multivariate analysis of risk factors effect on children with bronchiolitis

Risk factors	OR	CI 95%
Difficulty breathing	3.08	0.70 – 5.92
Fever	1.12	0.62 – 4.58
Hypertension	3.82	2.25 – 9.74
Asthma	5.59	2.66 – 12.65
HIV	3.39	1.27 – 5.86
Paternal Smoking	1.48	0.97 – 2.62
Past History of Admission	1.87	0.58 – 2.89
Respiratory syncytial virus (RSV)	2.40	0.85 – 3.92

## DISCUSSION

Previous investigations have shown that bronchiolitis among children can have significant impacts on outcomes, including complication rates, mortality rates, as well as quality of life. Complication rates in children with bronchiolitis have been demonstrated to vary, with some cases developing more serious complications like as

respiratory failure, pneumonia, as well as bronchiolitis obliterans. These complications may result in prolonged hospital stays and raised healthcare costs. [Stather, D. R. et al., 2013 – Collaco, J. M. et al., 2015]

According to a Spanish study, mortality rates among kids with bronchiolitis in Spain have been a source of concern, in a few studies reporting

higher mortality rates than in other countries, where factors that include access to healthcare, socioeconomic status, as well as resource availability can all have an impact on mortality rates for children in bronchiolitis. [Ing, C. *et al.*, 2012; Ing, C. H. *et al.*, 2014]

In terms of quality of life, a French study found that children who have had bronchiolitis in France may face challenges that include respiratory issues, recurrent infections, along with developmental delays, all of which can have an impact on their physical condition, emotional well-being, as well as overall quality of life over time. [Rappaport, B. A. *et al.*, 2015]

## CONCLUSION

Our study showed that the risk of bronchiolitis has a negative impact on children's quality of life, especially when detected late. Moreover, there are some risk factors that may cause a high rate of admission of children to the intensive care unit, which increases the risk of a high mortality rate and complication rate.

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