

REVIEW ARTICLE

# Evaluation of Impact of Some Epidemiologic Factors on the Bronchiolitis Caused by Respiratory Syncytial Virus (RSV) in Infants and Young Children Under 5 Years Old in Al- Diwaniyah Province

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## Abstract:

**Background:** The biggest viral cause of bronchiolitis and one of the major agents behind respiratory-tract infections globally is the Human Respiratory Syncytial Virus (HRSV). RSV is transmitted through airborne droplets or close contact with contaminated objects.

**Objective:** The purpose of this research is to detect major risk factors associated with susceptibility to and severity of bronchiolitis in infants and young children under the age of five caused by respiratory syncytial virus (RSV). study design to detect antibodies Immunoglobulin M (IgM) for human RSV in serum samples by using specific enzyme-linked immunosorbent assay (ELISA) kits as a diagnostic test

**Methods:** This study included 50 samples from children with respiratory infections diagnosed by pediatricians or seen at outpatient units of Al-Diwaniyah Teaching Maternity & Child Hospital, along with 50 samples from apparently healthy children under five as a control group. Samples were collected between December 2024 and February 2025. Clinical features, complications, and lab data were recorded. Statistical analysis was conducted to identify significant risk factors.

**Results:** This cross-sectional study was conducted in Diwaniyah City, Iraq. The current study showed that 24 (48.0%) positive samples out of 50 samples had RSV infection. Risk factors for severity of infection were identified in terms of age, sex, exposure to smoking, type of feeding, prematurity, and type of exposure (moderate or severe). The frequency distribution of Respiratory Syncytial Virus according to age showed that children less than 1 year old, of the male sex, exposed to tobacco smoke, and artificially fed are more susceptible to being infected with RSV.

**Conclusion:** Several risk factors have been associated with susceptibility to and severity of bronchiolitis caused by RSV in infants and young children under 5 years old.

**Keywords:** Prematurity, respiratory-tract infections, Respiratory Syncytial Virus, (ELISA) kits

## Introduction

Respiratory syncytial virus (RSV) is the primary cause of bronchiolitis and is estimated to lead to 33.1 million cases of lower respiratory tract infections in children under 5 years old each year. This results in approximately 3.2 million hospitalizations and over 100,000 deaths globally annually. (1). RSV has been identified as a major cause of viral infections that frequently result in young infants dying and necessitate admission to the pediatric critical care unit (ICU) and ventilator support. (2) The virus belongs to the family Paramyxoviridae as well as the order Mononegavirales and is a respiratory pathogen of the genus Pneumovirus that is found all over the world. The genome of H. RSV is a single-stranded negative-sense RNA.

Close contact with aerosols of infected respiratory secretions as well as medical personnel, who frequently play a key role in its dissemination, can both transfer the virus (3). RSV is considered the second most likely single pathogen to cause death in children <1 year of age (4). Due to the lack of effective antiviral drugs, current treatments for RSV primarily involve supportive care. (5) Pediatricians in Iraq have seen an increase in the prevalence of bronchiolitis and lower respiratory infections in children younger than two years old. These illnesses generally strike in the winter and can occasionally manifest as epidemics with elevated levels of morbidity and death, particularly in those with a history of medical conditions (6). There are three categories of risk factors for more severe RSV disease: viral,



environmental, and host variables. Male sex and age less than six months at the time of RSV infection are examples of host variables. (7) Risk variables related to demographics and the environment include exposure to indoor tobacco smoke and breastfeeding for less than two months (8). The most important risk factor continues to be age. Children’s airways are smaller, their respiratory capacity is compromised, and their respiratory reserve is decreased (9). Therefore, a blockage in an infant’s tiny airways is more clinically significant than one in an adult’s or older child’s peripheral airways (10). A patient’s serum can be tested for RSV-specific antibodies using an enzyme-linked immunosorbent assay (ELISA) for respiratory tract infections (RTIs). The enzyme-linked immunosorbent assay (ELISA) has demonstrated greater sensitivity and reliability compared to the traditional neutralization test. (11).

Materials and methods:

Methods:

A case-control study was conducted in the province of Al-Diwaniyah. This study was conducted during the period (December to February) in the winter of 2024 to 2025. 50 serum samples were collected from infants and young children less than 5 years of age. diagnosed with acute respiratory tract infections by pediatricians of in- and outpatient units of Al-Diwaniyah Teaching Maternity and Child Hospital, or those who were seen at outpatient clinics and chosen by consultants. 34 (68.0%) males and 16 (32.0%) females. and 50 samples from apparently healthy infants and children as a control group. The data collection about symptoms and epidemiologic factors was achieved. The ELISA technique was used for the diagnosis of RSV infections.

Serological Analysis:

IgM Detection: Human anti-respiratory syncytial virus (RSV) IgM antibodies in serum from respiratory infection patients and healthy controls were quantified using a commercial ELISA kit (Human Anti-RSV IgM ELISA; manufacturer details validated but omitted) according to the manufacturer’s protocol. Absorbance was measured at a wavelength of 450 nm.

Statistical Analysis:

An examination of statistics was done on a computing device using a software program for statistics for scientific applications. methods for comparing implementations that use chi-square as well as probabilities (P-value & X.2). A p-value is deemed of statistical significance (S) when its value is lower than 0.05, whereas it is not significantly different (N.S.) if it is more than 0.05.

Results:

1. Subject Groups:

The present study included 100 participants divided into two classes: Group 1: Patients with Bronchiolitis (50 patients). In addition, 50 healthy subjects were used as a control group. Clinical characteristics, complications, and laboratory data were collected for the study sample. A statistical analysis was conducted to identify the significant factors in the study.

2. Detection of respiratory syncytial virus (RSV) infection by ELISA technique (IgM):

The ELISA technique (IgM) was used in the present study to detect the respiratory syncytial virus antibody IgM in serum samples. The current study showed that 24 (48.0%) positive samples out of 50 samples had RSV infection. These results are

more clarified in figure (1).

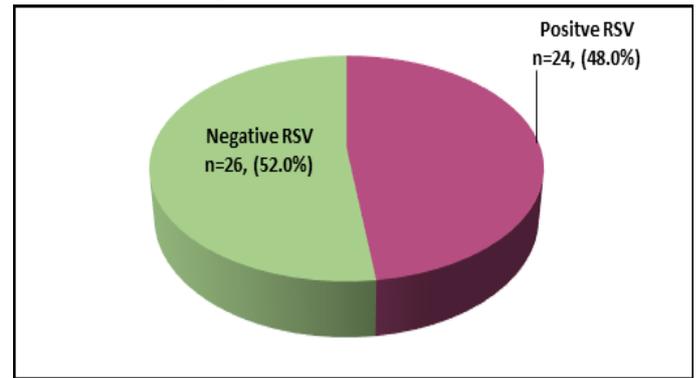


Figure (1) : Percentages of RSV by ELISA technique (IgM) of serum samples.

3. Frequency distribution of patients according to age groups

With regard to the ELISA technique (IgM), the frequency distribution of RSV-positive patients by age group included 12 (50.0%) cases in the less than 1-year-old age group, 6 (25.0%) cases between the ages of one and three, and 6 (25.0%) cases in the more than 3-year-old age group. While the frequency distribution of RSV-negative patients by age group was 15 (57.7%) cases in the less than 1-year-old age group, 7 (26.9%) cases between the ages of one and three, and 4 (15.4%) cases in the more than 3-year-old age group, and the difference was non-significant at P=0.694.

Table (1): Distribution of RSV infection between the age groups by ELISA-IgM

Test	Age group	RSV +ve	RSV -ve	X <sup>2</sup>	P value
ELISA-IgM	< 1 years, n	12 (50.0%)	15 (57.7%)	0.731	0.694
	1-3 years, n	6 (25.0%)	7 (26.9%)		
	3-5 years	6 (25.0%)	4 (15.4%)		

¥: test of chi-squared; \*: significant at P ≤ 0.05.

4. Distribution of the patients according to sex

The frequency distribution of positive RSV infections and negative RSV infections according to sex was shown in table (2). The frequency distribution of RSV-positive patients by sex included 16 (66.7%) cases that were male and 8 (33.3%) cases that were female. While the frequency distribution of RSV-negative patients by sex was 18 (69.2%) cases were male and 8 (30.8%) cases were female, and the difference was non-significant at (P= 0.846).

Table ( 2): Distribution of RSV infection between the male and female by ELISA-IgM

Test	Sex	RSV +ve	RSV -ve	X <sup>2</sup>	P value
ELISA-IgM	Male, n (%)	16 (66.7%)	18 (69.2%)	0.038	0.846
	Female, n (%)	8 (33.3%)	8 (30.8%)		

¥: test of chi-squared; \*: significant at P ≤ 0.05.

5. Distribution of the patients according to exposure to smoking

The frequency distribution of positive RSV infections and negative RSV infections according to exposure to smoking was shown in table (3). The frequency distribution of RSV-positive patients by exposure to smoking included 17 (70.8%) cases of exposure to smoking and 7 (29.2%) cases of no exposure to smoking. While the frequency distribution of RSV-negative patients by exposure to smoking was 13 (50.0%) cases of exposure to smoking and 13 (50.0%) cases of no exposure to smoking, and the difference was non-significant at (P= 0.133).

Table (3): Distribution of RSV infection between positive exposure to smoking and negative exposure to smoking by ELISA-IgM

Test	Exposure to smoking	RSV +ve	RSV -ve	X <sup>2</sup>	P value
ELISA-IgM	Positive, n (%)	17 (70.8%)	13 (50.0%)	2.257	0.133
	Negative, n (%)	7 (29.2%)	13 (50.0%)		¥
					NS

¥: test of chi-squared; \*: significant at P ≤ 0.05.

6. The frequency distribution of patients according to type of feeding

With regard to the ELISA technique (IgM), the frequency distribution of RSV-positive patients by type of feeding included 3 (12.5%) cases who were fed through breastfeeding, 15 (62.5%) cases with artificial feeding, and 6 (25.0%) with mixed feeding. While the frequency distribution of RSV-negative patients by type of feeding was 10 (38.5%) cases with breastfeeding, 11 (42.3%) cases with artificial feeding, and 5 (19.2%) cases with mixed feeding, and the difference was non-significant at (P= 0.111).

Table (4): The frequency distribution of patients according to type of feeding

Characteristics	RSV +ve	RSV -ve	P value	
Types of feeding				
Breast, n (%)	3 (12.5%)	10 (38.5%)	0.111	
Artificial, n (%)	15 (62.5%)	11 (42.3%)		¥
Mixed, n (%)	6 (25.0%)	5 (19.2%)		NS

¥: test of chi-squared; \*: significant at P ≤ 0.05.

7. Distribution of the patients according to prematurity

Table 5 displayed the frequency distribution of both positive and negative RSV infections by preterm. According to prematurity, the frequency distribution of RSV-positive patients showed that 10 (41.7%) of cases were mature and 14 (58.3%) were preterm. Only one (3.8%) of the patients who tested negative for RSV was preterm, and the difference was statistically significant (P=0.001).

Table (5): Distribution of RSV infection between premature patients and mature by ELISA-IgM

Test	Prematurity	RSV +ve	RSV -ve	X <sup>2</sup>	P value
ELISA-IgM	Premature, n (%)	14 (58.3%)	1 (3.8%)	17.643	0.001*
	Mature, n (%)	10 (41.7%)	2 (96.2%)		¥

8. Distribution of the patients according to severity

Table 6 displayed the frequency distribution of both positive and negative RSV infections by severity. There were 10 (41.7%) instances with moderate severity and 14 (58.3%) cases with severe severity in the frequency distribution of RSV-positive individuals by severity. In contrast, there were 12 (46.2%) cases of severe severity and 14 (53.8%) cases of moderate severity in the frequency distribution of RSV-negative individuals by type of exposure. According to the current study, there are more children with severe RSV infection than children with mild illness; nevertheless, statistical analysis shows that there are no significant differences between the two groups (p=0.389).

Table (6): Distribution of RSV infection between severe patients and moderate patients by ELISA-IgM

Test	Type of exposure	RSV +ve	RSV -ve	X <sup>2</sup>	P value
ELISA-IgM	Severe, n (%)	14 (58.3%)	12 (46.2%)	0.742	0.389
	Moderate, n (%)	10 (41.7%)	14 (53.8%)		¥

Discussion:

One of the primary causes of acute respiratory infections (ARIs) in children under five worldwide is respiratory syncytial virus (RSV) infection. This virus is linked to 22% of ARIs, with 40–90% of cases clinically manifesting as bronchiolitis. (12) In RSV-infected patients, the immune reaction results in neutrophils infiltrating the airways and narrowing them, causing respiratory illnesses including bronchiolitis. (13) The current study showed that 24 (48.0%) positive samples out of 50 samples had RSV infection. This means that RSV plays a major role in respiratory infections in infants and young children. Agree with (14), who pointed out that severe and fatal bronchitis is associated with RSV. A previous study (15) also confirmed that RSV was the leading cause of viral bronchiolitis in infancy. According to age group The results of the present study indicate that the most positive cases with RSV occur in children in the age group less than 1 year by the ratio of 12 (50.0%). These

results, in agreement with the result of a study done by (16) in Baghdad, demonstrate that high frequency of RSV in children younger than 1 year; infants are typically more prone to infections. Infants are at a greater risk of infections, particularly respiratory tract infections, due to their less developed adaptive immune systems compared to older children and adults. This risk increases further with the reduction of maternal antibodies, the end of breastfeeding, and exposure to daycare settings. The results of this study agree with (17). The largest percentage of hospitalized patients who tested positive for RSV was 37% in infants under 6 months, 25% in children aged 6 months to 2 years, and 12% in children aged 2 to 5 years. However, other studies indicate that hospitalizations related to RSV peak in children under three months of age. (18) Other authors suggest that the infection rate is elevated in children between the ages of 0 and 12 months. (19) Regarding sex, the present results show a high frequency distribution in male patients compared to female patients: 16 (66.7%) vs. 8 (33.3%), respectively. When studying the relationship between sex and viral infection, it is usually found that males are more likely than females to infect because of the differences in physiology, hormones, and genetics between men and women. Females have higher levels of innate and adaptive immunity than males, which could hasten the removal of viruses (20). The present results are consistent with the results of (21), which showed boys have a higher risk of RSV infection compared to girls. and agree with result (22) showing that boys may be more susceptible than females to developing severe respiratory syncytial virus bronchiolitis. This discrepancy may result from hereditary causes as well as variations in lung and airway development. (23) Several studies that have looked more closely at these disparities show that there are two boys for every girl in terms of infection, with the biggest difference in the sex ratio occurring in the first few months of life (24). However, other authors find no connection between sex and infection with Respiratory Syncytial Virus (25). He pointed out that the child's sex may not be a determining factor in the severity of infection with the RSV, which contradicts the results of this study. Tobacco smoking in the environment has been linked to an elevated risk for respiratory syncytial virus-attributable admission to hospital and disease severity. The indoor air pollution is a possible risk factor for the onset of RSV-ALRI within the community. This observation is consistent with the 2019 Global Burden of Disease Study, which identified household air pollution from solid fuels as the second leading cause of lower respiratory infection-related deaths in children under five, following child wasting. (26) Due to the immaturity of their immune and respiratory systems, and tobacco smoke contains toxic substances that affect the growth and development of the lungs. Other authors acknowledge that exposure to tobacco smoke is a major risk factor for RSV infection. It can exacerbate the severity of bronchiolitis and heighten the risk of other acute lower respiratory tract infections. (27), although others do not find this association (28). And in a study conducted by (29) The study revealed that exposure to environmental tobacco smoke (ETS) was associated with only a minimal increase in the risk of RSV illness (OR, 1.06), which contradicts the results of this research.

Taking into account the mode of feeding, the current study revealed that patients who were bottle-feeding had a greater per-

centage of RSV infection (62.5%), whereas a lower percentage was shown in patients who were nursing three (12.5%). This finding aligns with studies that confirm breastfeeding offers a protective impact on preventing respiratory infections in contrast to mixed and bottle feeding.

This protective role is particularly significant in the long term, frequently evaluated after six months of age, and demonstrates a lasting impact even after stopping breastfeeding. (30) One theory for this partial protection of nursing is that the nasopharynx of babies is colonized by lymphocytes from colostrum or milk that are sensitive to this virus, or to transfer sensitized T cells to stimulate the newborns' immune response. or deposition of antigen on macrophages or possibly as a result of breast milk suppressing the IgE response, which could play a significant role in the pathophysiology of bronchiolitis. (31) Research has indicated that RSV-IgA and lactoferrin in breast milk may support maturation, potentially influenced by prolactin. (32). In contrast, artificial breastfeeding lacks these protective factors (33), which increases the susceptibility to respiratory infections. This finding does not agree with previous literature, which has indicated that breastfeeding in the first year of life does not play a significant role in lowering common infectious diseases (34). According to prematurity, the current study showed that 14 (58.3%) were preterm out of 24 (48.0%) RSV-positive samples. Premature babies suffer from a deficiency in immunity, which makes them more susceptible to infections, especially respiratory infections, due to a deficiency in the transfer of IgG antibodies from the fetus to the mother across the placenta, as 90% of this transfer occurs in the last third of pregnancy, after the 32nd to 34th week. A study by Stoll et al. (2010) also stated that premature babies, especially those born before the 28th week, suffer from a severe deficiency in immunity, as they do not receive a sufficient amount of antibodies, which makes them more susceptible to respiratory infections, including RSV (35). Prematurity is linked with small, weak, and immature airways, an immature immune system, imperfect transfer of maternal antibodies, and insufficient cellular immunity—all of which are necessary for the viral clearance. At 30 weeks gestational age (GA), the lung development reveals that the air gap walls are one-third thicker than those of term newborns, but the lung volumes and surface area are about three and four times smaller, respectively (36). Individuals with RSV infection were classified according to the severity, based on length of hospitalization, oxygen supplementation, intensive care unit (ICU) hospitalization, and mechanical ventilation (37). RSV causes upper RTIs (URTIs) and LRTIs, and the severity can vary from minor to serious life-threatening LRTIs. (38). RSV infection (moderate to severe) has been found to be a risk factor for the recurrent wheeze that may develop later. and even asthma in children without any atopic predisposition (39)

## Conclusion:

Respiratory syncytial virus (RSV) is one of the main causes of lower respiratory tract infections in children, particularly those under one year of age. There was an association between several epidemiological risk factors—including age, sex, exposure to cigarette smoke, type of breastfeeding, and prematurity—and the severity of RSV-induced bronchiolitis.

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