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EPIDEMIOLOGY AND RISK FACTORS ANALYSIS OF CHILDREN WITH BRONCHIOLITIS ADMITTED TO NICU OF MARDAN MEDICAL COMPLEX

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Abstract

Background and Aim: Bronchiolitis stands as a prominent reason for hospitalization globally among children under the age of 2 years. Respiratory syncytial virus (RSV) infection is responsible for the onset of the disease, leading to breathing difficulties and, in severe cases, respiratory failure. The present study aimed to determine the epidemiological and risk factors analysis of children with bronchiolitis admitted to NICU.

Patients and Methods: This retrospective study was carried out on 216 children diagnosed of bronchiolitis in the Pediatric Department of Mardan Medical Complex, Mardan from January 2020 to December 2022. Children aged six years or younger who had been diagnosed with bronchiolitis were enrolled. Respiratory viruses were identified using multiplex polymerase chain reaction.

Results: Of the total 216 children, there were 156 (72.2%) male and 60 (27.8%) female. Among all patients, those under 6 months old contributed the most accounted for 56.5% (n=122) of the total, while 38 (17.6%) individuals experienced severe disease. The primary cause for hospital admissions was wheezing, accounting for 146 (67.6%) cases. All patients displayed typical symptoms of acute bronchiolitis, including cough, rapid breathing (tachypnea), and a runny nose. The incidence of bronchiolitis cases rose during the winter-spring season. Every patient revealed bronchiolitis-related abnormalities on chest X-rays, and 76 individuals (35.2%) displayed air trapping in their lungs. Several risk factors, including age (≤6 months), preterm birth, early weaning, low birth weight, and exposure to cigarette smoke, were associated with an increased possibility of developing severe disease.

Conclusion: The study observed that bronchiolitis remains a prominent cause of admission to the Pediatric Intensive Care Unit (PICU). Also, age, exposure to cigarette smoking, preterm birth, low birth weight, undergoing cesarean section, history of mechanical ventilation, breastfeeding <6 months, and substandard living conditions are different risk factors associated with severe bronchiolitis caused by RSV.

Keywords: Bronchiolitis, Respiratory syncytial virus, risk factors, epidemiology

INTRODUCTION

Bronchiolitis is characterized by inflammation and blockage of the bronchioles, primarily caused by viral infections in children under 2 years old. In severe cases, it can affect all parts of the airway, leading to symptoms such as difficulty in breathing, fever, cough, and wheezing [1]. Globally, bronchiolitis stands as the most prevalent medical reason for hospitalization among children ≤ 2years [2, 3]. The majority of these cases are reported in developing nations, where higher mortality rates are related to malnutrition and a lack of adequate medical care [4]. Research indicates that bronchiolitis follows a seasonal pattern, often manifesting as an epidemic, especially during winter [5]. Given its impact, bronchiolitis demands public health attention, affecting around 33.3% healthy children. Among reported children, approximately 2% to 10% needed hospitalization and admission to intensive care units was required in 5% of children [6, 7].

Bronchiolitis presents clinically with expiratory breathing difficulties in infants. Additionally, cough, tachypnea, chest retractions, and wheezing are among the atypical symptoms of bronchiolitis. A clinical trajectory was observed in the disease-suffering children with mild to moderate symptoms leading to respiratory failure among children. Hence, early diagnosis and prompt treatment are crucial for pediatric patients to prevent fatalities [8]. The mortality rate for severe bronchiolitis ranges from 1-7%, but it can increase significantly to 30-40% in children vulnerable due to bronchopulmonary dysplasia and preterm birth. Numerous parameters contributed to severe bronchiolitis development involved lack of breastfeeding, congenital heart defects, exposure to smoking, and living in crowded environments. These factors not only lead to prolonged hospitalization but also elevate the risk of mortality significantly [9, 10]. There is a limited literature available that compares the epidemiology and risk factors between children admitted to general wards and those requiring Pediatric Intensive Care Unit (PICU) care for acute bronchiolitis.

METHODOLOGY

This retrospective study was carried out on 216 children diagnosed of bronchiolitis in the Pediatric Department of Mardan Medical Complex, Mardan from January 2020 to December 2022. Children aged six years or younger who had been diagnosed with bronchiolitis were enrolled. Respiratory viruses were identified using multiplex polymerase chain reaction. Inclusion criteria comprised individuals showing initial symptoms of upper respiratory tract inflammation. Clinical examination or chest X-ray indicated signs of air stasis. Reduced vesicular murmur or the absence of rales was also possible. Upon admission, standardized sample collection procedures were followed for all children. Virus was isolated through a nasopharyngeal swab. All the samples were evaluated and uniform approach was implemented. A rapid direct immunofluorescence was utilized for the presence of respiratory syncytial virus (RSV) using nasopharyngeal swab. SPSS version 27 was used for data analysis.

RESULTS

Of the total 216 children, there were 156 (72.2%) male and 60 (27.8%) female. Among all patients, those under 6 months old contributed the most accounted for 56.5% (n=122) of the total, while 38 (17.6%) individuals experienced severe disease. The primary cause for hospital admissions was wheezing, accounting for 146 (67.6%) cases. All patients displayed typical symptoms of acute bronchiolitis, including cough, rapid breathing (tachypnea), and a runny nose. The incidence of bronchiolitis cases rose during the winter-spring season. Every patient revealed bronchiolitis-related abnormalities on chest X-rays, and 76 individuals (35.2%) displayed air trapping in their lungs. Several risk factors, including age (≤6 months), preterm birth, early weaning, low birth weight, and exposure to cigarette smoke, were associated with an increased possibility of developing severe disease. Table-I represents the epidemiological factors of severe bronchiolitis. Severity of acute bronchiolitis based on their age groups are illustrated in Table-II. The causes for hospital admission

among children suffering from acute bronchiolitis induced by RSV are depicted in Figure-1. Different signs and symptoms of bronchiolitis is demonstrated in Figure-2. X-ray images of the chest in children diagnosed with acute bronchiolitis due to RSV depicted in Figure-3.

Table-I epidemiological factors of severe bronchiolitis (N=216)

Variables	**N (%)**
Gender	
Male	156 (72.2%)
Female	60 (27.8%)
Age Groups (Months)	
<6	122 (56.5%)
6-10	44 (20.4%)
11-18	30 (13.9%)
19-24	20 (9.3%)
Disease severity status	
Mild-Moderate	178 (82.4%)
Severe	38 (17.6%)

Table-II Severity of acute bronchiolitis based on their age groups (N=216)

Age Groups (Months)	**N (%)**	**Mild-Moderate (178)**	**Severe (38)**	**P-value**
<6	122 (56.5%)	94 (77%)	28 (23%)	<0.01
6-10	44 (20.4%)	37 (84.1%)	7 (15.9%)	
11-18	30 (13.9%)	28 (93.3%)	2 (6.7%)	
19-24	20 (9.3%)	19 (95%)	1 (5%)	

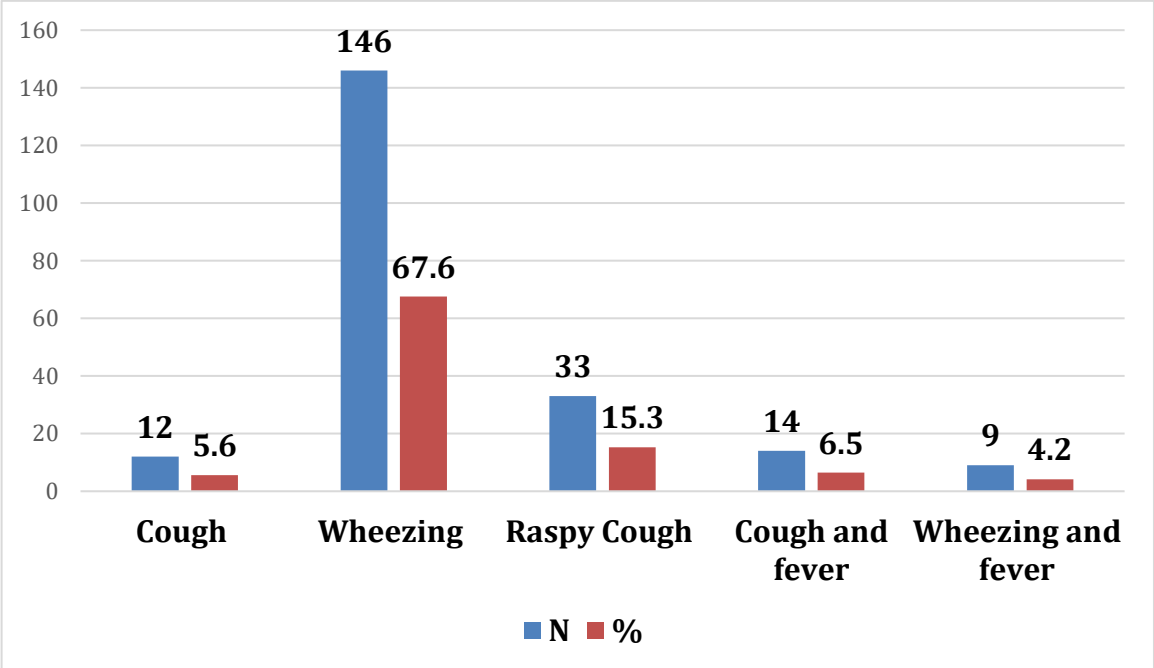

Figure-1 causes for hospital admission among children suffering from acute bronchiolitis induced by RSV (N=216).

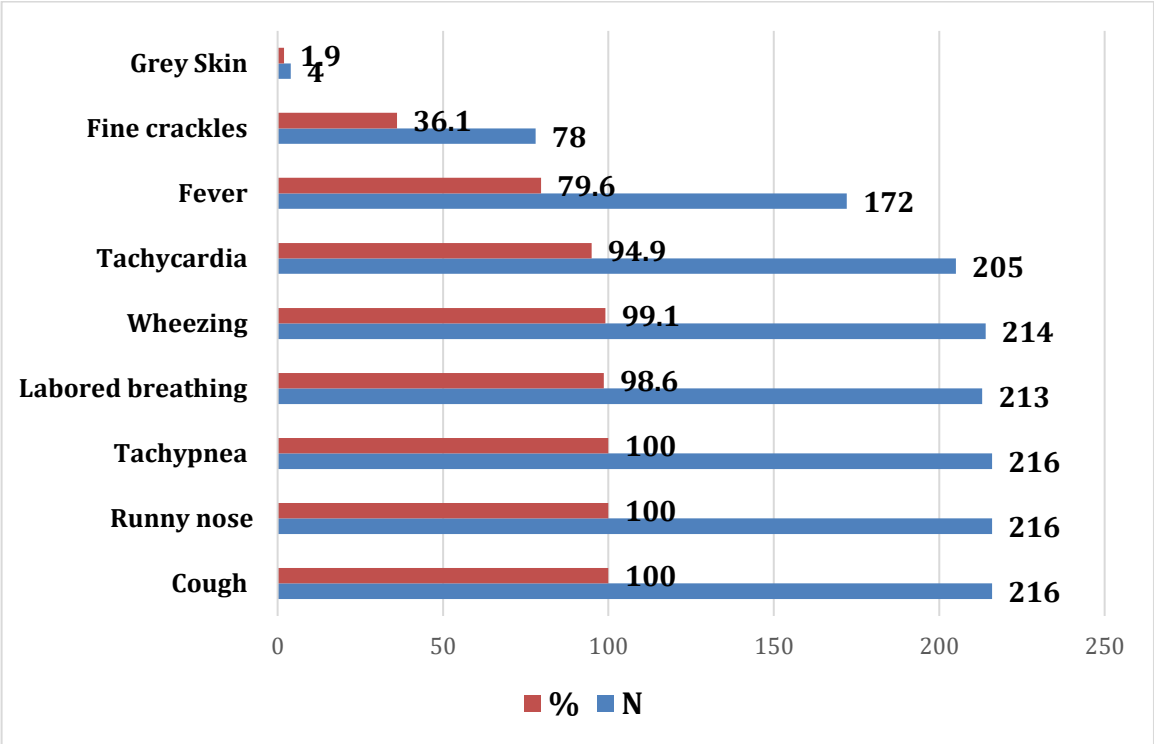

Figure-2 Different signs and symptoms of bronchiolitis (N=216)

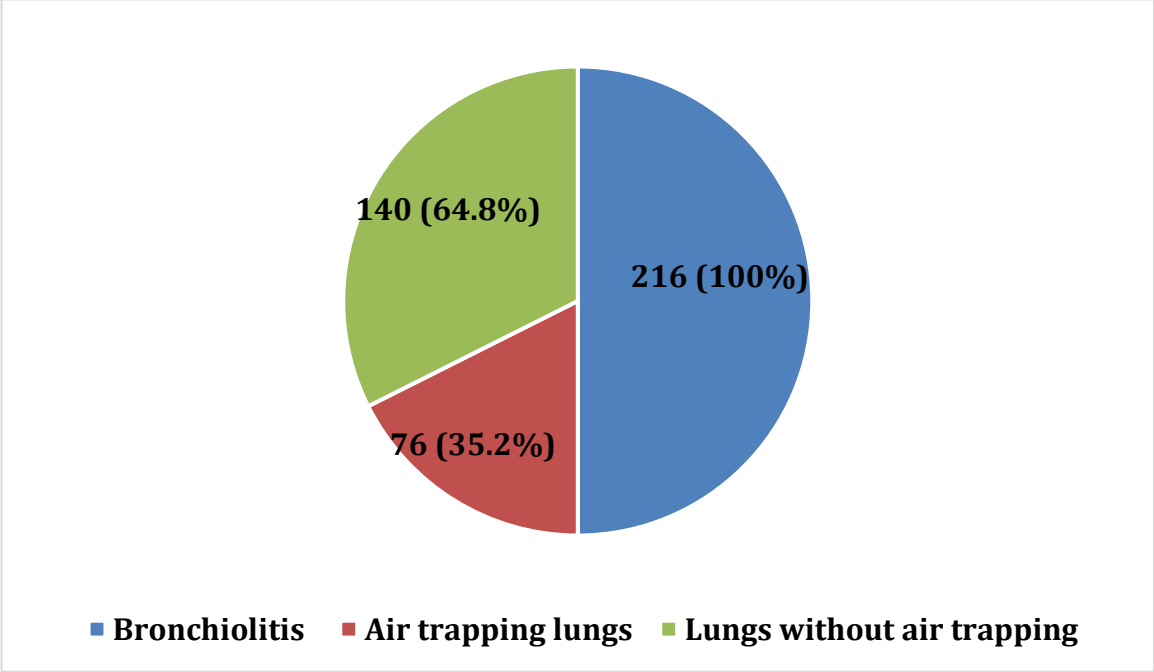

Figure-3 Status of X-ray images of the chest in children diagnosed with acute bronchiolitis (N=216)

DISCUSSION

The present study mainly focused on the epidemiological and risk factors of bronchiolitis in children and found that bronchiolitis remains a prominent cause of hospitalization. Age, exposure to cigarette smoking, preterm birth, low birth weight, undergoing cesarean section, history of mechanical ventilation, and substandard living conditions are severe bronchiolitis related risk factors. The major contributor to higher rate of morbidity and mortality is bronchiolitis [11]. As anticipated, RSV emerged as the predominant virus responsible for bronchiolitis in all patients, aligning with previous findings in the literature [12-14]. Regression analysis revealed that non-RSV infection

independently posed a risk factor, corroborating existing research indicating that RSV causing bronchiolitis are more prone to PICU admission [15].

Globally, bronchiolitis is mainly caused by viral infections among children, with Respiratory Syncytial Virus (RSV) being widely identified as promising cause for severe bronchiolitis among infants admitted in hospital [16]. Male children were most prevalent than female. These findings are comparable to Lee et al. results who reported a proportion of 61% [17]. Children ≤12 months were the most frequently hospitalized age group for bronchiolitis, with those under 6 months being the most prevalent, constituting 56.5% of the cases. Notably, 17.6% of the acute bronchiolitis cases in our study presented as severe bronchiolitis. Various factors, including gender, age, breastfeeding<6 months, exposure to smoking, history of cesarean section, mechanical ventilation, maternal education, and living conditions were examined to understand the differences between mild-moderate and severe bronchiolitis cases [18].

An earlier study reported that parents of children living in overcrowded area and exposure to smoking are elevated risk factors for severe bronchiolitis. Lee et al. [19] reported similar findings with additional risk factor of low socioeconomic status. In contrast, several other studies have suggested an association between gender and the severity of bronchiolitis [20-22].

A perinatal or neonatal history of respiratory diseases was identified as a risk factor for hospitalization. Infants with any condition that hampers the early postnatal development of the lungs are predisposed to an elevated risk of severe bronchiolitis. Studies conducted by Linssen et al. [23] and Mitting et al. [24] indicated a reduced risk of RSV-related hospitalization in infants who were breastfed. Additionally, living in crowded conditions and having siblings were identified as significant risk factors for more severe acute respiratory infections. This is attributed to the higher probability of exposure to circulating viruses, thereby increasing the risk of infection.

CONCLUSION

Bronchiolitis remains a prominent cause of admission to the Pediatric Intensive Care Unit (PICU). Also, age, exposure to cigarette smoking, preterm birth, low birth weight, undergoing cesarean section, history of mechanical ventilation, breastfeeding <6 months, and substandard living conditions are different risk factors associated with severe bronchiolitis caused by RSV.

REFERENCES

1. Alharbi, A.S.; Alqwaiee, M.; Al-Hindi, M.Y.; Mosalli, R.; Al-Shamrani, A.; Alharbi, S.; Yousef, A.; Al Aidaroos, A.; Alahmadi, T.; Alshammary, A.; et al. Bronchiolitis in children: The Saudi initiative of bronchiolitis diagnosis, management, and prevention (SIBRO). Ann. Thorac. Med. 2018, 13, 127–143
2. Nicolai, A.; Ferrara, M.; Schiavariello, C.; Gentile, F.; Grande, M.; Alessandroni, C.; Midulla, F. Viral bronchiolitis in children: A common condition with few therapeutic options. Early Hum. Dev. 2013, 89, S7–S11.
3. Li, Y.; Wang, X.; Blau, D.M.; Caballero, M.T.; Feikin, D.R.; Gill, C.J.; A Madhi, S.; Omer, S.B.; Simões, E.A.F.; Campbell, H.; et al. Global, regional, and national disease burden estimates of acute lower respiratory infections due to respiratory syncytial virus in children younger than 5 years in 2019: A systematic analysis. Lancet 2022, 399, 2047–2064.
4. Tsou, P.; Vadivelan, A.; Kovvuri, M.; Garg, N.; Thangavelu, M.; Wang, Y.; Raj, S. Association between multiple respiratory viral infections and pediatric intensive care unit admission among infants with bronchiolitis. Arch. Pediatr. 2020, 27, 39–44.
5. Naja, Z.; Fayad, D.; Khafaja, S.; Chamseddine, S.; Dbaibo, G.; Hanna-Wakim, R. Bronchiolitis admissions in a Lebanese tertiary medical center: A 10 years' experience. Front. Pediatr. 2019, 7, 189.
6. Praznik, A.; Vinšek, N.; Prodan, A.; Erčulj, V.; Pokorn, M.; Mrvič, T.; Paro, D.; Krivec, U.; Strle, F.; Petrovec, M.; et al. Risk factors for bronchiolitis severity: A retrospective review of

patients admitted to the university hospital from central region of Slovenia. Influ. Other Respir. Viruses 2018, 12, 765–771.
7. Najioullah, F.; Bancons, P.; Césaire, R.; Fléchelles, O. Seasonality and coinfection of bronchiolitis: Epidemiological specificity and consequences in terms of prophylaxis in tropical climate. Trop. Med. Int. Health 2020, 25, 1291–1297
8. Alharbi, N.S.; Alnasser, Y.; Alenizi, A.S.; Alanazi, A.S.; Alharbi, A.H.; AlQurashi, F.O.; Nafisah, I.; Yousef, A.A. Did the national lockdown in saudi arabia reduce lower respiratory illnesses in children? Front. Pediatr. 2021, 9, 717739.
9. Alharbi, A.S.; Alzahrani, M.; Alodayani, A.N.; Alhindi, M.Y.; Alharbi, S.; Alnemri, A. Saudi experts' recommendation for RSV prophylaxis in the era of COVID-19: Consensus from the Saudi Pediatric Pulmonology Association. Saudi Med. J. 2021, 42, 355–362.
10. Greenberg, D.; Dagan, R.; Shany, E.; Ben-Shimol, S.; Givon-Lavi, N. Incidence of respiratory syncytial virus bronchiolitis in hospitalized infants born at 33–36 weeks of gestational age compared with those born at term: A retrospective cohort study. Clin. Microbiol. Infect. 2020, 26, 256.e1–256.e5.
11. Al-Hindi, M.Y.; Alshamrani, Z.M.; Alkhotani, W.A.; Albassam, A.B.; Tashkandi, A.M.A.; AlQurashi, M.A. Utilization of health-care resources of preterm infants during their first 2 years of life after discharge from neonatal intensive care unit. J. Clin. Neonatol. 2021, 10, 37.
12. Fauroux, B.; Hascoët, J.-M.; Jarreau, P.-H.; Magny, J.-F.; Rozé, J.-C.; Saliba, E.; Schwarzinger, M. Risk factors for bronchiolitis hospitalization in infants: A French nationwide retrospective cohort study over four consecutive seasons (2009–2013). PLoS ONE 2020, 15, e0229766.
13. Lee, Y.-I.; Peng, C.-C.; Chiu, N.-C.; Huang, D.T.-N.; Huang, F.-Y.; Chi, H. Risk factors associated with death in patients with severe respiratory syncytial virus infection. J. Microbiol. Immunol. Infect. 2016, 49, 737–742.
14. Mecklin, M.; Heikkilä, P.; Korppi, M. Low age, low birthweight and congenital heart disease are risk factors for intensive care in infants with bronchiolitis. Acta Paediatr. 2017, 106, 2004–2010.
15. Mohammed, M.H.A.; Agouba, R.; EI Obaidy, I.; Alhabshan, F.; Abu-Sulaiman, R. Palivizumab prophylaxis against respiratory syncytial virus infection in patients younger than 2 years of age with congenital heart disease. Ann. Saudi Med. 2021, 41, 31–35.
16. Alejandre, C.; Guitart, C.; Balaguer, M.; Torrús, I.; Bobillo-Perez, S.; Cambra, F.J.; Jordan, I. Use of procalcitonin and C-reactive protein in the diagnosis of bacterial infection in infants with severe bronchiolitis. Eur. J. Pediatr. 2021, 180, 833–842.
17. Al-Hindi, M.Y.; Aljuhani, H.; Alnajjar, A.R.; Alessa, S.; Alqurashi, M.; Faden, Y.A. Examining the association between parental socioeconomic status and preterm birth using multidomain social determinants scale in a tertiary care center in Saudi Arabia. Cureus 2020, 12, e10506.
18. Jartti T, Smits HH, Bønnelykke K, Bircan O, Elenius V, Konradsen JR, Maggina P, Makrinioti H, Stokholm J, Hedlin G, Papadopoulos N. Bronchiolitis needs a revisit: Distinguishing between virus entities and their treatments. Allergy. 2019 Jan;74(1):40-52.
19. Lee, M.; Goh, A. Mortality in children hospitalised with respiratory syncytial virus infection in Singapore. Singap. Med. J. 2021, 62, 642–646.
20. Homaira N, Wiles LK, Gardner C, Molloy CJ, Arnolda G, Ting HP, Hibbert PD, Braithwaite J, Jaffe A. Assessing the quality of health care in the management of bronchiolitis in Australian children: a population-based sample survey. BMJ quality & safety. 2019 Oct 1;28(10):817-25.
21. Ghazaly M, Nadel S. Characteristics of children admitted to intensive care with acute bronchiolitis. European Journal of Pediatrics. 2018 Jun;177:913-20.
22. Tsou P, Vadivelan A, Kovvuri M, Garg N, Thangavelu M, Wang Y, Raj S. Association between multiple respiratory viral infections and pediatric intensive care unit admission among infants with bronchiolitis. Archives de Pédiatrie. 2020 Jan 1;27(1):39-44.

23. Linssen RS, Bem RA, Kapitein B, Rengerink KO, Otten MH, den Hollander B, Bont L, van Woensel JB, PICE Study Group Wösten-van Asperen Roelie M. Klein Richard H. Kneyber Martin CJ Kuiper Jan Willem Verlaat Carin van Heerde Marc Riedijk Maaike A. van Waardenburg Dick A.. Burden of respiratory syncytial virus bronchiolitis on the Dutch pediatric intensive care units. European Journal of Pediatrics. 2021 Oct;180(10):3141-9.
24. Mitting RB, Peshimam N, Lillie J, Donnelly P, Ghazaly M, Nadel S, Ray S, Tibby SM. Invasive mechanical ventilation for acute viral bronchiolitis: retrospective multicenter cohort study. Pediatric Critical Care Medicine. 2021 Mar 1;22(3):231-40.