Scientific Research Publishing

Open Journal of Pediatrics, 2025, 15(1), 130-140
https://www.scirp.org/journal/ojped
ISSN Online: 2160-8776
ISSN Print: 2160-8741

# Acute Bronchiolitis about 535 Cases at Zinder National Hospital, Niger

**Georges Thomas Ibrahim[1,2*], Doutchi Mahamadou[1,2], Hassane Maman Laoul[1,2], Hamza Mahaman Nafissa[2], Garba Moumouni[3,4], Samaila Aboubacar[3,4], Kamaye Moumouni[3,5]**

[1]Clinical Research and Health System Laboratory, Faculty of Health Sciences, André Salifou University, Zinder, Niger
[2]Zinder National Hospital, Zinder, Niger
[3]Faculty of Health Sciences, Abdou Moumouni University, Niamey, Niger
[4]Amirou Boubacar Diallo National Hospital, Niamey, Niger
[5]Niamey National Hospital, Niger
Email: *georgesthomasabraham@yahoo.fr

**How to cite this paper:** Ibrahim, G.T., Mahamadou, D., Laoul, H.M., Nafissa, H.M., Moumouni, G., Aboubacar, S. and Moumouni, K. (2025) Acute Bronchiolitis about 535 Cases at Zinder National Hospital, Niger. *Open Journal of Pediatrics*, **15**, 130-140.
https://doi.org/10.4236/ojped.2025.151013

**Received:** December 27, 2024
**Accepted:** January 24, 2025
**Published:** January 27, 2025



## Abstract

**Introduction:** Lower respiratory infections in general, and acute bronchiolitis in particular, represent a major cause of morbidity in children in Niger. The aim of this study was to investigate the epidemiological, diagnostic and therapeutic features of acute bronchiolitis in infants in the Pediatrics A department of the National Hospital in Zinder. **Patients and Methods:** This was a descriptive, cross-sectional study with prospective data collection conducted from April 1 to May 31, 2024. All infants aged 0 to 24 months hospitalized with acute bronchiolitis in the pediatric ward A of Zinder National Hospital were included in the study. Epidemiological, diagnostic and therapeutic aspects were the characteristics studied. Data analysis was performed using Epi info 7 software. **Results:** During the study period, acute bronchiolitis accounted for 51% of hospitalizations, and infants aged 3 - 11 months were the most affected (52.90%). The sex ratio was 1.6. The average age of patients was 10.40 ± 6.91 months, with extremes of 1 and 24 months. 98.50% of patients came from urban areas, and the socioeconomic level of families was average in 47.49% of cases. Mixed breastfeeding was practiced in 59.63% of cases. Average hospital admission time was 4.22 days. The main clinical signs were cough (43.18%), rhinorrhea (70.85%), ronchi (35.33%), crepitating rales (26.54%), sibilant rales (24.11%), signs of struggle (14.02%) and polypnea (70.85%). Paraclinical findings included chest distension, hyperleukocytosis and anemia, with 47.48%, 55.14% and 78.31% respectively. Therapeutically, nebulization was used in 93.08% of cases, respiratory physiotherapy (41.34%), corticosteroid therapy (34.08%), antibiotic therapy (21.50%), oxygen therapy (20.11%) and antipyretics (4.68%) were prescribed. Progression was favorable in 93.08% of patients, with a case-fatality rate of 1.12%. **Conclusion:** With its high frequency,

acute bronchiolitis is a public health problem. Boys were the most affected by the condition, and the predominant age group was 3 to 11 months. Management was essentially based on nebulization and physiotherapy.

**Keywords**

Acute Bronchiolitis, Infant, Zinder, Niger

## 1. Introduction

Acute bronchiolitis is an obstructive respiratory infection that affects the lower respiratory tract of the infant Leading to wheezing and occurs after an upper respiratory tract infection [1] [2]. It is an endemic-epidemic viral disease that occurs frequently in infants under two years of age responsible for many consultations and hospitalizations in pediatric settings [1]-[3]. A syncytial respiratory virus (VRS) and the rhinovirus are responsible for it [2]. Infants most at risk of contracting severe bronchiolitis are those under the age of 6 months and/or who have a sub-underlying such as prematurity, bronchopulmonary dysplasia and congenital heart disease [2]-[4]. In Africa in 2016, bronchiolitis was responsible for 20.9% of respiratory diseases acute and 1.7% of hospitalizations [5]-[7]. In a study conducted in Mali in 2018, a frequency of 1.05% was observed in hospitals [5]. In Niger, the acute respiratory failures, including bronchiolitis, were the main causes of consultation in the various health structures with a hospitalization frequency of 15.54% according to a 2007 study [8]. Therapeutically the use of certain means, including corticosteroids, bronchodilators and kinesitherapy is not unanimously approved by practitioners. Studies on this condition remain partials in Niger. We therefore report on our experience in the management of bronchiolitis acute to through epidemiological, clinical, therapeutic and evolutionary aspects in children admitted to the pediatrics department A of the Zinder National Hospital (HNZ) in order to contribute to the improvement of knowledge.

## 2. Patients and Methods

### 2.1. Framework and Type of Study

It was about a descriptive cross-sectional study with prospective data collection that had been carried out over a period of 2 months ranging from 1st April to May 31, 2024 in the Pediatrics department A of the National Hospital of Zinder.

### 2.2. Study Population

The study population consisted of all children 0 - 5 years old admitted to the pediatrics department A of the HNZ.

### 2.3. Inclusion Criteria

All infants aged 0 - 24 months with a diagnosis of acute bronchiolitis were

included in the study.

### 2.4. Non-Inclusion Criteria

This study did not include:

- Infants who are in their 3rd episode of bronchiolitis in the same period (infant asthma);
- Patients over 2 years of age;
- Patients whose parents did not consent to participate in the study;
- All infants with immunosuppression.

### 2.5. Variables Studied

These parameters have been explored:

- The socio-demographic data of patients (age, gender, origin, socio-economic level of the parents;
- Clinical data (a history, reason for admission, duration of signs before admission, physical examination);
- Paraclinical data (Chest X-ray results, blood count results, creatinine, urea, blood sugar);
- Therapeutic data (nebulization, antibiotics, corticosteroids, bronchodilators, antipyretics, physiotherapy, oxygen therapy, hydration);
- Evolutionary data (death, favorable evolution, loss of sight, escapees).

### 2.6. Course of the Study

- The interrogation of the mothers of infants to have anamnestic data of the patients, following the clinical examination in order to identify the clinical signs that the patients had presented and finally the patient records to access the assessment paraclinic;
- The positive diagnostic was based on the following clinical criteria: presence of cough, rhinorrhea, polypnea-like dyspnea, signs of respiratory struggle, wheezing, snoring or crackling sting;
- The following-up of the evolutionary data of the patients in particular the evolution of their clinical condition and the efficacy of the treatment instituted, elements which had enabled the prognosis of the patients to be determined.

### 2.7. Data Analysis

The data was analyzed and processed with the software Epi Info7.2.6.0 Regarding the descriptive part, qualitative variables were expressed in frequencies, quantitative variables in means ± standard deviation. The link between qualitative variables was estimated using Pearson's $Chi^2$ test.

### 2.8. Ethical Considerations

The anonymity of patients was respected and the informed consent of their parents had been obtained.

## 3. Results

### 3.1. Frequency

During the study period, 1048 children were hospitalized in Pediatrics for various pathologies, including 535 cases of acute bronchiolitis (51%).

### 3.2. Socio-Demographic Characteristics

The socio-demographic aspects of patients are represented in Table 1. The average age was of 10.40 months ± 6.91 with extremes of 1 and 24 months. Children aged 3 to 11 months were the most affected, with 52.90% of cases (n = 283). The male sex predominated in 62.06% of cases with a sex ratio of 1.6. The patients came essentially from the urban environment in 98.50% of cases (n = 527). They were admitted directly to the hospital in 62.57% of cases (n = 112). The average age of the patients' mothers was 27.30 years old with extremes of 17 and 44 years. These were schooled about 84.92% of cases (n = 152), with a level socio-economic means about 47.49% of cases (n = 254).

Table 1. Characteristics sociodemographic of infants.

| Variables | Staff (n) | % |
|---|---|---|
| **Age (in months)** | | |
| <3 | 49 | 9.16 |
| [3 - 11] | 283 | 52.90 |
| [12 - 24] | 203 | 37.94 |
| **Sex** | | |
| Masculine | 332 | 62.06 |
| Feminine | 203 | 37.94 |
| **Origin** | | |
| Urban district | 8 | 1.50 |
| Country road | 527 | 98.50 |
| **Admission method** | | |
| Direct | 423 | 79.06 |
| Referral | 112 | 20.94 |
| **Mother's age (in years)** | | |
| [15 - 20] | 44 | 8.23 |
| [21 - 30] | 381 | 71.21 |
| [31 - 40] | 98 | 18.31 |
| >40 | 12 | 2.25 |
| **Profession of mothers** | | |
| Housewife | 220 | 41.12 |
| Official | 189 | 35.32 |
| Student | 79 | 14.77 |
| Shopkeeper | 47 | 8.79 |
| **Level of education** | | |
| Instructed | 454 | 84.86 |
| Uneducated | 81 | 15.14 |
| **Socio-economic level** | | |
| Bottom | 120 | 22.43 |
| Means | 254 | 47.48 |
| Good | 161 | 30.09 |

### 3.3. Personal and Family History of Infants

Table 2 represents the personal and family histories of patients. The infants were up to date with their vaccinations according to the schedule of the expanded vaccination program (PEV) of Niger in 68.41% cases (n = 366). Breastfeeding mixed was practiced about 59.63% cases (n = 319), breastfeeding excluded about 28.78% (n = 154) and breastfeeding artificial about 11.59% cases (n = 62). Food diversification was poorly conducted in 50.84% of cases (n = 271). A history of congenital heart disease, sickle cell disease and asthma was found in infants in 2.80% (n = 15), 19.25% (n = 103) and 1.50% (n = 8) of cases respectively. Asthma, diabetes and atopy were the most found family histories in respectively 49.34% (n = 264), 37.95% (n = 203) and 6.35% cases (n = 34).

Table 2. Related characteristics to the personal and family history of infants.

| Variables | Staff (n) | % |
|---|---|---|
| **Vaccination status** | | |
| Updated | 366 | 68.41 |
| Not up to date | 169 | 31.59 |
| **Power supply mode** | | |
| Mixed laxation | 319 | 59.63 |
| Exclusive siltation | 154 | 28.78 |
| Artificial Breast-feeding | 62 | 11.59 |
| **Personal background** | | |
| Congenital heart disease | 15 | 2.80 |
| Drepanocytosis | 103 | 19.25 |
| Asthma | 8 | 1.50 |
| None | 409 | 76.45 |
| **Family history** | | |
| Asthma | 264 | 49.34 |
| Diabetes | 203 | 37.95 |
| Atopia | 34 | 6.35 |
| Others* | 34 | 6.36 |

*Others: High blood pressure, sickle cell disease.

### 3.4. Diagnostics Aspects

Respiratory distress with 40.19% (n = 215), fever 16.63% (n = 89), the cough 12.52% (n = 67) and the breathing difficulty 30.66% (n = 164) were the most frequent reasons for admission. The patients had consulted in the three (3) first days after the onset of symptoms in 55.32% of cases (n = 296). The average time to admission was 4.22 days with extremes of 1 day and 15 days. A fever, tachycardia and polypnea were present at admission in respectively 23.56% (n = 126); 79.06% (n = 423); 70.84% (n = 379). Patients were admitted in a state of agitation in 23.18%. The main clinical signs were cough about 43.18% (n = 231), rhinorrhea 70.85% (n = 379), the ronchi 35.33% (n = 189), crackling rattles 26.54% (n = 142) the sibilant rales 24.11% (n = 129), the signs of struggle 14.02% (n = 75) and polypnea 70.85% (n = 379) (Figure 1). Respiratory distress was moderate in 50.28% (n

= 269) infants and severe in 13.41% cases (n = 72). The pallor was found in 20.19% (n = 108). At the paraclinical level, a hyperleukocytosis and an anaemia were found in respectively 55.14% (n = 295) and 78.31% (n = 419) cases. Chest distension and interstitial syndrome pulmonary were the most common radiological findings, in 47.48% (n = 254) and 32.90% (n = 176) of cases respectively.

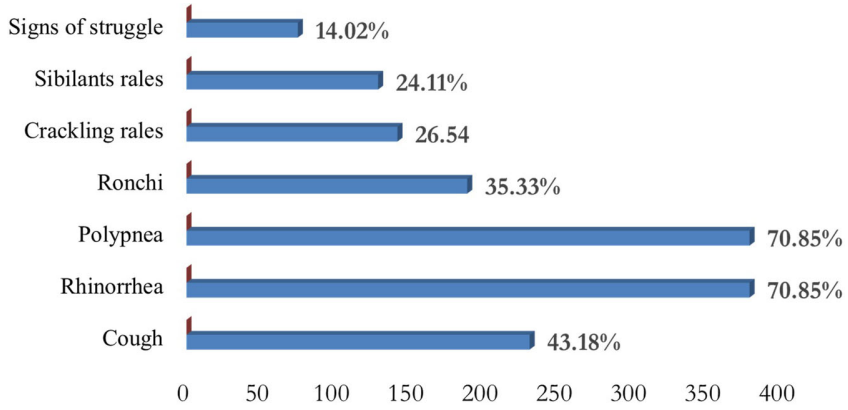


**Figure 1.** Distribution of patients according to physical signs.

### 3.5. Therapeutic Aspects and Evolutionary

The aspects are represented in **Table 3**. A nebulization was administered to 93.08% (n = 498) of the patients; physiotherapy respiratory 59.62% (n = 319); corticosteroid therapy 58.87% (n = 315), antibiotic therapy 21.50% (n = 115); oxygen therapy 36.44% (n = 195) and the nasal unobstruction 10.46% (n = 56). The antibiotic therapy was used in front of signs that raise fears of bacterial superinfection or particular fragility. One adjuvant treatment with paracetamol injection for the febrile episodes were used in 23.55% of cases (n = 126). The average duration residence permit was of 5.35 days with extremes of 1 and 11 days. The evolution was favourable about 93.08% (n = 498) and a rate of death of 1.12% (n = 6) was found.

**Table 3.** Distribution of patients according to the type of treatment.

| Type of treatment | Staff (n) | % |
|---|---|---|
| Nebulization | 498 | 93.08 |
| Physiotherapy | 319 | 59.62 |
| Oxygen therapy | 195 | 36.44 |
| Corticotherapy | 315 | 58.87 |
| Antibiotic therapy | 115 | 21.5 |
| Antipyretic | 126 | 23.55 |
| Nasal deobstruction | 56 | 23.55 |
| Hydration | 146 | 27.28 |

## 4. Discussion

This work reports the characteristics of acute bronchiolitis in the middle Hospital. This study presents some limits. The methodological in particular its short duration of two months may not accurately reflect the actual incidence of bronchiolitis.

The absence of explorations allowing the etiological confirmation (Immunofluorescence, PCR). However, these results can be discussed with scientific data. The frequency of acute bronchiolitis was 51% in this study. Of frequencies lower are reported in the literature [3] [9]-[11]. A Frequency found in this work could be related to the short duration of the study, but also to the promiscuity in view of the mode of transmission of viruses during cold episodes.

### 4.1. Sociodemographic Characteristics of Infants

In this study, a male predominance was found with a sex ratio of 1.6. This result confirms the observation that the male sex was preferentially affected in case of acute respiratory infections [3] [12]. This male predominance would be linked to the genetic predispositions making the little boy more susceptible to infections [13]. Doumbia *et al.* [14] to Mali in 2018 had regained a male predominance in 63% of the case. The children under 3 to 11 months were reached in 52.90% of cases. This could be explained by the immaturity of the immune system in this age group that I would expose these infants to repeated infections [15]. Banzet *et al.* [16] in Togo in 2015 had found a rate of 50.3% in infants from 0 - 3 months and 38.4% in 4 to 6 months. This disparity between the results would be explained by the difference between the places of study. As a result, bronchiolitis remains the infection of the lower respiratory tract read frequently in infants. Patients came mainly from urban areas with a rate of 98.50%. This result could be explained by the advantages of proximity and social benefits with free of care for children 0 - 5 years old offered by the HNZ. Magawata *et al.* [17] in 2017 in Niger had found respectively 90.67% of the cases from the environment urban. The patients were admitted directly to the HNZ in 79.06% against 19.44% of interim measures. This could be explained by the proximity of the HNZ to the majority of our patients whose origin is urban but also by non-compliance with the sanitary ramid linked to the free of charge of care for children aged 0 - 5 who are brought directly to the hospital without going through the integrated health centers (CSI). This factor has been found by other authors [12] [18]. Sagba *et al.* [18] in Benin in 2017 had found 46.6% of direct admissions compared to 53.4% of references. The socio-economic level was average in 47.49% of households. This factor had been found by other authors [14].

### 4.2. Characteristics Related to the Personal and Family History of Infants

Infants were up to date with their vaccinations according to the EPI Niger about 68.41% of the case. Proximity to health centers and the urban origin of our patients could be the main reasons for this vaccination coverage. This rate corroborates those of the literature [13] [19]. Breastfeeding mixed was practiced about 59.63% and exclusive breastfeeding about 28.78% cases.

### 4.3. Clinical Aspects and Therapeutic

A diagnosis of acute bronchiolitis is clinic. Complementary tests, notably

immunofluorescence and PCR are only necessary in special situations such as to detect the first cases of an epidemic, to suspend anti-RSV immunoprophylaxis in the premature infants or to limit nosocomial infection in infants in a care unit. We will discuss only the clinical aspects of the diagnosis. The most frequently encountered reasons for admission in this study were respiratory distress (RD) and respiratory difficulty with 40.19% and 30.66% respectively. These same observations had been made in the literature [16] [20]. Patients had consulted within three (3) days after the onset of symptoms in 55.32% and in 38.70% between 4 to 7 days. This delay in consultation could be explained by self-medication or traditional treatment by mothers at home. Ly F *et al.* [21] in Senegal in 2017 had found 54.8% and 24.2% of patients and put respectively within 3 days and between 4 to 7 days from the beginning of the disease. A average admission time was 4.22 days with extremes of 1 - 15 days. On physical examination, fever was present in 23.56% of patients. This low rate could be explained by the routine administration of paracetamol or ibuprofen by mothers in case of fever before consultation. This rate is lower than those of the literature [3] [21] [22]. Ronchi, crackling rales and wheezing were found respectively in 35.33%; 26.54% and 24.11%. This result shows the inflammation of the alveoli and bronchioles during bronchiolitis [23]. These results are comparable to those found by Bellon *et al.* [15] in Benin in 2019. In this study, skin pallor was found in 20.19% of cases. In bronchiolitis, pallor reflects the severity of circulatory disorders that may occur during the disease. Patients were admitted in a state of agitation in 23.18%. This neurological disturbance was described by other authors and is explained by the installation of brutal hypoxemia and the brain tropism of the RSV [23]. About this study, the rhinorrhea was present in 70.85%. Ouédraogo *et al.* [12] and Doumbia *et al.* [24] had also reported a rhinorrhea in 79.2% and 80% of patients respectively. Signs of struggle and the hissing rants were found in respectively 14.02% and 24.11% cases. Doumbia *et al.* [24] and Maiga *et al.* [9] had Found respectively 95.5% and 96.22% of signs of struggle. In this study, the prescription of complementary examinations was not systematic, it was based on signs of severity and/or infectious risk factors. Chest X-rays showed thoracic distension in 47.48%. Other authors had also reported pathological images in bronchiolitis to the chest X-ray [21] [22] [24]. Blood count was most often normal in infants admitted for RSV bronchiolitis. However, a discreet lymphocytosis was sometimes noted. Polynucleosis or neutropenia should suggest a bacterial superinfection. In this study, hyperleukocytosis 55.14% and anemia 78.31% were reported. This high frequency of anemia in this study could be not only of origin carentielle in nutriments or infectious, but also of malaria origin because of its endemic character in Niger.

### 4.4. Therapeutic Aspects and Evolutionary

The nebulization has been used in 93.08% of our patients with essentially salted serum associated with the salbutamol. Doumbia *et al.* [24] used this association in all patients (100%). Other studies in the literature had shown a decrease in

symptoms and the hospitalization period of 24 hours with the sessions of nebulizations [25] [26]. Physiotherapy Respiratory had been practiced about 59.62% of cases in this study. Antibiotic therapy was administered in 21.5% of patients. The frequency of bacterial superinfection during acute infant bronchiolitis could explain this antibiotic therapy. Bogne *et al.* [3] in Yaoundé in 2013 had used antibiotics in 91.7% of patients. Corticosteroids were used in 58.87% of patients. Other authors had reported this corticosteroid therapy in the literature [24] [27]. The mean length of hospitalization was 5.35 days with extremes of 1 and 11 days. Aubry *et al.* [28] in Lille in 2019 had reported a similar result with 4.37 days. The use of corticosteroids in this study could explain the decrease in hospitalization duration. The evolution was favorable in 93.08% of patients. The mortality rate was 1.12%. These results could be explained by the improvement of the technical plateau in the management of bronchiolitis especially with the availability of respiratory physiotherapy.

## 5. Conclusion

Acute bronchiolitis with its high frequency found constitutes a public health problem. Boys were the most affected by the affection and the predominant age group was 3 to 11 months. Support was essentially based on nebulization and physiotherapy.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

## References

[1] Tsifiregna, R.L., Ratovoarisoa, S.P., Andrianirina, Z.Z. and Rakotomalala, R.L.H. (2018) Ravelomanana Acute Infant Bronchiolitis: Descriptive Study at Soavinandriana. *Revue Malgache de Pédiatrie*, **1**, 82-88.

[2] (2016) Bronchiolitis. In: Török, E., Moran, E. and Cooke, F.J., Eds., *Oxford Handbook of Infectious Diseases and Microbiology*, Oxford University Press. 609-611.

[3] Bogne, J.B., Chiabi, A., Yatchet, T.D., Nguefack, S., Mah, E., Tchokoten, P.F., *et al.* (2013) Acute Bronchiolitis in Infants under 24 Months of Age at Yaounde (About 296 Cases). *Health Sciences and Disease*, **14**, 1-6.

[4] WHO (2017) Acute Respiratory Infections WHO/ARI.

[5] Ramatou, T. (2023) Impact of Salbutamol over the Duration of Hospitalization of Bronchiolitis Cases in the Pediatric Emergency Room of the Gabriel Touré University Hospital. Bamako University of Sciences, Techniques and Technologies Faculty of Medicine and Odonto-stomatology.

[6] Grimprel, E. (2001) Épidémiologie de la bronchiolite du nourrisson en France. *Archives de Pédiatrie*, **8**, 83-92. https://doi.org/10.1016/s0929-693x(01)80162-7

[7] Toubiana, J. (2018) Acute Infant Bronchiolitis. In: *E. Pilly: Maladies infectieuses et et tropicales*, 26th Edition, Alinéa Plus, 195-197.

[8] Souleymane, I.K. (2022) Acute Bronchiolitis in children: Epidemiological, Diagnostic, Therapeutic and Evolutionary Aspects of the serVice of Pediatrics of the National Hospital Amirou Boubacar Diallo of Niamey. University Abdou Moumouni.

[9] Maiga, B., Togo, B., Dial, H., Togo, P., Doumbia, A.K., *et al*. (2016) Epidemiological and Clinical Study of Acute Respiratory Distress in Children Aged 1 to 59 Months Admitted in the Pediatric Emergency Department at the Gabriel Toure University Hospital in Bamako. *Malian Journal of Infectiology and Microbiology*, **7**, 27-32.

[10] Savage, E., David, M., Bresson, V., Return, K., Bosdure, E. and Dubus, B.C. (2017) Hypertonic Dirty Serum Nebulise and Acute Infant Bronchiolitis: Current Data. *Archives of Pediatrics*, **19**, 635-641.

[11] Mehdi, Y., *et al*. (2019) Pathologie respiratoire, quel profil épidémiologique en contexte hospitalier. Thèse-med, 19-22.

[12] Ouédraogo Yugbaré, S.O., Ouédraogo, R., Nenebi, A., *et al*. (2016) Respiratory Syncytial Virus (RSV) Infections in the Pediatric Teaching Hospital Charles de Gaulle of Ouagadougou, Burkina Faso. *Bulletin de la Société de Pathologie Exotique*, **109**, 20-25. https://doi.org/10.1007/s13149-016-0473-6

[13] Brasset, D. (2017) Prise en charge de la bronchiolite aiguë du nourrisson en médecine générale: Taux de guérison et facteurs associés à la guérison. Thèse-méd, 21-22, 26, 41.

[14] Doumbia, A.K. *et al*. (2018) Acute Infant Bronchiolitis: About 112 Cases Hospitalized in the Pediatrics Department of the CHU Gabriel Touré. *Revue Malienne d'Infectiologie et de Microbiologie*, **11**, 42-47.

[15] Bellon, G., *et al*. (2019) Bronchiolite aiguë du nourrisson: Aspects de la prise en charge médico-kinésithérapique. Ouvrage du Réseau Respiratoire d'Aquitaine, 10-11, 18.

[16] Banzet *et al*. (2015) Characteristics of Bronchiolitis Epidemics in Languedoc Roussillon. *Health Watch Bulletin*, No. 4, 5.

[17] Magawata, H. (2017) Epidemiological, Diagnostic, Therapeutic and Evolutionary Aspects of Bronchopulmonary Infections in Children Aged 0 to 5 Years in the Pediatrics Department of the Niamey National Hospital. Doctoral Thesis, Universidad Autónoma de Madrid.

[18] Sagba, G.G., Padonou, C., Tohodjede, Y., Bognon, G., Bello, D. and Okay, V.F. (2017) Respiratory Distress of the Nour Risson at the CHUD-OP of Porto-Novo, Benin: Epidemiology, Causes and Evolution of 320 Cases. *African Journal of Pediatrics and Medical Genetics*, **2**, 40-46.

[19] Baked, B., Tatagan, K., Kessié, K., Cafechina, A.B.L., Assimadi, K., Paupe, J., *et al*. (1998) Hospital Epidemiology of Low Acute Respiratory Infections (AKI) in Togolese Infants and Children. *Médecine d'Afrique Noire*, **45**, 435-439.

[20] Toloba Diallo, S., Sissoko, B.F., Diallo, A.N., Keita, B. and Chaulet, P. (2011) Practical Approach to Respiratory Health (APSR) in Mali: Basic Investigation. *Revue de Pneumologie Clinique*, **15**, 7-13.

[21] Ly, F., Camera, B., After, D., Sakho, K.A., Sow, A., Sarr, F.N., *et al*. (2018) Characteristic Study Epidemiological, Clinical, Radiological and Evolutionary Tics of Low Acute Respiratory Infections (AKI) in the Pediatrics Department of the CHN PIKINE in Dakar. *African and Malagasy Review for Scientific Research/Health Sciences*, **2**, 108-118.

[22] Soumana, A., Kamaye, M., Assumane, M. and Moumouni, G. (2014) Acute Respiratory Infections in the Pediatrics Department of the National Hospital of Lamordé. *Annales de l'Université Abdou Moumouni de Niamey*, **16**, 126-133.

[23] Jacque, B., Lea, T., Agathe, F. and Astrid, V. (2016) Bronchiolitis Acute: A pathophysiologye Complex but Which Makes It Possible to Guide the Care. *Journal of the*

*Practitioner*, **66**, 968-970.

[24] Doumbia, A.K., Togo, P., Coulibaly, O., Dembélé, A., Sacko, K., Maiga, B., *et al*. (2018) Study of Acute Bronchiolitis of the Infant ABOUT 112 cases Hospitalized in the Pediatrics Department of the Gabriel Toure University Hospital in Bamako. *Malian Journal of Infectiology and Microbiology*, **11**, 42-47.

[25] Kuzik, B.A., Al Qadhi, S.A., Kent, S., Flavin, M.P., Hopman, W., Hotte, S., *et al*. (2007) Nebulized Hypertonic Saline in the Treatment of Viral Bronchiolitis in Infants. *The Journal of Pediatrics*, **151**, 266-270.E1. https://doi.org/10.1016/j.jpeds.2007.04.010

[26] Al-Ansari, K., Sakran, M., Davidson, B.L., El Sayyed, R., Mahjoub, H. and Ibrahim, K. (2010) Nebulized 5% or 3% Hypertonic or 0.9% Saline for Treating Acute Bronchiolitis in Infants. *The Journal of Pediatrics*, **157**, 630-634.E1. https://doi.org/10.1016/j.jpeds.2010.04.074

[27] Soumana, A., Kamaye, M., Djafar, M., Samailla, A., Hamadou, A.B., Dima, H., *et al*. (2016) Risk Factors Associated with the Death of Infants Suffering from Respiratory Distress. *Annals of Abdou University Moumouni*, **21**, 146-152.

[28] Aubry, P. and Gauzère, B.A. (2022) Infections respiratoires aiguës Actualités 2019. p. 1.