

Strategie of the “Acute Respiratory Disease Room” in two tertiary referral clinics: a retrospective multicenter cohort study

Estrategia de “Sala Enfermedad Respiratoria Aguda” en dos clínicas de referencia de tercer nivel de complejidad: estudio de cohorte multicéntrica retrospectiva

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What do we know about the subject matter of this study?

The ARD ward strategy aims to reduce morbidity and mortality due to acute respiratory disease in children between 3 months and 5 years of age, providing early and standardized management to this population.

What does this study contribute to what is already known?

This study identifies the outcomes of the ARD ward strategy in two healthcare centers in Bogotá, the adherence to the guidelines, and the follow-up regarding the education of parents and caregivers based on the district health guide of Bogotá - Colombia. The positive results of the implementation of this strategy are recorded.

Abstract

Respiratory diseases are one of the main causes of morbidity and mortality in children under 5 years of age. The acute respiratory disease (ERA in Spanish) room strategy implemented in Colombia is an important tool to reduce hospitalization and mortality rates in this population. **Objective:** To describe the health outcomes of the implementation of the ERA room strategy in two health institutions in Bogotá. **Patients and Method:** Multicenter descriptive study including 1785 patients admitted to the ERA rooms of two institutions in Bogotá, between December 2019 and 2022. Data on sex, age, admission diagnosis, length of stay in ERA room, education provided, and post discharge follow-up were collected. The main outcomes were evaluated through hospitalization requirement, ICU requirement, and post discharge improvement. **Results:** 1785 patients were included during the study

Keywords:

Respiratory Therapy;
Asthma; Bronchiolitis;
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period. 57% were male; median age was 26.6 months (IQR: 11.8 to 40.6); length of stay in ERA room was 2.62 hours (IQR: 1.73 to 4.88); 91.65% of family members and/or caregivers received educational measures. **Conclusions:** This study describes the results of the implementation of the ERA room strategy; the low proportion of patients requiring hospitalization is evident. Additionally, the education provided to parents and caregivers on home management is relevant, as well as the post discharge follow-up of this cohort of patients with acute respiratory disease.

Introduction

Acute respiratory disease (ARD) refers to a group of entities affecting the respiratory tract caused by viruses and bacteria responsible for high morbidity and mortality rates in children under 5 years of age worldwide, especially in low- and middle-income countries¹⁻⁴. The World Health Organization (WHO) estimates that nearly three million deaths worldwide in 2016 (40 deaths per 100,000) were attributable to ARD^{5,6}.

ARD presents with a variety of symptoms and signs, with most children having one or more symptoms of mucosal irritation or inflammation (rhinorrhea, cough)⁷. Patients with lower respiratory tract infections (pneumonia, bronchiolitis) may show signs of respiratory distress, and impaired gas exchange, with life-threatening compromise⁸.

Prevention measures have been developed for this age group, which have led to a decrease in the morbidity and mortality rate. In Colombia, the ARD ward strategy has been implemented, originally developed in Chile in the 1980s, with the main objective of reducing mortality due to acute respiratory infections (ARI), hospital stays due to obstructive bronchitis (OB) as the main cause of pediatric consultations and giving priority to the education of parents and caregivers⁹. In Colombia, this strategy has been implemented since 2004 and is included as part of primary health care, the IMCI program, and the Ten-Year Public Health Plan 2022-2031^{5,10}.

The implementation of the ARD ward strategy has reduced the complications rate, the ARD level in children under 5 years of age, and the number of hospitalizations due to OB and has facilitated the decongestion of emergency services in Bogotá¹⁰. In 2005, the mortality rate for respiratory diseases was 53.68 per 100,000 inhabitants, in 2015 this rate was 15.16 per 100,000 inhabitants, and, in 2021, it had its lowest point presenting only 5.84 per 100,000 inhabitants, which are preventable and intervenable at national and district levels according to the Ministry of Health and Social Protection (MHSP).

The objective of this study was to describe the health outcomes of the ARD ward strategy of two tertiary healthcare centers in Bogotá between December 2019 and December 2022.

Patients and Method

The ARD ward of the healthcare centers included in this study works as an adjoining room of the emergency department. In this service, patients are admitted after a complete pediatric evaluation and those who meet the following inclusion criteria: age between 3 months and 5 years, premature children older than 6 months of age, presence of mild respiratory distress, oxygen requirement through nasal cannula < 1 liter/min, be able to take fluids orally, diagnoses such as croup, wheezing, bronchiolitis, and asthma attack. The therapeutic intervention is carried out by a cardiopulmonary physiotherapist or respiratory therapist who assesses the patient comprehensively before and after treatment. At the end of the initial treatment (nebulized medication or short crisis scheme with metered-dose inhaler), the patient is assessed again by the pediatrician of the department who decides whether to refer the patient to the emergency observation department or to discharge her/him home. According to the norm, the care in the ARD ward should not exceed 6 hours.

Study design

Multicenter descriptive study, which includes patients admitted to the ARD wards of the *Clínica Pediátrica Colsanitas* and *Clínica Infantil Santa María del Lago* in Bogotá between December 2019 and December 2022, and who meet the criteria for inclusion in the ARD ward. The database was created with the records of clinical histories and statistical tools shared with the district health secretariat (SDS in Spanish). The results were presented according to the guidelines for reporting observational studies in epidemiology (STROBE)¹¹.

Variables and data

Clinical and sociodemographic variables were recorded, such as sex, age, admission diagnosis, risk factors, diagnostic tests solicited (chest X-ray and laboratory tests), length of stay in the ARD ward, therapeutic interventions used (inhalation therapy, nebulized medications), as well as education provided to parents and caregivers, post-discharge follow-up, hospitaliza-

tion requirement and time, and post-discharge improvement.

Statistical analysis

Statistical analysis was performed with the statistical software STATA version 15 (licensed to Unisantas). Categorical variables were described as absolute and relative frequencies and quantitative variables were described as measures of central tendency and dispersion, depending on the distribution of the data evaluated by the Shapiro-Wilk test ($p < 0.05$).

The categorical variables were compared by the Chi-square test or Fisher's exact test, while the continuous ones were compared by the Mann-Whitney U test.

Results

Demographic and clinical characteristics

1785 patients were included during the study period (figure 1). 57% were male, the median age was 26.6 months (IQR: 11.8 to 40.6), the length of stay in the ARD ward was 2.62 hours (IQR: 1.73 to 4.88), the most prevalent diagnosis was OB, asthma, or equivalent in 748 patients (41.9%), the risk factors identified were recurrent obstructive bronchitis (ROB) (16.5%) followed by prematurity (2.1%), 71.8% of the patients were discharged to their homes. 68.5% were followed up 7-14 days after discharge (figure 2), 15% ($n = 270$) of patients required hospitalization with a median length of stay of 2 days (IQR: 1 to 4), and only 13 patients (0.7%) required subsequent hospitalization in the pediatric intensive care unit (PICU) with a median length of stay of 5 days (IQR: 3 to 5) (table 1) (figure 3).

Treatments received

Metered-dose inhalers were administered to 80.5% of the patients during their care in the ARD ward. The median number of inhalation therapy sessions was 3 doses (IQR: 2 to 6), 100% of the admitted patients had pulse oximetry recorded and the median was 2 measurements (1-2), 91.7% of the patients and family members received educational actions (figure 2). 50.5% of the patients with a diagnosis of OB, asthma, or equivalent received treatment with inhalation therapy, and 78.8% of the patients with laryngotracheitis/croup received treatment with nebulized medication. Of the patients who received inhalation therapy, 74.1% were sent home upon discharge from the ARD ward; likewise, 56.4% of the patients who received nebulization were sent home upon discharge from the ARD ward (table 2).

Diagnostic tests

Laboratory tests (CBC, CRP, viral panel, or SARS-CoV-2 tests) were performed in 20.9% of patients, and chest X-rays were solicited in 51.2% (table 2).

Discussion

The objective of this study was to evaluate the health outcomes of the implementation of the ARD ward strategy in two tertiary referral healthcare centers in Bogotá, Colombia. The results of the study showed the effectiveness of patient care in the ARD ward.

It was found that 15% of the patients seen in the ARD ward required hospitalization, 1% of this cohort required PICU, the prevalent diagnosis was OB in 49.1% of the patients, and the main risk factor identified was ROB in 16.5% of the cases. Additionally, 71.8% of the patients were discharged to their homes and 91.7% of the patients and family members received educational actions.

The median age of the patients included in this study was 26.6 months, in agreement with the prevalence of respiratory infection in children under 5 years of age reported in different studies¹²⁻¹⁵. Likewise, in this cohort, the incidence was higher in the male sex (57%) which coincides with that reported in previous studies^{14,16,17}. The available evidence suggests that males are more susceptible than females to present ARD, which is related to anatomical differences in the airway between them, lifestyle, and socioeconomic conditions¹⁸.

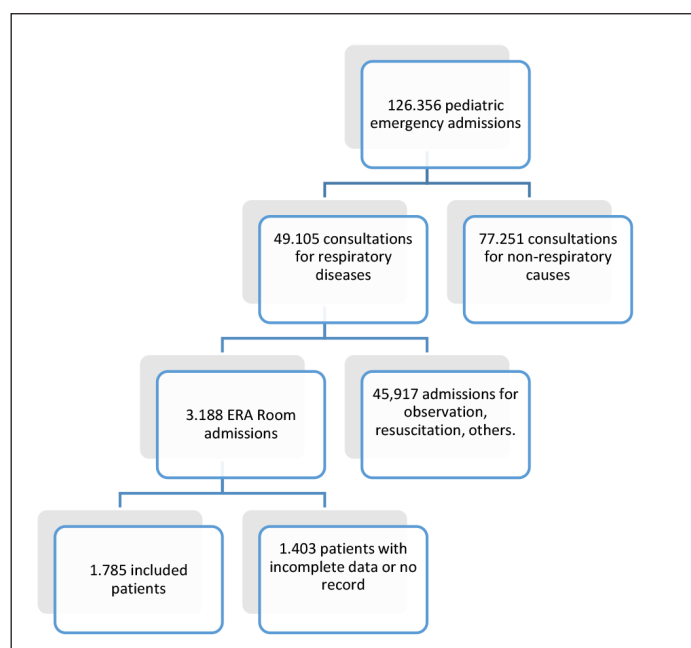


Figure 1. Flow chart of included patients

Table 1. Demographic and clinical characteristics in the Acute Respiratory Disease Room study population

Gender male, n (%)	1017 (57)
Age months, median (RIQ)	26.6 (11.8-40.6)
Consultation time, median (RIQ)	2.62 horas (1.73-4.88)
Admission diagnosis, n (%)	
Obstructive bronchial syndrome	748 (41.9)
Bronchiolitis	536 (30)
Risk factors, n (%)	
Recurrent obstructive bronchial syndrome	293 (16.4)
Prematurity	38 (2.13)
None	1404 (78.7)
Patients who required hospitalization, n (%)	270 (15)
Patients who required ICU, n (%)	13 (1)
Length of hospital stay (days), n (median)	
Hospitalization	2 (1.4)
ICU	5 (3.5)
Resolution of the reason for consultation, n (%)	1704 (95.5)

*ICU: Intensive Care Unit.

In newborns, the disadvantage of males is a well-established clinical fact, especially in the preterm population¹⁹.

Obstructive bronchitis (including diagnosis of asthma) and bronchiolitis were the most prevalent admission diagnoses in the cohort of this study and correspond to the diverse group of respiratory diseases that account for nearly 20% of the total mortality of children under 5 years of age²⁰.

Herrera Gana et al., in their research, which aimed to determine hospitalization and mortality rates in children under 5 years of age with a diagnosis of acute bronchitis and asthma, showed that most of the patients were under 2 years of age and were hospitalized in the winter months, particularly in July²¹. This coincides with this study, where the greatest number of patients seen in the ARD ward corresponded to May to June, being the rainiest months of the year in Bogota.

Bello et al. in a prospective study of 200 children under 2 years of age with OB in an inhalation therapy unit demonstrated the efficacy of this intervention

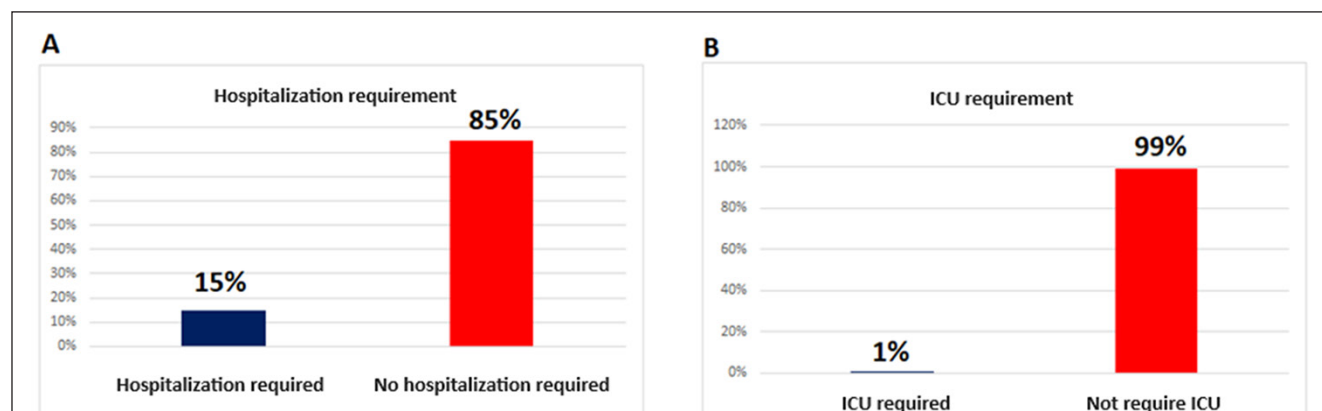


Figure 2. (A) Patients who received educational actions in the ERA ward, **(B)** patients who received follow-up 7-14 days after discharge from the ERA ward.

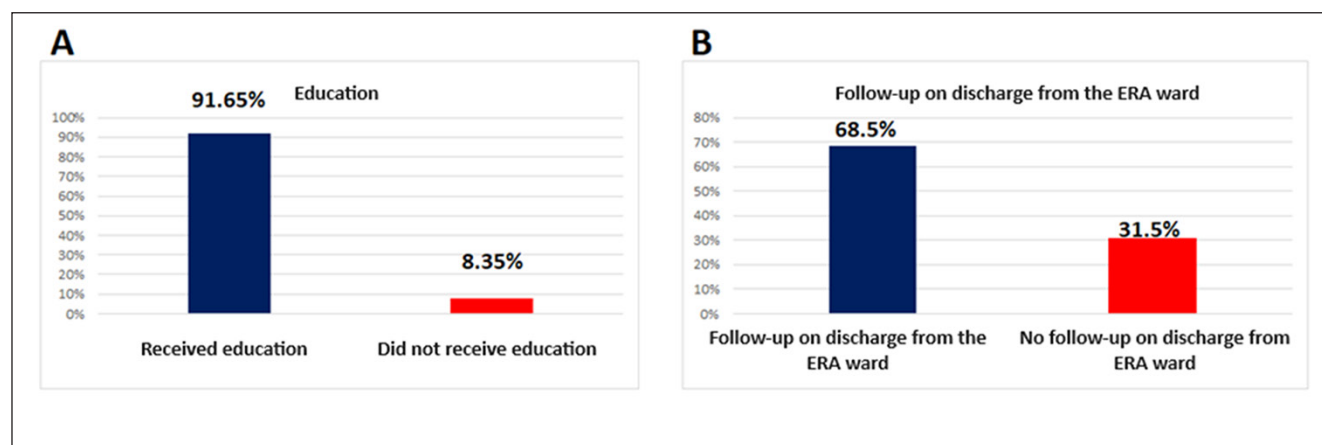


Figure 3. (A) hospitalization requirement and **(B)** pediatric intensive care following physiotherapy intervention in the ERA ward.

and found that 54.5% of patients were sent home after early intervention with inhalation therapy²². Morales et al, estimated the cost-effectiveness of the ARD ward strategy in Ciudad Bolívar, Bogotá, concluding that it is cost-effective, and reduces costs and hospitalizations simultaneously.²³ In our investigation, 80.4% of patients received inhalation therapy with bronchodilators and 15.1% required hospitalization, which showed the low proportion of hospitalization of patients treated in the ARD ward, favoring the recovery process of acute obstructive disease, and facilitating the patient's discharge home in 71.4% of cases; however, this finding could be explained by the low complexity of patients admitted and treated in the ARD ward.

Kang et al., in a multicenter study, showed that children under 2 years of age account for a significant proportion of respiratory syncytial virus-related PICU admissions²⁴. Linssen et al. also concluded in their investigation that the burden of severe RSV bronchiolitis in PICUs has increased in the Netherlands with the need for invasive and noninvasive respiratory support²⁵. In our study, 13 patients required subsequent admission to the PICU, which corresponds to 1% of the total number of patients seen, 42.8% of whom had RSV infection. It should be noted that the sample studied presented low severity, determined by signs of mild respiratory distress and low oxygen requirements as defined in the inclusion criteria for the ARD wards in Colombia.

ROB was the most prevalent risk factor found in our cohort. ROB is defined by the presence of repeated respiratory episodes characterized by cough of variable intensity, wheezing, or distant audible bronchial sounds during the first years of life and whose common feature is airway obstruction^{26,27}. Viral infections are the most frequently associated factor in ROB; however, other factors are also responsible for the frequency of occurrence, such as household contamination, especially family smoking, and those of the pregnant mother, perinatal, maturational, dietary, and immunoallergic history²⁸.

Manotas et al. in a prospective study evaluated the impact of a health literacy program for the care and self-management of respiratory diseases and bronchial asthma and found that literacy improved health outcomes and general well-being, empowering and promoting better self-management skills in children and caregivers²⁹. WHO states that "improving health literacy in populations provides the basis on which citizens can play an active role in improving their own health, participate successfully in community action for health, and push governments to fulfill their responsibilities to address health and health equity"³⁰.

Patient and family education actions are the cornerstone of care in the ARD ward, such actions are de-

Table 2. Treatments received and diagnostic tests in the study population in the Acute Respiratory Disease Room study population

Treatment	
Metered-dose inhalers n (%)	1435 (80.5)
Nebulizations n (%)	397 (22.3)
Oximetry sessions per patient, median (RIQ)	2 (1-2)
Inhalotherapy sessions, median (RIQ)	3 (2-6)
Patient and family education actions n (%)	1636 (91.7)
Antibiotics n (%)	48 (2.7)
Post-management discharge	
Metered-dose inhalers, %	74.1
Nebulizations, %	56.4
Diagnostic tests	
Chest X-ray n (%)	914 (51.2)
SARSCOV 2 antigen n(%)	49 (2.74)
PCR SARSCOV 2 n(%)	52 (2.9)
Clinical laboratories n (%)	373 (20.9)

veloped in such a way that allows parents and caregivers to understand everything related to support measures and support at home and preventive measures to avoid new respiratory events, as well as the timely identification of warning signs for immediate consultation³¹. In our study, education was provided on time to patients and caregivers in 91.7% of the cases, including indications for home management regarding the proper administration of inhalation therapy, as well as nasal hygiene, alarm signs, and other discharge recommendations. This was a relevant education figure in this cohort.

A fundamental aspect of the ARD ward strategy is to perform post-discharge follow-up, which is described in the guidelines for the promotion and care of respiratory disease of the SDS and supports the continuity of treatment and patient recovery. In addition, a follow-up is suggested at 48 hours and 7 days after care¹⁰. This research showed that 74% of patients were followed up by telephone 48 hours after discharge and 68% 7 days after having been seen in the ARD ward, identifying needs for reevaluation or readmission, and strengthening the education of parents and caregivers. Only 5.1% of the patients who underwent post-discharge follow-up showed deterioration of their health condition, which is considered a low figure in this cohort.

One of the strengths of this study is that this research shows the health outcomes of the implementation of the ARD ward strategy in Colombia. Its multicenter character brings us closer to the statistical representativeness of the Colombian population.

The limitations include the nature of an observational design, the inclusion criteria for admission in the ARD ward, which may lead to sample selection bias, the conditioning of working with retrospective data recorded in the data system, which could facilitate the inclusion of biases and loss of patient follow-up. It should also be mentioned that, within the retrospective nature of the data and local practice guidelines, the diagnosis of asthma and OB, as far as acute management in the emergency department is concerned, were left in a single entity “obstructive bronchitis, asthma, or equivalent”. Future projects differentiating the two entities could further clarify the prevalence of the diagnosis in patients admitted to the ARD ward.

There is limited information on the results of this strategy in Colombia. This study provides rigorously constructed evidence demonstrating the health outcomes of the ARD ward strategy in patients with respiratory disease. However, the high probability of selection bias due to the inclusion criteria of the ARD ward and the retrospective nature of the study means that the findings of this study should be interpreted with caution.

Conclusions

In this cohort of patients treated in two healthcare centers in Bogota, the results of the implementation of the ARD ward strategy are described, which shows that according to the guidelines of the SDS, the main purpose is to contribute to the resolution of the signs and symptoms of acute respiratory diseases in order to reduce the rate of hospitalization and admission to the PICU. Additionally, the education provided to parents and caregivers on home management was relevant, the detection of alarm signs as well as the post-discharge follow-up verifying the evolution of the clinical condition are fundamental aspects, as well as the measures to prevent the recurrence of respiratory conditions and the reduction of transmission to other members

of the family. Finally, the importance of strengthening the implementation of this strategy in the country and thus contributing to the satisfactory evolution of the infant population with ARD is highlighted.

Ethical Responsibilities

Human Beings and animals protection: Disclosure the authors state that the procedures were followed according to the Declaration of Helsinki and the World Medical Association regarding human experimentation developed for the medical community.

Data confidentiality: The authors state that they have followed the protocols of their Center and Local regulations on the publication of patient data.

Rights to privacy and informed consent: The authors have obtained the informed consent of the patients and/or subjects referred to in the article. This document is in the possession of the correspondence author.

Conflicts of Interest

Authors declare no conflict of interest regarding the present study.

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