

ORIGINAL ARTICLE

Improving emergency department care of infants with acute bronchiolitis by reducing the use of unrecommended drugs: a quality-of-care initiative in a Spanish autonomous community

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Objective. To evaluate the impact of a quality-of-care improvement program implemented in emergency departments (EDs) in a Spanish autonomous community with the aim of reducing the use of unrecommended drugs when treating infants for acute bronchiolitis.

Methods. Before-after quasi-experimental intervention study. We retrospectively included infants aged 12 months or less who were treated for acute bronchiolitis in 24 Spanish national health system hospital EDs in December during 2 epidemic periods: in 2018, before implementing the program, and in 2019, after implementation. Data collected included epidemiologic information, clinical and care details, and clinical course. The program consisted of providing informative material and training sessions before the epidemic period started.

Results. A total of 7717 episodes (4007 in 2018 and 2710 in 2019) were identified. Epidemiologic and clinical characteristics did not differ between the 2 periods. ED use of the following treatments decreased between the 2 periods: salbutamol, from 29.4% (95% CI, 28.8%-30.8%) in 2018 to 10.6% (95% CI, 9.6%-11.6%) in 2019; epinephrine from 6.0% (95% CI, 5.3%-6.8%) to 0.9% (95% CI, 0.7%-1.3%); and hypertonic saline solution fell from 8.2% (95% CI, 7.3%-9.1%) to 2.1% (95% CI, 1.7%-2.6%) ($P<.001$, all comparisons). Prescriptions for salbutamol on discharge fell from 38.7% (95% CI, 36.9%-40.4%) to 10.6% (95% CI, 9.6%-11.6%) ($P<.001$). Admissions and readmissions did not change, and the median time (interquartile range) spent in the ED fell from 81 (44-138) minutes to 66 (37-127) minutes ($P<.001$).

Conclusions. The quality-of-care improvement initiative was able to decrease the number of unrecommended therapeutic interventions for acute bronchiolitis. However, we identified great variations between EDs, suggesting that training and assessment of impact should continue.

Keywords: Bronchitis, acute. Total quality management. Bronchodilator agents. Practice guideline. Emergency health services.

Iniciativa de mejora para reducir el uso de fármacos no recomendados en el manejo de lactantes con bronquiolitis aguda en los servicios de urgencias de una comunidad autónoma

Objetivo. Evaluar el impacto de una iniciativa de mejora realizada en los servicios de urgencias (SU) de una comunidad autónoma para reducir el uso de fármacos no recomendados en lactantes con bronquiolitis aguda (BA).

Método. Estudio cuasi-experimental analítico del tipo "antes y después de una intervención". Se incluyeron de forma retrospectiva todas las BA en niños ≤ 12 meses atendidas en los SU de 24 hospitales públicos durante el mes de di-

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ciembre de dos periodos epidémicos: 2018 (preintervención) y 2019 (postintervención). Se recogieron variables epidemiológicas, clínicas, asistenciales y evolutivas. La intervención consistió en difundir material informativo y realizar actividades formativas previas al periodo epidémico.

Resultados. Se incluyeron 7.717 episodios (2018: 4.007 y 2019: 3.710). No existieron diferencias en las características epidemiológicas y clínicas. El empleo de salbutamol en los SU descendió del 29,4% [intervalo de confianza del 95% (IC 95%): 28,8-30,8] en 2018 al 10,6% (IC 95%: 9,6-11,6) en 2019 ($p < 0,001$), el de adrenalina del 6,0% (IC 95%: 5,3-6,8) al 0,9% (IC 95%: 0,7-1,3) y el de suero salino hipertónico del 8,2% (IC 95%: 7,3-9,1) al 2,1% (IC 95%: 1,7-2,6) ($p < 0,001$). La prescripción al alta de salbutamol se redujo del 38,7% (IC 95%: 36,9-40,4) al 10,6% (IC 95%: 9,6-11,6) ($p < 0,001$). La tasa de ingreso y la tasa de readmisión no cambiaron y la mediana de tiempo de estancia en los SU se redujo 81 minutos [rango intercuartil (RIC) 44-138] a 66 (RIQ: 37-127) ($p < 0,001$).

Conclusiones. La iniciativa de mejora ha conseguido disminuir la tasa de intervenciones terapéuticas no indicadas en BA. Sin embargo, existe una gran variabilidad entre los diferentes SU por lo que la estrategia y la medición de su impacto deben mantenerse en el tiempo.

Palabras clave: Bronquiolitis aguda. Estrategia de mejora de la calidad. Broncodilatadores. Guías de práctica clínica. Servicios de urgencias.

Introduction

Acute bronchiolitis (AB) is the most common lower respiratory tract infection in the first year of life and the leading cause of hospital admission in this age group.^{1,2} Classically, AB has been defined as the first episode of acute-onset wheezing with previous signs of viral upper respiratory tract infection in children younger than 24 months.³ However, there is no universal consensus on its definition, and patients diagnosed with AB often constitute a heterogeneous sample with different etiopathogenic and clinical patterns.^{4,5} The most frequent cause is respiratory syncytial virus (RSV), responsible for 75% of AB.⁶ The peak and duration of the RSV epidemic depends on the geographic area and tends to repeat consistently every year.⁷ Studies on health-related quality of life have shown the high impact of RSV-AB on children and their families in Spain, and the average cost per patient per episode has been estimated at 600 euros.⁸ There is possibly no other acute illness that has such a significant effect on infant health and generates such a high health, social and economic impact.⁹

There is currently no effective pharmacological treatment for patients with AB. Meta-analyses evaluating the therapeutic options used such as salbutamol, adrenaline, hypertonic saline (HS), corticosteroids or antibiotics show no evidence to support their use.¹⁰⁻¹⁴ Therefore, clinical practice guidelines (CPG) advise against their use.¹⁵⁻¹⁷

In the health care setting, the difficulties in translating the evidence contained in CPGs into daily clinical practice are well known. In the case of BA, CPG recommendations have had little impact on reducing the use of off-label resources.¹⁸⁻²⁰ BA is a special case because CPGs do not recommend specific interventions, but rather focus on avoiding excessive treatments and unnecessary complementary tests. Unfortunately, there has been less research on the evaluation of strategies to reduce the use of nonrecommended resources than on the evaluation of strategies to increase the use of effective resources.²¹

In 2014, the Hospital Infantil Universitario Niño

Jesús in Madrid launched an initiative to improve the care of patients with AB in the emergency department (ED) that continued for 5 years. This project demonstrated that the systematic and continuous deployment over time of actions aimed at reducing the use of unnecessary diagnostic tests and drugs is an effective strategy.²² In view of the results, the “NOT TO DO strategy in acute bronchiolitis” was launched in 2019, in which all EDs in public hospitals in the Autonomous Community of Madrid were invited to participate.

The main objective of this study is to evaluate the impact of an initiative to reduce the use of drugs not recommended for the treatment of infants with AB carried out in all EDs caring for pediatric patients in an autonomous community. The secondary objective is to analyze the impact of this initiative on the performance of complementary tests.

Method

Study design

This is an analytical quasi-experimental study of the “before and after intervention” type conducted in 24 of the 25 EDs that attend pediatric patients in the public hospital network of the Autonomous Community of Madrid.

We collected all the ABs attended in the EDs in the month of December of two epidemic periods: 2018 (preintervention) and 2019 (postintervention). The month of December was chosen as it invariably coincided with the peak of the RSV epidemic in Spain.²³ All ED discharge reports coded as “acute bronchiolitis” (CIE-10: J21) and as “acute bronchitis” (CIE-10: J20) were reviewed.

All patients meeting the diagnostic criteria for AB were included: first episode of acute onset respiratory distress with previous signs of upper respiratory tract infection in children ≤ 12 months. It was preferred by consensus to restrict the age of inclusion to ≤ 12 months to achieve a more homogeneous sample.^{4,5,16}

RECOMMENDATIONS

for patients with
ACUTE BRONCHIOLITIS

The aim of these recommendations is to improve the patient's health, reducing unnecessary interventions, which may even be counterproductive.

1. Bronchiolitis is a respiratory infection caused by viruses. The diagnosis is made based on the symptoms and signs presented by the patient. It is not necessary to request complementary tests.
2. Chest X-rays should not be routinely performed.
3. Blood tests should not be routinely performed.
4. Determination of the virus in nasal mucus does not help in deciding treatment or care in patients with bronchiolitis.
5. Bronchiolitis is not treated with antibiotics.
6. Cough syrups, mucolytics or nasal decongestants should not be used.
7. There is no scientific evidence that bronchiolitis improves with drugs such as salbutamol or adrenaline or with inhaled hypertonic saline.
8. There is no scientific evidence that oral, injected, or inhaled corticosteroids are effective in bronchiolitis.

Frequent hand washing is the most effective measure to prevent the transmission of respiratory infections.

Figure 1A. Poster designed for the “Strategy NOT TO DO in acute bronchiolitis in the Community of Madrid”.

Patients were excluded if they met any of the following criteria: presence of a history of bronchitis or bronchiolitis or incomplete data for the variables under study. It was considered that the duration of AB could reach a maximum of 28 days, excluding episodes with a longer duration of symptoms.

The intervention consisted of the following elements:

- Updating of the protocol of each ED according to the diagnostic and therapeutic recommendations of the current current CPGs for AB.¹⁵⁻¹⁷

- Incorporation into the protocol of each ED of a scale for the of the severity of AB that would allow its classification as mild, moderate, or severe.

- At the beginning of the epidemic, in November, a clinical session was held in each hospital for physicians and residents caring for patients with AB, presenting the current protocol and the improvement initiative.

Distribution of common posters designed for all EDs all EDs “Strategy NO HACER in bronchiolitis” to be placed to be placed in boxes and waiting rooms (Figure 1a).

- Delivery of an information sheet for parents common to all levels of care (Figure 1a).

- Providing an information sheet for parents at all levels of care (Figure 1b).

- Dissemination by e-mail and availability on each center’s of the strategy material on the intranet of each center.

INFORMATION AND ADVICE ON
BRONCHIOLITIS
FOR PARENTS AND CAREGIVERS

ABOUT BRONCHIOLITIS

Bronchiolitis is a viral infection that affects children under two years of age and manifests with difficulty breathing and sometimes with “wheezing” noises in the chest. It usually starts with cough and nasal mucus. After 3-4 days, shortness of breath appears. The child may be irritable, eat less and have a fever.

Symptoms of bronchiolitis may persist from a few days to 4 weeks. To avoid contagion, it is highly recommended that the child does not attend day care during the first 7 days after the diagnosis of bronchiolitis.

After the time of evolution, the symptoms disappear spontaneously. There is currently no medication to cure bronchiolitis.

MEASURES FOR HOME CARE

- Keep the child standing upright as this will help him/her to breathe better.
- Nasal washes are recommended if the child has mucus, preferably before eating.
- It is advisable to feed the child with smaller and more frequent meals to avoid fatigue.
- Avoid stuffy or smoky environments.

WHEN SHOULD YOU GO TO THE EMERGENCY DEPARTMENT?

- If you notice a decline in the child’s general health condition with symptoms of irritability and drowsiness
- If the child gets fatigued after meals or loses appetite.
- If you notice the child’s skin color turn purple or pale.
- If the child has difficulty breathing, experiences agitation while breathing or stops breathing for a few seconds. Other symptoms may include visible ribs, odd abdomen movements, and sunken chest.

REMEMBER THAT FREQUENT HAND WASHING IS THE MOST EFFECTIVE MEASURE TO PREVENT THE TRANSMISSION OF RESPIRATORY DISEASES.




Figure 1B. Acute bronchiolitis fact sheet for parents and caregivers.

The general coordinators of the strategy were two physicians from the ED of the Hospital Infantil Universitario Niño Jesús. The rest of the centers chose between one and three people in charge of implementing the initiative and collecting data. The general coordinators of the strategy verified that all the centers had carried out all the elements of the intervention prior to the start of the epidemic. Registration by those responsible for each ED was carried out retrospectively using a form available on the intranet of the Consejería de Sanidad de la Comunidad Autónoma de Madrid (Regional Ministry of Health of the Autonomous Community of Madrid). The data were grouped in a general database to which a person in charge of the Consejería de Sanidad and the general coordinators of the strategy had access. A specific session was given on how to register each patient and a document with instructions was included on the intranet. The strategy coordinators provided an e-mail address and a contact telephone number for resolving doubts and solving problems.

Variables studied

We collected demographic data (age, sex), clinical data (time of evolution, previous illnesses, fever, oxygen saturation, respiratory frequency and estimation of severity), complementary examinations performed (RSV determination, chest X-ray, blood analysis, blood gases) and prescribed treatments (use in the ED of nebulized

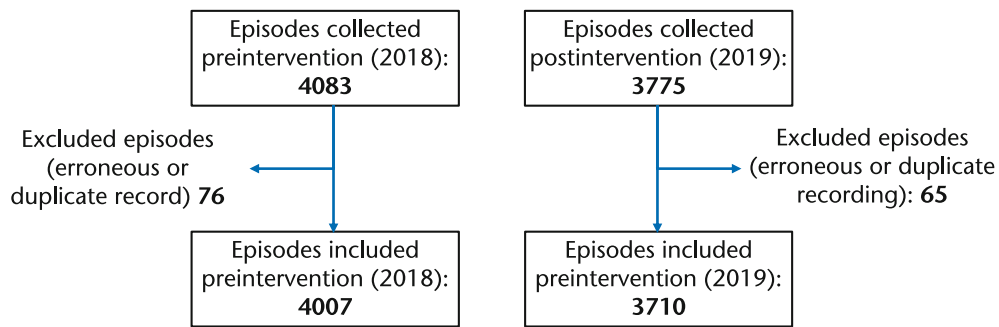


Figure 2. Episodes included by the emergency departments of the 24 public hospitals that participated in the analysis.

salbutamol, nebulized adrenaline, SSH, systemic corticosteroids, systemic antibiotics and treatments prescribed at discharge: inhaled salbutamol, oral antibiotics and oral corticosteroids). All variables collected in the two periods were compared.

In order to assess the effect of the intervention in each center, the prescription of salbutamol before and after the intervention in each center was analyzed individually. This drug was chosen because it was the most prescribed in the pre-intervention phase. In order to assess the possible influence of age and severity on the prescription of bronchodilator treatment, an additional analysis was performed by subgroups of age (0-6 months and 6-12 months) and severity.

To assess possible unintended consequences of the initiative, the following control measures were recorded:

- Admission rate: percentage of patients hospitalized.
- Length of stay in the ED: time elapsed from registration at ED admission to home discharge (not calculated in patients who were admitted).
- Readmission rate: patient who returned to the ED for the same reason and had been treated in the previous 72 hours. A distinction was made between patients who required admission and patients who were discharged again.

Statistical analysis

Categorical variables were described as absolute and relative frequencies, and quantitative variables as mean and standard deviation. The median and interquartile range (IQR) were used for data that did not have a normal distribution. The normality test was performed with the Shapiro-Wilks test. Qualitative variables were compared using the chi-squared test and quantitative variables were compared using Student's t test or the non-parametric Mann Whitney U test. Data analysis was performed with STATAv16.0 software, and a value of $p < .05$ was considered statistically significant.

Ethical considerations

The study complied with the guidelines of the Oviedo Convention and the Helsinki Convention and

was approved by the Clinical Research Ethics Committee (CREC) of the Hospital Infantil Universitario Niño Jesús.

by the Clinical Research Ethics Committee (CREC) of the Hospital Infantil Universitario Niño Jesús. The CREC waived the need for informed consent.

Results

A total of 7717 infants under 1 year of age with AB seen in the EDs were included in the analysis: 4007 in December 2018 (preintervention) and 3710 in December 2019 (postintervention) (Figure 2). Twenty-four of the 25 EDs in the Autonomous Community of Madrid participated in the data collection. One hospital performed the intervention but did not participate in the data collection for organizational reasons and was therefore excluded from the analysis. The age, sex, clinical characteristics, and diagnostic tests performed in the patients included in each of the periods under study are shown in Table 1.

The number of episodes receiving non-recommended drugs in the ED decreased from 40.3% [95% confidence interval (95% CI): 38.8-41.8] in 2018 to 14.1% in 2019 (95% CI: 13.0-15.3) ($P < .001$). ED use of salbutamol decreased by 63.9% (95% CI: 62.9-65.1; $P < .001$), adrenaline by 85.1% (95% CI: 84.2-85.8; $P < .001$), SSH by 74.3% (95% CI: 73.3-75.2; $P < .001$), and corticosteroids by 61.0% (95% CI: 59.8-62.1; $P < .001$). For episodes discharged home, there was a decrease in the prescription of non-recommended drugs from 40.4% (95% CI: 38.7-42.2) in 2018 to 14.4% (95% CI: 13.1-15.7) in 2019 ($P < .001$). The discharge indication for salbutamol decreased by 67.6% (95% CI: 66.4-68.8; $P < .001$), antibiotics by 47.8% (95% CI: 46.5-49.1; $P < .001$) and corticosteroids by 48.2% (95% CI: 47.0-49.5; $P < .001$) (Table 1).

Regarding patient outcome, the intervention reduced the length of stay in the emergency department by 22.7% (95% CI: 21.7-23.6; $P < .001$). There were no differences in the admission rate or readmission rate (Table 1).

The impact of the strategy in each center with respect to the use of salbutamol in the ED is shown in

Table 1. Epidemiological and clinical characteristics, diagnostic tests performed, treatments prescribed, and evolution of the patients included in each of the periods under study

	Pre-intervention phase 2018		Postintervention phase 2019		P value
	N = 4007	n (%)	N = 3710	n (%)	
Clinical characteristics					
Male	2289	(57.1)	2106	(56.8)	.750
Age, days [median (IQR)]	142	(76-212)	141	(73-207)	.419
Previously healthy	3832	(95.6)	3489	(94.0)	.002
Time evolution, days [median (IQR)]	3	(2-5)	3	(2-5)	.299
Fever	1630	(40.7)	1537	(41.5)	.504
Fever evolution time, days [median (IQR)]	1	(1-3)	2	(1-3)	.644
Oxygen saturation, % [median (IQR)]	97	(95-98)	97	(95-98)	.262
Respiratory rate, rpm [median (IQR)]	48	(40-56)	48	(40-58)	.123
Estimated severity in the emergency department					
Mild	2779	(70.5)	2553	(70.8)	
Moderate	1014	(25.7)	902	(25.0)	.497
Severe	147	(3.7)	151	(4.2)	
Diagnostic tests in the emergency department					
RSV rapid test in nasal lavage/aspirate	1101	(27.5)	987	(26.6)	.392
Chest X-ray	208	(5.2)	172	(4.6)	.262
Blood test	212	(5.3)	227	(6.1)	.116
Venous blood gas analysis	175	(4.4)	204	(5.5)	.021
Treatments in the emergency department					
Salbutamol in the emergency department	1177	(29.4)	392	(10.6)	< .001
Adrenaline in the ED	242	(6.0)	35	(0.9)	< .001
Hypertonic saline in the emergency department	327	(8.2)	79	(2.1)	< .001
Antibiotic in the ED	35	(0.9)	44	(1.2)	.210
Corticosteroid in the emergency department	103	(2.6)	38	(1.0)	< .001
Treatments at discharge (2018: N = 3,128; 2019: N = 2,828)					
Salbutamol at discharge	1209	(38.7)	352	(12.4)	< .001
Antibiotics at discharge	143	(4.6)	68	(2.4)	< .001
Corticosteroids at discharge	92	(2.9)	43	(1.5)	< .001
Evolution					
Admission	879	(21.9)	882	(23.8)	.055
Readmission in the emergency department	1056	(33.8)	950	(33.6)	.450
Readmission without admission	803	(25.7)	694	(24.5)	
Readmission	253	(8.1)	256	(9.1)	.124
Time in ED, minutes [median (IQR)]	81	(44-138)	66	(37-127)	< .001

IQR: interquartile range.

Bold values denote statistical significance ($P < .05$).

Figure 3. The percentage was reduced in all participating hospitals, and in a statistically significant way in 21 of the 24 centers. The maximum percentage decrease was in relative terms in "hospital no. 21" 96.1% (95% CI 94.4-97.3; $P < .001$) and in absolute terms in "hospital no. 18" 53.3% (95% CI 43.9-63.0; $P < .001$).

The use of bronchodilator treatments in the ED according to the severity of AB and patient age is shown in Table 2. The use of salbutamol, adrenaline and SSH decreased after the intervention in both the 0-6 month and 6-12-month subgroups. Salbutamol continued to be the most frequently used bronchodilator; its use was more frequent in the subgroup of moderate and severe bronchiolitis in children 6-12 months of age.

Discussion

The intervention carried out in the ED has managed to reduce the use of non-indicated pharmacological treatments by 65% overall. The use of nebulized sal-

butamol, adrenaline and SSH and systemic corticosteroids in the ED and the prescription at discharge of inhaled salbutamol, corticosteroids and antibiotics have been reduced, without increasing the admission rate, the length of stay in the ED, or the readmission rates of these patients.

The demographic and clinical characteristics of the infants treated with AB in the two seasons under study were similar. The only difference was in the percentage of infants with previous pathology, which was higher in the postintervention group. This fact could have produced an increase in the admission rate regardless of the initiative implemented, since these are patients who are frequently admitted due to the greater risk of progression to severe conditions. The characteristics of the patients in other studies published in the ED are similar.^{20,22,24} If it is also considered that the epidemic occurs year after year with the same chronological pattern, it is possible to prepare for each season by adapting resources and protocolizing the care of these patients.

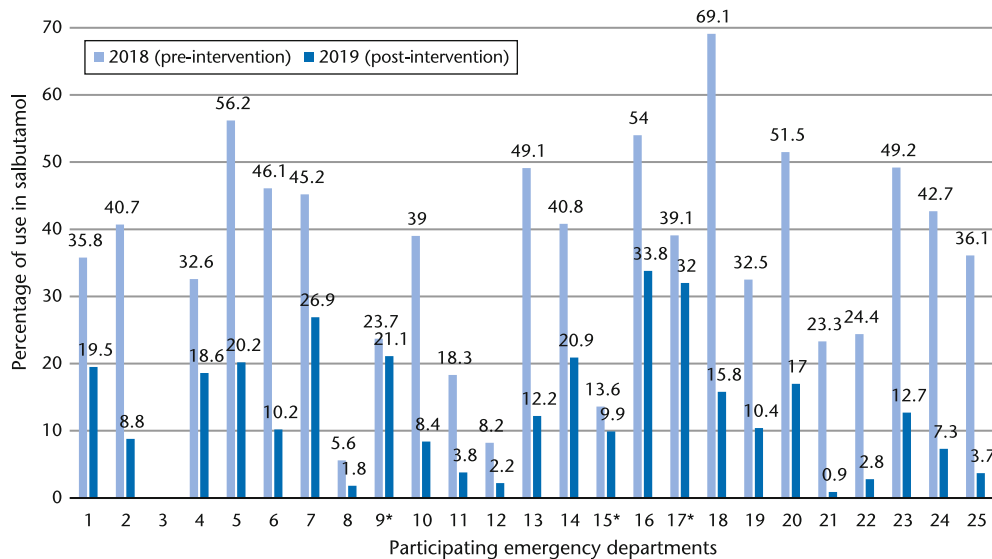


Figure 3. Percentage of salbutamol use in each of the participating emergency departments (with * those centers in which the decrease in salbutamol use is not significant; hospital no. 3 did not participate in data collection; hospital no. 8 corresponds to the hospital that led the strategy).

The use of salbutamol in the ED drops to 10.6% in 2019 and is at similar percentages to the most recent strategies published in the ED.²⁵ In the case of adrenaline and SSH, which already started from lower percentages of use, their use becomes residual. This achievement has not been described in other interventions.^{24,25} The prescription of medication at discharge, after implementation of the strategy, is also lower than that published in other studies.²⁶

However, the decrease in the use of salbutamol is variable and is still far from that achieved by the hospital leading the strategy, although in this case after a more prolonged intervention over 5 years.²² Although the variability between EDs has decreased after the intervention, there are still large differences between the center with the highest use of salbutamol (33.8%) and the one with the lowest (0.9%). The origin of this variability should be studied, as it may be related to various factors: characteristics of the professionals involved in health care in the ED, involvement of those responsible for the strategy in each center, and the rate of use of drugs not recommended prior to the intervention. To reduce this variability, we consider that the strategy should be maintained and in fact has been maintained in the years since the years analyzed in this study. However, the outbreak of the COVID pandemic meant that there was no RSV epidemic during the cold months of 2020, which made it impossible to measure the impact in the second year of the intervention.²⁷

The reduction in the use of bronchodilator treatment occurs in mild, moderate, and severe cases, although it is more important in the former. More severe cases in patients older than 6 months continue to receive treatment with salbutamol more frequently, a possibility included in the protocols of the centers for patients with poor clinical evolution despite initiating oxygen therapy.

In terms of diagnostic testing, there has been little change in probable relation to the fact that the intervention has focused more on reducing pharmacological treatments. The proportion of patients screened for RSV is higher than in other studies.^{20,24,28} After the intervention, this proportion is closer to that of admitted patients, reflecting the fact that the participating centers establish cohorts (RSV+, RSV-) to admit infants with AB and representing an important barrier to reduce the use of this test. In the case of chest radiography, the percentage before the intervention was already significantly lower than in other studies and close to the percentage of AB classified as severe, which implies good adherence to the recommendations of the CPG.^{20,24,28} The number of blood tests and blood gases performed is higher than expected.^{20,28} Moreover, blood gas readings increase after the intervention, which should be taken into account in the future in order to develop specific actions in this regard.

As a control measure of the strategy, it was important to verify that the intervention did not lead to an increase in admissions or readmissions. The admission rate is like that of other series published in Spain²⁹ and has not varied. However, it is higher than the 17.8% described in a recent American series.²⁸ In the previous experience carried out at the Hospital Infantil Universitario Niño Jesús, it was possible to reduce the admission rate after 5 years of intervention from the initial 20.7% to 16.8%.²²

It is striking that one in three patients returns to the ED, although less than one in ten requires admission. The healthcare organization in the Autonomous Community of Madrid, where during the night and on public holidays, care can only be received in hospital EDs, may explain this high percentage. In a study published with data provided by the EDs of different countries, the readmission rate was 19%, lower than in our

Table 2. Bronchodilator treatments prescribed in each of the periods under study as a function of severity and age

	Preintervention phase 2018 Salbutamol n (%)	Postintervention phase 2019 Salbutamol n (%)	P value	Preintervention phase 2018 Adrenaline n (%)	Postintervention phase 2019 Adrenaline n (%)	P value	Preintervention phase 2018 Hypertonic n (%)	Postintervention phase 2019 Hypertonic n (%)	P value
Younger than 6 months									
Mild	317/1767 (17.9)	70/1639 (4.3)	< .001	52/1767 (2.9)	7/1639 (0.4)	< .001	138/1767 (7.8)	53/1639 (3.2)	< .001
Moderate	162/711 (22.8)	39/652 (6.0)	< .001	142/711 (20.0)	13/652 (2.0)	< .001	101/711 (14.2)	6/652 (0.9)	< .001
Severe	12/113 (10.6)	4/106 (3.8)	.050	27/113 (23.9)	9/106 (8.5)	.002	24/113 (21.2)	1/106 (0.9)	< .001
TOTAL	491/2591 (18.9)	113/2397 (4.7)	< .001	221/2591 (8.5)	29/2397 (1.2)	< .001	263/2591 (10.2)	60/2397 (2.5)	< .001
Older than 6 months									
Mild	429/1012 (42.4)	143/914 (15.6)	< .001	2/1012 (0.2)	1/914 (0.1)	.62	42/1012 (4.2)	12/914 (1.3)	< .001
Moderate	208/303 (68.6)	95/250 (38.0)	< .001	12/303 (4.0)	2/250 (0.8)	.019	17/303 (5.6)	6/250 (2.4)	.060
Severe	22/34 (64.7)	18/45 (40.0)	.030	5/34 (14.7)	2/45 (4.4)	.112	3/34 (8.8)	1/45 (2.2)	.190
TOTAL	659/1349 (48.9)	256/1209 (21.2)	< .001	19/1349 (1.4)	5/1209 (0.4)	.009	62/1349 (4.6)	19/1209 (1.6)	< .001

Bold values denote statistical significance ($P < .05$).

study.²⁶ However, in that study, 43% of readmissions required admission, which is higher than our figures. Finally, the decrease in the length of stay in the ED is a logical consequence of not using drugs that require time for administration and for reevaluation. This effect of the intervention will help to improve patient flow during the cold months, when the overload of care is frequent.

The results of this initiative present the limitation of “before and after intervention” studies in that they lack a control group. Therefore, there could be a trend in the reduction in the use of treatments not recommended in the management of AB that has acted independently of the initiative implemented. Furthermore, given that the impact of the intervention was only measured in the month with the highest epidemic incidence, the study does not allow us to evaluate the variability of prescription that may exist in the rest of the months and, therefore, the drug utilization rates may not represent the overall epidemic. Finally, patients between 1 and 2 years of age have been excluded, as occurs in an increasing number of studies on AB,^{16,24,26} but it is this age group that is associated with a higher prescription of drugs in relation to a lower diagnostic certainty.³⁰

In summary, we have shown that the results of an improvement initiative of an improvement initiative initially implemented in the ED of the Hospital Infantil Universitario Niño Jesús were extrapolable to other centers in the same autonomous community. However, there is still great variability between the different EDs, so that the intervention and the measurement of its impact should be maintained over time, something that we plan to continue to carry out in each epidemic season. To this end, health authorities should implement tools that allow automatic monitoring of the use of non-recommended resources. In addition, it should be investigated which factors specific to each hospital could have contributed to a greater success of the intervention in some centers than in others.

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Addendum

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