

## Empowering Respiratory Therapists to Take a More Active Role in Delivering Quality Care for Infants With Bronchiolitis

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**BACKGROUND:** Cincinnati Children's Hospital Medical Center developed a bronchiolitis-treatment guideline and implemented a program, led by respiratory therapists, to encourage the use of respiratory function assessment to determine the need for and effect of bronchodilator treatment of infant bronchiolitis patients. **METHODS:** The program was implemented on January 14, 2002, and included (1) a revised respiratory scoring form, (2) a change in the respiratory score threshold for a recommendation of bronchodilator treatment, (3) establishment of multidisciplinary rounds, (4) providing current data to the respiratory therapists, and (5) increasing effective data-based communication between the respiratory therapists and physicians. Guideline-eligible patients admitted before the implementation of the program (between 12/1/01 and 1/13/02) were compared to patients admitted during the program (between 1/14/02 and 3/31/02). We compared the mean numbers of bronchodilator treatments per patient in fiscal years 2001 and 2002. We defined "perfect respiratory care" as administration of bronchodilator only if preceded by suction treatment that resulted in a post-suction respiratory score  $\geq 3$ . **RESULTS:** Documentation of respiratory scoring significantly increased following implementation of the program, as did "perfect respiratory care." Between the 2001 and 2002 bronchiolitis seasons, there was a decrease in both the mean number and the variability in the number of bronchodilator doses administered. **CONCLUSIONS:** Expanding guideline recommendations to the level of specific protocols and empowering respiratory therapists to take a more active role improve the quality of care for infant bronchiolitis patients. *Key words:* bronchiolitis, guideline, protocol, evidence-based medicine, respiratory therapy, suction, bronchodilator. [Respir Care 2004;49(6):589–599. © 2004 Daedalus Enterprises]

### Introduction

Bronchiolitis is an acute inflammatory disease of the lower respiratory tract, resulting from obstruction of small airways. It is initiated by infection of the upper respiratory tract by any one of several seasonal viruses, the most common of which is respiratory syncytial virus (RSV).<sup>1–4</sup> Bronchiolitis is the most common cause of pediatric hospital admission during the winter months, and since 1980 the hospitalization rate of children suffering bronchiolitis has increased over 200%.<sup>5</sup>

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There is considerable disagreement about and variability in the clinical management of infant bronchiolitis. Various therapies have been advanced and practiced, but most have been shown to be ineffective when tested in rigorous clinical trials.<sup>6,7</sup> Ribavirin, interferon- $\alpha$  and vitamin A have not been effective in clinical practice.<sup>8–11</sup> One well-conducted systematic review found shorter duration of stay

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with steroid therapy for bronchiolitis,<sup>12</sup> but recent large clinical trials found that steroids did not affect clinical status or duration of stay of bronchiolitis patients.<sup>13–16</sup> A number of trials and reviews and a meta-analysis suggest that a subpopulation of bronchiolitis infants benefit from  $\beta$  agonists,<sup>17–21</sup> but those studies conflict with a meta-analysis and several trials that found that  $\beta$  agonists have no effects.<sup>22–26</sup> A recent Cochrane systematic review noted that bronchodilators can produce modest short-term improvements in clinical scores but that this small benefit must be weighed against the cost of those drugs.<sup>27</sup> Nebulized racemic epinephrine reduced the hospitalization rate by 59% in 1 trial<sup>28</sup> and improved pulmonary physiology and clinical scores in several other studies,<sup>28–32</sup> but not all studies showed improvement with epinephrine.<sup>33</sup> A recent multicenter, randomized, double-blind, placebo-controlled trial reported no reduction in duration of stay or time to discharge readiness with epinephrine.<sup>34</sup>

An evidence-based clinical practice guideline for the care of infants suffering first-time bronchiolitis was first implemented at Cincinnati Children's Hospital Medical Center in January 1997. The guideline discouraged the routine use of bronchodilator therapy for patients with typical and uncomplicated bronchiolitis. That guideline significantly reduced admissions, duration of stay, and the use and costs of diagnostic and treatment resources, without increasing readmissions or decreasing satisfaction among patients' families.<sup>35,36</sup>

Although that guideline significantly improved appropriate resource utilization, the routine use of bronchodilator therapy remained higher than expected, which suggested that guideline recommendations needed to be made into specific protocols for front-line caregivers at the point of care. The guideline was revised in November 2001 to reflect then-current evidence and to encourage respiratory function assessment to determine the need for and effect of bronchodilator treatment. We hypothesized that the implementation of a program, led by respiratory therapists (RTs), to translate the guideline recommendations into practice would increase the assessment of respiratory function.

## Methods

### Location

Cincinnati Children's Hospital Medical Center is a 373-bed hospital that provides Level I pediatric trauma care, tertiary care, and pediatrics training.

### Revised Bronchiolitis Guideline

The guideline was intended for infants  $\leq 1$  year old who present to Cincinnati Children's Hospital Medical Center with first-time, typical bronchiolitis. The guideline

recommended that the infant be suctioned before feeding, as needed, and prior to each inhalation therapy. Determining the therapeutic benefit of nasal suctioning using a standardized respiratory assessment was strongly encouraged. A trial inhalation treatment was recommended only if suctioning did not improve respiratory function score. Similarly, scheduled or serial bronchodilator aerosol therapy was not recommended unless the patient had a documented clinical improvement. Specifically, it was recommended that the therapy not be continued or repeated if respiratory function score had not substantially improved 15–30 min after a trial inhalation therapy. Use of the respiratory assessment form was recommended to determine the appropriateness of repeating the therapy.

## Program Development and Implementation

With the implementation of the revised bronchiolitis guideline in November 2001 a multidisciplinary committee began a focused effort to encourage respiratory function assessment to determine the need for and effect of bronchodilator treatment. That committee consisted of RTs, the respiratory therapy department's education coordinator, nurses from patient services, and a project coordinator and education coordinator from the Center for Health Policy and Clinical Effectiveness. Upon receiving an order for inhalation therapy for a bronchiolitis patient, the RT was instructed (1) to perform a respiratory assessment and determine an initial respiratory function score, (2) to suction the patient, and (3) to reassess and re-score the patient.

Appendix 1 shows the original respiratory assessment form and Appendix 2 shows the revised form. The scoring system includes measurement of respiratory rate, heart rate, accessory muscle use, air exchange, wheezing, and inspiration-expiration ratio. If the score after suctioning was  $< 2$ , the RT recommended that inhalation therapy not be administered. If an inhalation therapy was given, respiratory score was determined 15–30 min after the treatment to determine the treatment's effectiveness. A fluorescent green sticker placed in the patient's chart summarized the RT's recommendations to the physician.

Contrary to expectations, weekly monitoring of the program at the start of the bronchiolitis season showed that administration of inhalation therapies was increasing. To identify barriers to practice change we interviewed the RTs and found 5 problems:

1. There was poor communication between the RTs and the residents/community physicians.
2. The respiratory assessment system had been developed for assessing patients suffering asthma exacerbations<sup>37</sup> and it was found to be less useful for bronchiolitis patients.
3. The respiratory assessment form was confusing, resulting in charting errors.

4. The respiratory therapy recommendations stickers were placed in the chart separately from the orders, so the stickers were not routinely reviewed by the ordering physician.

5. RTs did not receive feedback on how they were performing.

A program was developed to address the RTs' concerns and to encourage respiratory function assessment, to determine the need for and effect of bronchodilator treatment. The program was implemented on January 14, 2002. It included:

1. A revised respiratory assessment form (see Appendix 2). The revised form reflected the guideline recommendation that nasal suctioning and respiratory scoring be done prior to any bronchodilator treatment and that respiratory scoring be done 15–30 min following treatment, to determine if the treatment improved the respiratory score.

2. A change in the respiratory score threshold for a recommendation for bronchodilator treatment. Though a recommendation for bronchodilator treatment with a respiratory score of  $\geq 2$  was deemed appropriate for asthma patients, that did not account for the typical presentation of a bronchiolitis patient, which includes increased secretions, increased respiratory rate, and decreased air movement. Therefore, a respiratory score  $\geq 3$  was required to recommend bronchodilator treatment for a guideline-eligible bronchiolitis patient. Patients who warranted a trial bronchodilator therapy typically had elevated respiratory rate, increased use of accessory muscles, decreased air exchange, and mild expiratory wheezes, due to increased secretions and airway inflammation. Figure 1 shows the revised treatment algorithm.

3. Multidisciplinary rounds. When possible an RT accompanied the physician on morning rounds. Attending physicians familiar with the evidence encouraged the residents to listen to the RTs' recommendations. The education coordinator for Health Policy and Clinical Effectiveness attended rounds 1 day each week, with each of the 3 physician teams responsible for treating bronchiolitis patients. She tracked eligible patients and reinforced use of the new respiratory assessment form and treatment recommendations.

4. Improved effective, data-based communication between the RTs and physicians. The chart sticker (that summarized the RT's recommendations) was discontinued and replaced by the RTs making their recommendations verbally to the physician. Specifically, when an order was written for a bronchodilator treatment, the RT would do the nasal suctioning and before-and-after-treatment scoring. If the post-suctioning score was  $< 3$ , the RT would page the physician who wrote the order and advise that bronchodilator was unwarranted. If the post-suctioning score was  $\geq 3$ , the RT would conduct the treatment and

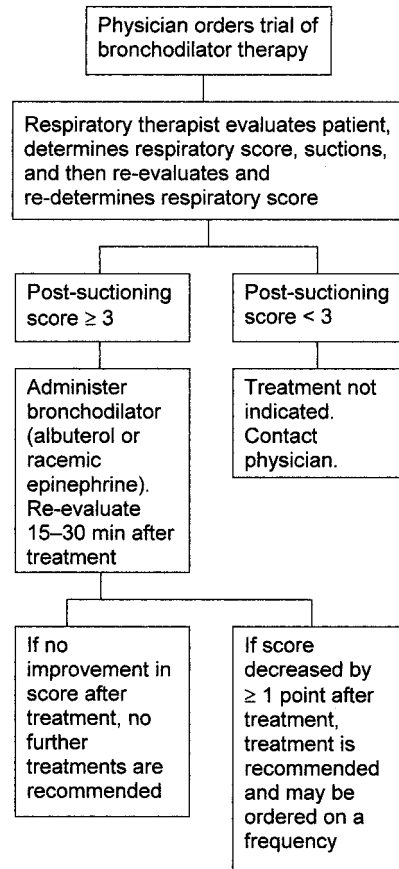


Fig. 1. Infant bronchiolitis treatment algorithm.

the post-treatment respiratory scoring and advise the physician whether the therapy should be continued.

5. Better-informed RTs. The respiratory therapy education coordinator (author EC) reviewed the charts of all bronchiolitis patients daily and conducted biweekly meetings to increase communication among the RTs, to receive their opinions on what was and was not working, and to share the data being regularly collected. Two RTs, one from the day shift and one from the night shift, became guideline champions on the floor. Therapists were given watches with timers to remind them to conduct the follow-up respiratory scoring 15–30 min following bronchodilator treatment.

### Study Population

Guideline-eligible patients were infants  $\leq 1$  year old and admitted to the hospital with a first-time episode of uncomplicated bronchiolitis.<sup>35,36</sup> All guideline-eligible patients were included in the study, except for infants who had histories of cystic fibrosis, immunodeficiency, congenital heart disease, bronchopulmonary dysplasia, congenital airway disease, or any other comorbid condition

that might make the effect of the bronchiolitis more severe and thereby make care more complicated. Also excluded were patients who required mechanical ventilation or other intensive therapies and patients who had an intensive care unit admission at any time during their stay. Premature infants were eligible if they did not have one of the exclusion criteria. Guideline-eligible patients admitted between 12/1/01 and 1/13/02, before the implementation of the revised bronchiolitis program, were compared to patients admitted after the program was implemented, between 1/14/02 and 3/31/02. We compared the mean number of bronchodilator treatments per patient during the same months in fiscal years 2001 (12/1/00 – 3/21/01) and 2002 (12/01/01 – 3/31/02).

Our institutional review board reviewed the protocol for guideline implementation and concluded that it was primarily a patient care instrument, and as long as patients were not randomized to the guideline or identified in publications, informed consent was not required to use the guideline recommendations. The respiratory scoring form and fluorescent sticker were approved by our health information committee (medical records).

#### Data Sources

Patient data on suctioning, respiratory scoring, and bronchodilator administration were collected concurrently via chart reviews. Demographic data were obtained retrospectively from the hospital's financial and clinical computer systems.

#### Data Analyses

We used the chi-square test to analyze categorical variables, Student's *t* test for normally distributed continuous variables, and the Wilcoxon rank sum tests for non-normally distributed data. Differences were considered statistically significant if *p* was < 0.05. A control chart was constructed to examine the impact of the intervention on mean bronchodilator administration. The control chart method was chosen because it is particularly useful for displaying and analyzing variation in time-series data, especially for quality improvement. The associated statistical tests are comparable to more commonly used methods. A control chart can differentiate common cause variation from special cause variation and evaluate the effectiveness of a change.<sup>38</sup> The upper and lower control limits displayed on a control chart establish the margins within which the measurement will be found approximately 99% of the time. A change is not considered due to chance if (1) one or more data points are above the upper control limit or below the lower control limit, (2) eight consecutive points are above or below the center line, (3) five lines between 6 consecutive points are all going up or all going

down, or (4)  $\geq 14$  points alternate up and down. The "constant area of opportunity" (known as the "C chart") constructed for this study is based on count data with a Poisson distribution. The control limits for this type of control chart are computed from the standard deviation, which for a Poisson distribution is the square root of the mean of the samples. All statistical analyses were performed with commercially available software (PC-SAS release 6.12, SAS Institute Inc, Cary, North Carolina).

## Results

### Study Subjects

Table 1 shows selected characteristics of the study population. Patients who received a bronchodilator or suction treatment after program implementation were significantly less likely to be male (*p* = 0.02).

### Clinical Outcomes

Table 2 shows the clinical outcomes of patients who received a bronchodilator or suction treatment. Before the implementation of the program bronchiolitis patients received an average of < 1 suction treatment. Following implementation patients received an average of 1.5 suction treatments (*p* = 0.2). There was no change in the proportion of patients who received 1 or more suction treatments. Over the course of the entire bronchiolitis season, suction treatments lowered the respiratory score by 1 or more points 32% of the time. Fourteen percent of the time suctioning lowered the respiratory score from  $\geq 3$  to < 3.

There was no significant change in the frequency or intensity of bronchodilator treatments following implementation of the program. The control chart (Fig. 2) compares the number of bronchodilators given in fiscal years 2001 and 2002. Each data point represents a group of 10 consecutive patients. In fiscal year 2002 there was a decrease in both the mean number (2.6 vs 1.7 bronchodilator doses per patient) and the variability in the number of doses administered.

### Process Outcomes

Respiratory care was considered "perfect" if bronchodilator administration was preceded by suctioning and the post-suctioning score was  $\geq 3$ . Prior to the program only 2% of study patients received perfect care (Table 3). Perfect care increased to 19% (*p* = 0.0002) following program implementation.

Documentation of respiratory scoring increased following implementation of the program, especially the post-treatment scoring (ie, following suction treatment or bronchodilator administration) (*p* < 0.0001). There was a

## QUALITY CARE FOR INFANTS WITH BRONCHIOLITIS

Table 1. Characteristics of the Study Population

	Before Program	During Program
All patients ( <i>n</i> )	78	117
Age at admission (mean ± SD d)	117 ± 87	103 ± 77
Male (%)	67	54
White (%)	78	79
Had commercial insurance (%)	45	55
Patients who received a bronchodilator or suctioning ( <i>n</i> )	38	47
Age at admission (mean ± SD d)	137 ± 92	118 ± 85
Male (%)	82	57*
White (%)	68	85
Had commercial insurance (%)	47	51
Patients who received suctioning only ( <i>n</i> )	7	6

\*p = 0.02.

Table 2. Clinical Outcomes of Patients Who Received a Bronchodilator or Suctioning Treatment

	Before Program	During Program
Mean number of suctionings per patient	0.97	1.5
Patients who received ≥ 1 suctioning (%)	61	66
Patients who received any bronchodilator treatment (%)	40	35
Patients who received > 1 bronchodilator treatment (%)	17	15
Patients who received > 2 bronchodilator treatments (%)	13	12
Patients who received > 4 bronchodilator treatments (%)	6.4	7.7
Mean number of bronchodilator treatments per patient	1.2 for all patients; 3.03 for patients who received at least 1 treatment	1.1 for all patients; 3.07 for patients who received at least 1 treatment

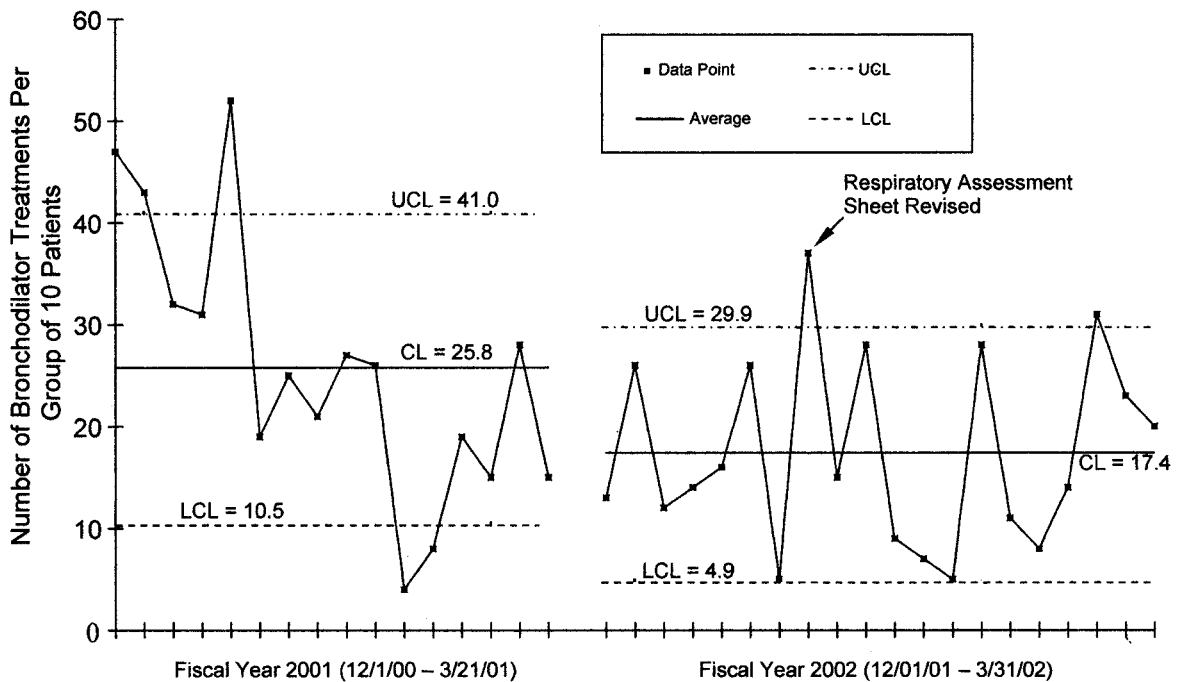


Fig. 2. The control chart compares the number of bronchodilator treatments administered (to bronchiolitis patients ≤ 1 year old) during fiscal years 2001 and 2002. Each data point on this “constant area of opportunity” chart represents a group of 10 consecutive inpatients. The upper control limit (UCL) and lower control limit (LCL) equal 3 standard deviations. CL = center line.

Table 3. Process Outcomes

	Before Program (%)	During Program (%)
Patients who received perfect care (bronchodilator administration was preceded by suctioning and the post-suctioning score was $\geq 3$ )	2	19*
For all treatments (bronchodilators and suctionings), pre-treatment respiratory score documented	89	91
For all treatments (bronchodilators and suctionings), post-treatment respiratory score documented	44	73*
Respiratory score documented before and after suctioning	78	94†
Patients who received a bronchodilator treatment even though the post-suctioning score was $< 3$	44	59
Bronchodilator treatments given without a pre-score or with a pre-score $< 3$	69	61

\*p < 0.001.

†p = 0.02.

significant increase in the proportion of patients for whom the respiratory score was documented, both before and after suction treatment ( $p = 0.02$ ). There was no change in the proportion of bronchodilator treatments given without a pretreatment respiratory score being documented or with a pretreatment score  $< 3$ . Despite making the recommendations for treatment stricter, there was no change in the number of treatments given when the post-suctioning score was  $< 3$ .

### Discussion

Documentation of respiratory scoring increased significantly following implementation of a program to encourage respiratory function assessment to determine the need for and effect of bronchodilator treatment of bronchiolitis patients. Perfect respiratory care also increased significantly. Between the 2001 and 2002 bronchiolitis seasons there was a decrease in both the mean number of and the variability in the number of bronchodilator doses administered.

The medical literature contains evidence both for and against the use of bronchodilators for bronchiolitis. Two reviews concluded that bronchodilators produce modest short-term improvement in the clinical features of mild or moderately severe bronchiolitis,<sup>21,27</sup> whereas 2 others<sup>25,39</sup> concluded that short-term  $\beta_2$ -agonist therapy has no impact on hospitalization rate or respiratory rate. There have also been randomized trials both supporting and refuting the benefit of bronchodilators.<sup>18,20,23,24,26,31,40-44</sup> The team of clinicians who developed our guideline was aware of the conflicting evidence, and the guideline's recommendations represent their best judgment of the interpretation of that evidence. Bronchodilators may be safe and efficacious in a subset of patients,<sup>21,27</sup> but no criteria are known to prospectively identify that subset.<sup>7</sup>

That we did not see a decrease in the frequency or intensity of bronchodilator treatments after program im-

plementation may be partly because the bronchodilator treatment rate was already quite low. In the years prior to implementation of the original bronchiolitis guideline (in January 1997), 69% of admitted infants were given at least 1 bronchodilator treatment, 57% received multiple bronchodilator treatments, and the mean number of bronchodilator treatments was 11.5.<sup>35</sup> Since then we have seen steady decreases in those numbers. Also, the focus of the program was to encourage the use of respiratory function assessment to determine the need for and effect of bronchodilator treatment—not to avoid all use of bronchodilators. Since some bronchiolitis patients are admitted only to administer bronchodilator therapy, eliminating unnecessary treatments may prevent hospitalization or reduce duration of stay. In addition, a recent Cochrane systematic review noted that the cost of bronchodilator therapy is substantial.<sup>27</sup> Given an estimated cost of \$50 per child for metered-dose inhaler with spacer (for out-patients) or nebulizer, bronchodilator, tubing, and mask (for in-patients), the authors estimated that the total cost to provide bronchodilator therapy to children with primary RSV-positive bronchiolitis in the United States could be \$37.5 million per year. There have been several other reports of bronchiolitis guideline implementation. All of the guidelines have recommended stopping bronchodilator treatment if no response is evident after 1 or 2 treatments; most reports suggest that, though the protocols decreased the number of bronchodilator treatments, substantial numbers of treatments were still ordered.

Dawson et al<sup>45</sup> in Australia developed a clinical guideline for the management of acute viral bronchiolitis. It stated that bronchodilators should be avoided in infants younger than 6 months but noted that “some believe a trial may be indicated in the older child and where there is a strong history of atopy.” A follow-up survey of pediatricians in 1998 found that 66% sometimes used bronchodilators for out-patient management and 88% sometimes used

bronchodilators for in-patient management of bronchiolitis.<sup>46</sup>

The bronchiolitis guideline developed by Adcock et al<sup>47</sup> in Kentucky recommended considering an initial trial of nebulized albuterol or epinephrine for most patients, limited to the first 24 hours, and saline nose drops and bulb suction for upper respiratory congestion. Comparing historical controls and study patients drawn from a single RSV season, they reported a statistically significant decrease in bronchodilator use and the median number of treatments, though the mean was 10 bronchodilator treatments.

Todd et al<sup>48</sup> in Denver developed a guideline for bronchiolitis and viral pneumonia. That guideline had a “prove it or don’t use it” policy that required observed improvement, as measured by a defined respiratory distress score, to justify the continued use of bronchodilators. They found no overall decrease in the targeted use of bronchodilators but a significant decrease in bronchodilator administration among patients treated for 1 day and an increase among those never treated or treated for  $\geq 2$  days.

Harrison et al<sup>49</sup> in Syracuse, New York, developed a guideline for RSV bronchiolitis that recommended that nebulized albuterol be reserved for patients with documented pretreatment and post-treatment improvement, or at the discretion of the attending physician. Following implementation, children received fewer albuterol treatments, had a greater likelihood of documented physician’s assessment of response to albuterol, and were less likely to be discharged home on albuterol therapy. However, patients with uncomplicated bronchiolitis still received a mean of  $7 \pm 5$  albuterol treatments.

When the guideline developed at our institution was implemented in Child Health Accountability Initiative study hospitals, data from 5 sites revealed a significant decrease in the mean number of bronchodilator treatments, from 11.3 (median 8) to 6.1 (median 3).<sup>50</sup>

Numerous reports have noted the difficulty of sustaining practice changes beyond the first year of guideline use.<sup>51–55</sup> We have previously detailed the results of our efforts to maintain the use of an earlier version of this bronchiolitis guideline.<sup>36</sup> As our experience with evidence-based clinical practice guidelines has increased, the implementation and reinforcement tools we employ have been refined. All guidelines, with links to the original literature, are posted on hospital Internet sites and the hospital’s internal computer network and can be downloaded to handheld computers for point-of-care availability. We have increased the frequency of reporting outcomes data to guideline development team members and guideline users and have developed an automated online reporting system that employs our hospital’s internal computer network. A special section of the staff bulletin is now devoted to outcomes data from our guidelines. Our chief residents re-

ceive training in evidence-based medicine and have begun a more intensive discussion of each guideline through their teaching efforts. We also now put guidelines and aligned parent education material on the education department’s computer system, which allows materials to be printed and given to parents. An education coordinator attends team rounds and makes periodic presentations to health unit coordinators, nurses, residents, and attending physicians. The educational materials include pocket cards, posters, the guideline and its companion documents, and the guideline highlight sheet.

The standardized respiratory scoring form specific to bronchiolitis patients allows our RTs to determine the effect of suctioning separately from the effect of a bronchodilator, and the scoring information allows the physician to prescribe the appropriate therapy.

Previous research conducted at the Primary Children’s Medical Center in Utah has demonstrated the efficacy of nasal suctioning. Researchers there have reported that a bronchiolitis symptom score improved following 60% of suction treatments,<sup>56</sup> reducing the need for bronchodilators<sup>57</sup> and oxygen.<sup>58</sup> They suggest that the observed patient improvement may be associated with improved feeding and, thus, less need for intravenous fluids. A recent survey showed that pediatric emergency room physicians strongly favor nasal suction as a treatment for infants with bronchiolitis.<sup>6</sup> Suctioning appears to be a logical, safe, and inexpensive treatment for bronchiolitis patients.<sup>7</sup>

RTs are an integral part of our bronchiolitis care team and every effort was made to involve them in the program. By attending daily rounds with physicians and the multidisciplinary team, the RTs helped reinforce the guideline recommendations and educate others about the guideline revisions. Ongoing data collection was shared with the RTs so they saw the progress and had support for their evidence-based conversations with the residents. Involving and empowering the RTs helped make them enthusiastic champions of change.

One of the limitations of our study is the sample size. With additional data from future bronchiolitis seasons, we believe we will see further improvements in appropriate care. Ongoing education of new residents and staff will translate the bronchiolitis guideline recommendations into practice. The study is also limited by the use of historical controls, but since the guideline represents best practices, it would not be feasible to deny best care to infants in a concurrent control group.

## Conclusion

Expanding guideline recommendations to the level of specific protocols and empowering RTs to take a more active role place the best evidence in the hands of front-

line caregivers at the point of care, which improves the quality of care for infants suffering bronchiolitis.

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QUALITY CARE FOR INFANTS WITH BRONCHIOLITIS

Appendix 1  
Original Respiratory Assessment Form



RESPIRATORY ASSESSMENT/CARE RECORD  
SIGNATURES:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

RR  
Accessory Muscles  
Air Exchange  
Wheeze  
I:E Ratio

Frequency of treatment									
Date									
Time (Military Time)									
Pre or Post assessment									
Oxygen Saturation (%)									
Flow Rate									
O2 Delivery Device									
Heart Rate									
Peak Flow (60% pred. )									
0) Normal									
1) Above Tachypnea Threshold infant >50,									
0) Normal									
1) Suprasternal/Subcostal/Intercostal Retractions									
2) Neck Muscle or Abdominal muscles , (belly breathing)									
0) Normal									
1) Localized decreased									
2) Multi areas decreased									
0) End Expiratory/None									
1) Entire expiration									
2) Entire expiration&inspiration									
0) ≤1:2									
1) ≥ 1:3									
TOTAL ∅									
Albuterol mg/route									
Ipratropium mg/route									
Steroid mg/route									
<b>Initials</b>									
∅Weaning guideline: Treatment is recommended for a score of 2 or more.									
∅When aerosol frequency is increased, resume weaning at new time interval.									
Comments:									

QUALITY CARE FOR INFANTS WITH BRONCHIOLITIS

Appendix 2  
Revised Respiratory Assessment Form



**BRONCHIOLITIS  
RESPIRATORY SHEET**

MUST INCLUDE DATE AND TIME					
Date		Flow Rate		Initials	Signature
Time (Military Time)		O2 Delivery Device			
Oxygen Saturation (%)		Heart Rate			

**TREATMENT IS RECOMMENDED FOR A SCORE OF 3 OR HIGHER**

	Pre Suction Score	Post Suction Score
<b>Respiratory Rate</b> 0) Normal 1) Above Tachypnea Threshold (infant greater than 50)		
<b>Accessory Muscles</b> 0) Normal 1) Retractions/Substernal/Subcostal/Intercostal 2) Neck or Abdominal Muscles		
<b>Air Exchange</b> 0) Normal 1) Localized Decreased 2) Multi Areas Decreased		
<b>Wheezes</b> 0) None/ End Expiratory 1) Entire Expiratory 2) Entire Expiration and Inhalation		
<b>I:E Ratio</b> 0) Less or Equal to 1:2 1) Greater than 1:3		
<b>Total</b>		
<b>Initials</b>		
<input type="checkbox"/> Treatment not recommended. Comments:		
	Pre Treatment Score	15-30 Minute Post Treatment Score
<b>Respiratory Rate</b> 0) Normal 1) Above Tachypnea Threshold (infant greater than 50)		
<b>Accessory Muscles</b> 0) Normal 1) Retractions/Substernal/Subcostal/Intercostal 2) Neck or Abdominal Muscles		
<b>Air Exchange</b> 0) Normal 1) Localized Decreased 2) Multi Area Decreased		
<b>Wheezes</b> 0) None/ End Expiratory 1) Entire Expiration 2) Entire Expiration and Inhalation		
<b>I:E Ratio</b> 0) Less or equal to 1:2 1) Greater than 1:3		
<b>Total</b>		
<b>Initials</b>		
	<input type="checkbox"/> Albuterol <input type="checkbox"/> Racemic Epinephrine	
<input type="checkbox"/> Improved with treatment. Further treatments indicated. Comments:		