Bronchiolitis Management Preferences and the Influence of Pulse Oximetry and Respiratory Rate on the Decision to Admit

Michael D. Mallory, MD, MPH*‡; David K. Shay, MD, MPH§; Joanne Garrett, PhD*; and W. Clayton Bordley, MD, MPH*‡

ABSTRACT. *Objective.* **High incidence, rising admission rates, and relatively ineffective therapies make the management of bronchiolitis controversial. Since 1980, the rate of hospitalization for children with bronchiolitis has increased by nearly 250%, whereas mortality rates for the disease have remained constant. It has been speculated that the increasing use of pulse oximetry has lowered the threshold for admission and may have contributed to the rise in bronchiolitis-related admissions. The objective of this study was to describe pediatric emergency medicine physicians' management preferences regarding infants with moderately severe bronchiolitis and to assess the influence of specific differences in oxygen saturation as measured by pulse oximetry (Spo_2) and respiratory rate (RR) on the decision to admit.**

Methods. **Physicians who are members of the American Academy of Pediatrics Section of Emergency Medicine and living in the United States were randomized into 4 groups and mailed a survey that contained 1 of 4 vignettes. Vignettes were identical except for given Spo_2 values (94% or 92%) and RR (50/min or 65/min). Subjects were asked to answer questions regarding laboratory tests, treatment options, and the decision to admit for the patient in their vignette.**

Results. **We received completed surveys from 519 (64%) of the 812 physicians contacted. Most respondents recommended use of bronchodilators (96%), nasal suction (82%), and supplemental oxygen (57%). Few respondents recommended decongestants (9%), steroids (8%), or antibiotics (2%). When asked to rank therapies, respondents gave nasal suction 182 number 1 votes; bronchodilators received 164. The decision to admit varied with Spo_2 and RR. Forty-three percent of respondents who received a vignette featuring Spo_2 of 94% and a RR of 50/min recommended admission for the infant in their vignette. Fifty-eight percent recommended admission when the vignette Spo_2 was 94% and RR was 65/min ($\chi^2 = 5.021$). Respondents who received a vignette with Spo_2 of 92% were nearly twice as likely to recommend admission: 83% recommended admission when vignette RR was 50/min, and 85% recommended admission when vignette RR was 65/min ($\chi^2 = 0.126$).**

Conclusions. **When treating infants with moderately severe bronchiolitis, pediatricians who work in emergency departments frequently use bronchodilators and nasal suction, 2 practices for which supporting data are either conflicting (bronchodilators) or nonexistent (nasal suction). In addition, their decisions to admit differ markedly on the basis of only a 2% difference in Spo_2. It is possible that increased reliance on pulse oximetry has contributed to the increase in bronchiolitis hospitalization rates seen during the past 2 decades.** *Pediatrics* **2003;111:e45–e51. URL: http://www.pediatrics.org/cgi/content/full/111/1/e45; *bronchiolitis, bronchodilators, steroids, nasal suction, pulse oximetry, practice variation.***

ABBREVIATIONS. Spo_2, oxygen saturation as measured by pulse oximetry; RR, respiratory rate; RSV, respiratory syncytial virus; OR, odds ratio; CI, confidence interval; Pao_2, arterial oxygen pressure; Sao_2, arterial oxygen percent saturation.

Bronchiolitis is the most common serious lower respiratory tract infection in infants.[1] Among total hospitalizations for children younger than 1 year, the proportion associated with bronchiolitis increased from 5.4% in 1980 to 16.4% in 1996.[2] It is the most common cause of pediatric hospital admissions during the winter months and has been associated with 200 to 500 deaths in the United States annually.[3–5]

Bronchiolitis typically begins with fever and coryza, and then progresses to cough and wheezing. Signs of respiratory distress occur in severe cases. Failure to maintain hydration and development of respiratory distress or failure are the classic reasons for hospital admission.[6] Hospital care is basically supportive and includes intravenous hydration, supplemental oxygen, nasal suction, and mechanical ventilation.

Given the significant morbidity and mortality associated with bronchiolitis, effective therapy is sorely needed. Although a number of therapies have been tested in clinical trials, none has shown great success. In clinical practice, ribavirin, interferon-α, and vitamin A have not demonstrated easily measurable clinical effects.[7–10] Although a recent meta-analysis demonstrated an association between corticosteroid use and a decrease in length of hospital stay by 0.4 days,[11] recent large clinical trials leave little optimism regarding corticosteroid use in bronchiolitis.[12–17] In contrast, a number of trials, reviews, and a meta-analysis suggest that a subpopulation of infants with bronchiolitis benefit from β-agonists administration.[18–22] These data, however, are balanced with a meta-analysis and several trials that fail to show any effects.[23–27] Epinephrine has received the most

From the *Robert Wood Johnson Clinical Scholars Program and ‡Division of Community Pediatrics, Department of Pediatrics, University of North Carolina, Chapel Hill, North Carolina; and §Respiratory and Enteric Viruses Branch, Centers for Disease Control and Prevention, Atlanta, Georgia.
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Reprint requests to (M.D.M.) Division of Pediatric Emergency Medicine, Primary Children's Medical Center, 100 North Medical Dr, Salt Lake City, UT 84113. E-mail: michael.mallory@hsc.utah.edu

consistent support from clinical trials[28–32]; however, its benefits are limited and it is not yet widely prescribed for inhalation outside the hospital setting. Despite the conflicting evidence regarding bronchodilators for bronchiolitis, previous studies have demonstrated that physicians favor their use.[33,34] We found no published studies that examined the role of nasal suction in the treatment of bronchiolitis.

Although admissions for bronchiolitis have steadily risen during the past 15 years,[2] mortality rates for the disease have remained relatively constant.[3] Pulse oximetry has been used ever more widely since the 1980s and is now widely regarded as the "fifth vital sign."[35] Greater reliance on oxygen saturation as provided by pulse oximetry (Spo_2), especially in outpatient settings, may have lowered the threshold for admission regarding infants with bronchiolitis.[2]

High incidence rates, rising admission rates, and relatively ineffective therapies make the treatment of this common disease controversial. The purpose of this study was to describe diagnostic and treatment preferences of pediatric emergency medicine physicians for infants with moderately severe bronchiolitis and to assess the influence of specific differences in Spo_2 and respiratory rate (RR) on the decision to admit.

METHODS

Subjects

We obtained a roster of members of the American Academy of Pediatrics Section of Emergency Medicine with permission from the section's chairman. Section members were randomly assigned to 1 of 4 groups using a computerized random-number generator (Microsoft Corp, Redmond, WA). In December 2000, each was sent a survey and a business reply envelope when a United States mailing address was provided. A second mailing was sent to nonrespondents approximately 6 weeks after the initial mailing. Subjects received no incentive for participation. This project was approved by the Institutional Review Board of the University of North Carolina School of Medicine.

Survey Instrument

The survey consisted of a brief clinical vignette of an infant with moderately severe bronchiolitis followed by 17 questions about the physician's diagnostic and treatment preferences and perceptions of the importance of potential treatments. An additional 13 questions sought information regarding the subject's demographics, training, and practice characteristics. The 4 vignettes were identical except for Spo_2 (94% or 92%) and RR (50/min or 65/min). Each described an infant with copious nasal secretions, wheeze, cough, and other historical and physical examination features typical of infants with moderately severe bronchiolitis (Fig 1). A group of pediatric emergency medicine physicians and general pediatricians participated in a pilot study of the survey and reviewed the features of the history and physical examination before the survey was finalized and distributed. Spo_2 and RR values were chosen on the basis of their feedback and projected potential to influence treatment decisions.

Questions based on the vignette sought to describe the subject's treatment preferences for each of the following potential therapies: antibiotics, bronchodilators (including epinephrine), decongestants, nasal suction, corticosteroids, and supplemental oxygen. We asked respondents to rank specified treatments on the basis of their potential for positive clinical effects and had them indicate their confidence in these therapies using a 5-point Likert scale. Respondents were asked to specify which laboratory studies they believed were indicated by choosing from a list. Options on the list included blood culture, blood gas analysis, chest radiograph, complete blood count, respiratory syncytial virus (RSV) antigen detection, serum electrolytes, urinalysis, urine culture, and "I would order none of these tests." Professional and demographic items at the end of the survey asked questions about residency and fellowship experiences, board certification, current practice settings, years spent practicing, and academic affiliation. Most items were yes/no or multiple-choice format. "Other" was included in most multiple-choice items with specification encouraged. Specific categories were developed for common responses to "other."

Admission preference was ascertained by asking the respondents the following question: "If the patient in the vignette did not improve, how likely would you be to recommend admission?" Potential responses to this question were, "Definitely," "Probably," "Probably not," and, "Definitely not."

On a chilly evening in March, a six-month old, previously healthy infant presents to your emergency department with what appears to be bronchiolitis. This is the parents' only child. The family lives nearby, and the parents appear responsible and appropriately concerned. Below you will find a summary of the history and physical exam findings.

History:	Exam:
• Cough and runny nose with low grade fever • Decreased feeding (but normal number of wet diapers) • Fussy • Duration of illness: approx. 3 days (and not improving) • Full term uncomplicated birth; no prior illnesses • No prior history of asthma or wheezing • No family history of asthma	• Fussy, but consolable, not cyanotic • Copious nasal secretions with audible upper airway congestion • Temp 101°F (rectal), RR = [50 or 65], Pulse = 160 • SpO_2= [92% or 94%] • Mild intra- and sub-costal retractions • Expiratory wheezes • Not dehydrated

SpO2 indicates oxygen saturation as measured by pulse oximetry; RR, respiratory rate.

Fig 1. One of 4 vignettes was provided with the survey to pediatric emergency medicine physicians. The data given in the vignettes differed only in Spo_2 and RR values provided.

Statistical Analysis

Survey data were double entered using Entrypoint data entry software (Phoenix Software International, Inc, Los Angeles, CA) and analyzed using Intercooled Stata 6.0 for Windows (Stata Corp, College Station, TX). Physicians who identified themselves as no longer in practice or not practicing in a pediatric emergency department were excluded from analysis so that the survey would reflect the practices and views of physicians who routinely provide care in emergency departments.

Outcomes variables were the expressed preferences for or against the specified diagnostic and therapeutic options, including admission. For some analyses, we used the responses to the 5-point Likert scales as ordinal variables; for other analyses, we dichotomized the scales into 2 categories. Means, medians, and proportions were recorded for responses in each vignette group, as well as for all subjects combined. For dichotomous outcomes, Pearson χ^2 tests were used to assess differences between subjects who received different vignettes. Stratified analysis was performed to assess for interaction between RR and Spo_2. One-way analysis of variance and Kruskal-Wallis tests were used to detect differences in the ordinal outcomes among vignette groups. When we dichotomized each outcome variable, we used multiple logistic regression to assess the contribution of several demographic and professional variables. Independent variables included vignette Spo_2, vignette RR, university affiliation, pediatric emergency medicine subspecialty board certification, practice at a facility with ≥30 000 pediatric visits a year, and gender of respondent. The outcome of admission was dichotomized as would "definitely" or "probably" admit versus would "probably not" or "definitely not" admit. Significance was assessed using likelihood ratio tests.

We used the American Medical Association's "Physician Select" Web site[36] to gather information regarding gender, residency, and sub-board certification in 50 nonrespondents (17%) and were able to identify medical school graduation dates for the selected nonrespondents and for 50 respondents (10%). Using Pearson χ^2 test for categorical variables and Student t test for continuous variables, we assessed differences in gender, residency, sub-board certification, and years since graduation from medical school.

RESULTS

A total of 519 subjects, or 64% of those contacted, responded to the survey. We excluded from analysis the 34 subjects (6.6%) who reported that they were not clinically active or did not provide care in an emergency department.

Characteristics of Physicians

Table 1 summarizes demographic and professional characteristics of the 485 respondents included in the analysis. Mean age was 43 years, and just more than half (55%) were men. Fifty-five percent had completed a pediatric emergency medicine fellowship, and the median number of years in practice since finishing training was 10 (range: 0–46). Nearly 76% were board-certified in pediatric emergency medicine. Half of the respondents practiced primarily in an urban setting, and three quarters of respondents had a professional affiliation with a university. There were no significant differences in professional or demographic characteristics among subjects who received different vignettes. Respondents and nonrespondents did not differ significantly regarding gender, type of residency training, sub-board certification, or years since medical school graduation.

Use of Therapeutic Options

Overall, 96% of respondents indicated that they would treat the patient in their vignette with a bronchodilator (Table 2). Variation in vignette SPo_2 or RR did not significantly affect this decision. Inhaled albuterol was the most common drug specified (84%). Thirteen percent reported that they would use inhaled epinephrine. Sixty percent of those who initially chose to treat the patient with a bronchodilator said that they would administer another bronchodilator treatment if the first were ineffective. Inhaled epinephrine (57%) followed by inhaled albuterol (35%) were the most commonly recommended drugs for a second bronchodilator treatment. Sixty percent of respondents who initially favored albuterol treatment changed their preference to inhaled epinephrine for the second administration.

Eighty-two percent of respondents indicated that they would attempt to remove nasal secretions for therapeutic reasons. Responses to this item were not significantly different between the subjects who received different vignettes. Fifty-three percent preferred bulb suction, and 44% preferred catheter suction.

Overall, 57% of respondents indicated that they would administer supplemental oxygen to the patient in the vignette. The proportion of respondents who preferred to administer supplemental oxygen varied markedly among subjects who received different vignettes ($P < .001$). Respondents who received vignettes with Spo_2 of 94% chose to recommend supplemental oxygen 34% or 39% of the time for respiratory rates of 50 or 65, respectively. When the given Spo_2 was 92%, 75% or 81% of respondents recommended supplemental oxygen (for respiratory rates of 50 or 65, respectively).

Respondents with vignettes that featured an RR of 65 were no more likely to recommend supplemental oxygen than those whose vignette featured an RR of 50 ($P = .326$). Controlling for other independent

TABLE 1. Characteristics of Respondents ($N = 485$)

Characteristic	
Mean age in years (SD)	43 (6.6)
Male	55%
Median years since finishing training (range)	10 (0–46)
Completed fellowship in pediatric emergency medicine	55%
Board certified in pediatric emergency medicine	76%
Location of practice	
Urban, inner city	51%
Urban, not inner city	35%
Suburban	12%
Rural	3%
Most frequent practice setting	
Pediatric ED in a free-standing children's hospital	46%
Separate pediatric ED, adjacent to adult ED	35%
General ED (adult and children in same facility)	9%
Private practice	5%
Affiliated with a university	76%
Residency training	
General pediatrics	90%
Emergency medicine	5%
Median yearly pediatric visits (range)	30 000 (1000–108 000)

SD indicates standard deviation; ED, emergency department.

TABLE 2. Management Preferences, Expressed as Percentages

	Spo_2 = 94%		Spo_2 = 92%		Overall (N = 485)
	RR = 50 (N = 119)	RR = 65 (N = 125)	RR = 50 (N = 124)	RR = 65 (N = 117)	
Would admit the patient	43	58	83	85	67
Would treat patient in vignette with a bronchodilator	92	95	97	98	96
Inhaled albuterol	85	82	85	86	84
Inhaled epinephrine	13	17	13	11	13
Would give a repeat bronchodilator treatment if patient failed to respond to first treatment	60	56	62	62	60
Inhaled epinephrine	55	43	59	69	57
Inhaled albuterol	37	43	35	27	35
Nasal suction	80	82	85	80	82
Bulb syringe	45	64	49	55	53
Suction catheter	51	35	48	44	44
Supplemental oxygen	34	39	75	81	57
Decongestants	7	10	10	9	9
Steroids	7	6	8	11	8
Antibiotics	2	2	2	3	2

variables, respondents who were board certified or worked in higher volume emergency departments (≥30 000 visits annually) were only half as likely to recommend supplemental oxygen as those who were not (odds ratio [OR]: 0.5; 95% confidence interval [CI]: 0.3–0.9; and OR: 0.6; 95% CI: 0.4–0.99, respectively).

Only 9% expressed a preference to treat the patient in their vignette with a decongestant. Among those who would prescribe a decongestant, oral decongestants were preferred by a ratio of 2:1 over intranasal decongestants. The decision to use decongestants did not vary based on vignette.

Eight percent expressed a preference for corticosteroid administration. Nine percent indicated that they would use an antibiotic in treating the patient in the vignette. Subjects who reported working in a high-volume facility were less likely to favor steroids (OR: 0.4; 95% CI: 0.2–0.9), and those affiliated with a university were less likely to recommend antibiotics (OR: 0.1; 95% CI: 0.0–0.5).

Comparison of Therapeutic Options

Respondents were asked to rank the given therapeutic options from 1 to 6 in descending order of expected potential for positive clinical effect. Nasal suction received the greatest number of first-place rankings (182), followed by bronchodilators (164) and supplemental oxygen (133). In multiple logistic regression analysis, subjects who responded to vignettes with Spo_2 of 92% were more likely to rank oxygen first than those with Spo_2 of 94% (OR: 2.5; 95% CI: 1.6–3.9). Respondents who practiced in a high-volume facility were less likely than their counterparts to rate oxygen number 1 (OR: 0.5; 95% CI: 0.3–0.8).

Laboratory Tests

Respondents were asked whether they would order laboratory tests from a specified list of diagnostic studies. Preferences for the various tests are given in Table 3. Seventy-one percent of respondents favored ordering at least 1 test. Forty percent chose 2 or more, and 12% chose 3 or more. Twenty-nine percent indicated that they would order no tests. The most popular choices were chest radiograph (61%), RSV antigen detection (47%), and complete blood count (11%).

Respondents who received a vignette with Spo_2 of 92% were slightly more likely to order tests than

TABLE 3. Diagnostic Test Preferences, Expressed as Percentages

	Spo_2 = 94%		Spo_2 = 92%		Overall (N = 485)
	RR = 50 (N = 119)	RR = 65 (N = 125)	RR = 50 (N = 124)	RR = 65 (N = 117)	
Would order a chest x-ray	55	58	64	67	61
Would order RSV antigen detection	42	42	52	53	47
Would order a complete blood count	9	9	10	15	11
Would order a blood gas analysis	4	5	2	11	5
Would order a blood culture	3	4	4	4	4
Would order serum electrolytes	3	2	5	4	4
Would order a urinalysis	3	3	4	3	3
Would order a urine culture	3	0	2	2	2
Would not order any tests	34	31	25	24	29

those who received a vignette with Spo_2 of 94% (OR: 1.5; 95% CI: 1.0–2.2). Specifically, those who received a vignette with Spo_2 of 92% were more likely to recommend ordering chest radiographs (OR: 1.4; 95% CI: 1.0–2.1) and RSV antigen detection tests (OR: 1.5; 95% CI: 1.1–2.2). Multiple logistic regression showed that respondents who were board-certified or worked in higher volume emergency departments were less likely to order any tests (OR: 0.5; 95% CI: 0.3–0.9 and OR: 0.5; 95% CI: 0.3–0.7, respectively).

Admission

When admission preferences were dichotomized to "would admit" (would "definitely" or "probably" admit) versus "would not admit" (would "probably not" or "definitely not" admit), 67% of all respondents indicated that they would recommend admission (Table 2). The recommendation for admission varied significantly with the Spo_2 in the vignette. Respondents who received a vignette with Spo_2 of 94% recommended admission 43% of the time for RR of 50/min and 58% of the time for RR of 65/min. Respondents who received a vignette with Spo_2 of 92% were much more likely to recommend admission: 83% recommended admission for RR of 50/min and 85% for RR of 65/min. Respiratory rate was significantly associated with admission preference only when the vignette Spo_2 was 94% ($\chi^2 = 5.021$; $P = .025$) but not when the Spo_2 was 92% ($\chi^2 = 0.126$; $P = .723$).

DISCUSSION

US pediatric emergency medicine physicians' recommendations regarding admission of infants with bronchiolitis seem to vary markedly on the basis of the difference in Spo_2 between 94% and 92%. The results of our study suggest that mild to moderate hypoxemia has become a criterion for admission. This finding may help to explain the previously documented 2.4-fold increase in bronchiolitis-associated admissions since the increased use of pulse oximetry that began in the 1980s.

Our findings also indicate that pediatric emergency medicine physicians favor the use of bronchodilators and nasal suction when treating infants with bronchiolitis. A 1989 survey of US pediatric pulmonologists and allergists reported that 86% of respondents recommended a trial of bronchodilators for infants with bronchiolitis.[34] Since that time, the use of bronchodilators for bronchiolitis has been the subject of several meta-analyses. Kellner et al[22] found a modest short-term improvement associated with bronchodilator use, whereas Flores and Horwitz[27] concluded that there is insufficient data to support their use. In the words of 1 of its authors, the Cochrane Acute Respiratory Infections Group's "original lukewarm endorsement of these agents is now even weaker."[37,38] Regardless of these results, 96% of respondents to our survey said that they would use these agents. This contrasts sharply with the results of a 1993 survey of British physicians that reported infrequent bronchodilator use in the treatment of bronchiolitis.[39] Although it might be argued that there is little harm in giving at least a trial of bronchodilators to determine whether a positive response occurs, the annual cost of this approach has been estimated at nearly $40 million.[37]

It is possible that respondents were inclined to favor bronchodilators because of the similarity between the signs and symptoms of asthma and bronchiolitis. Although both diseases may cause children to wheeze, they do not share a common pathophysiology. Bronchiolitis is characterized by airflow restriction at the level of the bronchioles as a result of increased mucus production, tissue edema, and sloughed respiratory epithelium plugging the airways.[40] In contrast, asthma is characterized by reversible bronchospasm and a lesser degree of necrotic cell debris in the airway.[41] This difference in pathophysiology may explain the more favorable trial evidence in support of epinephrine as compared with that for albuterol.[42] Respondents' familiarity with this evidence is reflected in their patterns of bronchodilator use. Although albuterol was the most popular choice for first bronchodilator administered, epinephrine was the most popular choice among those who would try a bronchodilator again.

Nasal suction is another therapy that received favorable responses from participating physicians. When asked to rank the various therapeutics' potential for positive clinical impact, more respondents gave nasal suction a number 1 ranking than any other treatment modality, and it received a more favorable mean Likert score than bronchodilators. Although the importance of a patent nasal airway for neonates and young infants has been established,[43,44] our finding that pediatric emergency medicine physicians strongly favor nasal suction is noteworthy given the lack of published trials assessing its efficacy. In light of its popularity and the dearth of evidence to support its use, the role of nasal suction in the treatment of bronchiolitis should be studied more thoroughly.

Pulse oximetry, which was introduced into clinical practice in the early to mid-1980s, is a relatively recent addition to the outpatient evaluation of children with respiratory complaints.[45] Since its introduction into clinical practice, pulse oximetry has become commonplace, and its use has led to significant changes in physicians' management decisions.[35,46] In a prospective study of the evaluation and treatment of wheezing children who presented to a pediatric emergency department, Yamamoto et al[47] documented a rise in the use of pulse oximetry from 87% in the winter of 1987 to 1988 to 96% in the summer of 1991. The corresponding hospitalization rate for these children rose from 10.4% to 15.6%.

Several studies support the use of pulse oximetry in the assessment of infants with bronchiolitis. Using a discriminant analysis method, Shaw et al[48] demonstrated that Spo_2 of <95% is strongly predictive of more severe illness. In this study, the authors used a broad definition of mild and severe disease and purposefully did not specify strict criteria for their outcomes. Mulholland et al[49] demonstrated a relationship between bronchiolitis severity and Spo_2. The surrogate outcome for severity in this study was the amount of supplemental oxygen provided to study

patients. Subjects were not treated according to a protocol, and no clinical indications for increased fraction of inspired oxygen were given; therefore, it is not surprising that they found an association between Spo_2 and the administration of supplemental oxygen during admission. Our respondents' decisions to admit differed markedly on the basis of a 2% difference in Spo_2. Although the above-cited studies demonstrate the usefulness of pulse oximetry in the evaluation of infants with bronchiolitis, neither goes so far as to argue that 2 infants who are clinically identical in every way except for a 2% difference in Spo_2 should be treated so differently.

Although subjects who responded to the survey were expected to take the pulse oximetry values at face value and were given no reason to doubt the measurement technique, several studies indicate that pulse oximetry is poorly understood by health care personnel.[50] What is the clinical difference between Spo_2 values of 94% and 92%? The upper inflection point of the oxyhemoglobin dissociation curve is generally thought to be at an arterial oxygen pressure (Pao_2) of 60 mm Hg (correlating with arterial oxygen percent saturation [Sao_2] of 90%).[51] Above and to the right of this point, the curve is relatively flat: larger changes in Pao_2 result in relatively small changes in Sao_2.[52] Below and to the left of this point, the curve becomes steep: smaller changes in Pao_2 result in larger changes in Sao_2. At sea level, Spo_2 of 95% is generally considered to correspond to Pao_2 of 75 mm Hg, and Spo_2 of 90% with Pao_2 of approximately 60 mm Hg. Assuming a roughly linear relationship between Spo_2 and Pao_2 between these 2 points on the oxyhemoglobin dissociation curve, the estimated difference in expected Pao_2 values for Spo_2 values of 94% and 92% would be approximately 6 mm Hg.

When we consider the performance characteristics of most pulse oximeters, the clinical significance of this 2% difference becomes less clear. Pulse oximeters make their most accurate measurements at Sao_2 levels >70%, but even in this range, most manufacturers report an accuracy of ±2% (1 standard deviation).[52] Further clouding the significance of a 2% difference are the multiple and common sources of error encountered in using pulse oximeters—errors such as optical shunts, poor pulse pressure, and motion artifact.[52] Given the relatively small absolute difference between Spo_2 of 92% and 94%, the relatively wide 95% CI of pulse oximeter measurements, and the multiple other sources of error, the actual clinical difference between 2 infants whose presentations are identical except for Spo_2 of 94% versus 92% may be negligible. On the basis of the results of our study, however, patients with Spo_2 of 92% are much more likely to be admitted than patients with Spo_2 of 94%. Our findings suggest that small changes in pulse oximetry measurements may result in big changes in patient treatment. The relationship between the increased use of pulse oximeters and the rise in bronchiolitis-associated hospitalization rates may extend beyond temporal coincidence.

The limitations of our study include those common to surveys. We acknowledge that a mailed survey is not an assessment of actual clinical practice. However, vignettes have been validated as useful tools for measuring physician practice in outpatient settings.[53] On the basis of the results of our study, we cannot infer that the relationship between the increased use of pulse oximetry and rising admission rates related to bronchiolitis is causal, but we have sought to demonstrate the plausibility of such a relationship. We also cannot comment on other factors that may have contributed to the increase in bronchiolitis-related admissions—factors such as increased litigation, increased numbers of pediatric emergency medicine physicians, and the increased participation of parents in decisions regarding the care of their children. Although we were able to gather limited information on nonrespondents, we found no significant differences between respondents and nonrespondents, and our 64% response rate exceeded the national average for mailed physician questionnaires (61%).[54]

CONCLUSION

Pediatric emergency medicine physicians seem to favor use of bronchodilators for infants with bronchiolitis despite conflicting results of clinical trials and meta-analyses. They also seem to value nasal suction, a therapy that lacks any supporting data regarding its role in treating bronchiolitis. Despite the relatively wide 95% CIs around pulse oximetry measurements and the relatively small clinical difference expected between the 2 Spo_2 values, the decision to admit was significantly influenced by the 2% difference between Spo_2 values of 94% and 92%. This finding may help to explain the increased numbers of admissions for bronchiolitis since the popularization of pulse oximetry in the 1980s.

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