Practice Variation in Acute Bronchiolitis: A Pediatric Emergency Research Networks Study

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abstract

BACKGROUND AND OBJECTIVES: Studies characterizing hospitalizations in bronchiolitis did not identify patients receiving evidence-based supportive therapies (EBSTs). We aimed to evaluate intersite and internetwork variation in receipt of ≥1 EBSTs during the hospital management of infants diagnosed with bronchiolitis in 38 emergency departments of pediatric emergency research networks in Canada, the United States, Australia, New Zealand, the United Kingdom, Ireland, Spain, and Portugal. We hypothesized that there would be significant variation, adjusted for patient characteristics.

METHODS: Retrospective cohort study of previously healthy infants aged <12 months with bronchiolitis. Our primary outcome was that hospitalization occurred with EBST (ie, parenteral fluids, oxygen, or airway support).

RESULTS: Out of 3725 participants, 1466 (39%) were hospitalized, and 1023 out of 1466 participants (69.8%) received EBST. The use of EBST varied by site ($P < .001$; range 6%–99%, median 23%), but not by network ($P = .2$). Significant multivariable predictors and their odds ratios (ORs) were as follows: age (0.9), oxygen saturation (1.3), apnea (3.4), dehydration (3.2), nasal flaring and/or grunting (2.4), poor feeding (2.1), chest retractions (1.9), and respiratory rate (1.2). The use of pharmacotherapy and radiography varied by network and site ($P < .001$), with respective intersite ranges 2% to 79% and 1.6% to 81%. Compared with Australia and New Zealand, the multivariable OR for the use of pharmacotherapy in Spain and Portugal was 22.7 (95% confidence interval [CI]: 4.5–111), use in Canada was 11.5 (95% CI: 3.7–36), use in the United States was 6.8 (95% CI: 2.3–19.8), and use in the United Kingdom was 1.4 (95% CI: 0.4–4.2). Compared with United Kingdom, OR for radiography use in the United States was 4.9 (95% CI 2.0–12.2), use in Canada was 4.9 (95% CI 1.9–12.6), use in Spain and Portugal was 2.4 (95% CI 0.6–9.8), and use in Australia and New Zealand was 1.8 (95% CI 0.7–4.7).

CONCLUSIONS: More than 30% of infants hospitalized with bronchiolitis received no EBST. The hospital site was a source of variation in all study outcomes, and the network also predicted the use of pharmacotherapy and radiography.

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WHAT'S KNOWN ON THIS SUBJECT: There is an important knowledge gap regarding the use of resources for bronchiolitis in emergency departments; studies characterizing bronchiolitis hospitalizations do not identify patients receiving evidence-based supportive therapies (EBSTs). The information presented here may help minimize potentially unnecessary hospitalizations.

WHAT THIS STUDY ADDS: Thirty percent of infants hospitalized with bronchiolitis receive no EBSTs during emergency department or inpatient stay. The hospital site is a predictor of the receipt of EBSTs, nonrecommended pharmacotherapies, and radiography, independent of disease severity.

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Bronchiolitis is the leading cause of hospitalization in infants.[1,2] In the United States, annual bronchiolitis-related hospitalization expenses exceed $500 million[3] and other western countries have similar challenges with the costs of managing bronchiolitis.[4,5] Because effective therapies remain elusive, clinical guidelines advocate for supportive measures and discourage the use of pharmacotherapy and diagnostic testing.[6–13] Nonetheless, the desire to improve the child's well-being, combined with the lack of evidence-based therapeutic options, has led to the continued use of resources that provide little benefit.[14–23]

The evidence regarding resource use in the treatment of bronchiolitis largely targets the inpatient population,[14,15,18,22,23] leaving knowledge gaps in the emergency department (ED) management. Furthermore, the literature quantifying hospitalizations in bronchiolitis has employed epidemiologic designs and has not focused on ED management.[24–26] The authors of studies that characterized hospitalizations in bronchiolitis[27–34] do not distinguish between patients who receive beneficial supportive therapies[6–12] from those who receive interventions without evidence of benefit. The authors of recent work on hospitalizations in bronchiolitis also suggests there may be a recent trend toward hospitalizing infants with milder disease.[35] Most of these studies were conducted in the United States, and comparative analysis of the management strategies employed in infants with bronchiolitis in other countries has not been performed.

Given the high-financial burden of hospitalizations and risks of unnecessary hospitalizations of patients with bronchiolitis, it is important to examine therapeutic interventions administered in infants presenting with bronchiolitis to the ED during their ED or inpatient management. This information would clarify the use of evidence-based supportive therapies (EBSTs) as compared with those that are not evidence based. EBSTs include intravenous (IV) or nasogastric (NG) hydration, oxygen, and airway support.[6–12,36] This knowledge can be used to decrease hospitalizations, optimize resource use, and decrease the cost of care.[37]

We conducted a multinational, retrospective cohort study of previously healthy infants with bronchiolitis. Participants presented to 38 EDs associated with 6 pediatric emergency research networks in Canada, the United States, Europe (Spain and Portugal), United Kingdom, Ireland, Australia, and New Zealand. The primary objective was to evaluate the intersite and internetwork variation in the proportion of eligible patients who are hospitalized and received at least 1 EBST during their ED or inpatient stay. We hypothesized that there would be significant differences in this outcome across sites after adjusting for patient-level characteristics. Secondary objectives were to determine the variation in the administration of chest radiography and nonrecommended pharmacotherapies in the ED.

METHODS

Study Design and Population

This was a multicenter retrospective cohort study conducted at 38 pediatric EDs in 8 countries. All study hospitals are members of the Pediatric Emergency Research Network (PERN),[38] which consists of the following 6 pediatric emergency research networks: (1) Pediatric Emergency Research Canada (PERC); (2) the Pediatric Emergency Medicine Collaborative Research Committee (PEM-CRC) and the Pediatric Emergency Care Applied Research Network (PECARN) in the United States; (3) the Pediatric Research in Emergency Departments International Collaborative (PREDICT) in Australia and New Zealand; (4) the Pediatric Emergency Research United Kingdom and Ireland (PERUKI); and (5) Research in European Pediatric Emergency Medicine (REPEM) in Spain and Portugal. Lack of ED data precluded inclusion of data from the Argentine-Uruguayan network, which is also a member of PERN. The annual patient volume in the participating EDs ranged from 20 000 to 120 000. The study was approved by the research ethics boards of all participating institutions.

Eligible children were <12 months of age and diagnosed in the ED between January 1 and December 31, 2013 with bronchiolitis, defined as the first presentation with a viral respiratory tract infection with respiratory distress.[6,7] This definition was operationalized to include only children diagnosed with bronchiolitis in the ED and for whom there were no previous visits to a health care provider for these symptoms more than 1 month before the index ED visit.

Exclusions were a previous diagnosis of bronchiolitis ≥1 month before the index episode, coexistent lung disease, congenital heart disease, immunodeficiency, neuromuscular, neurologic, or bone disease, metabolic, genetic, kidney, or liver disease, or previous enrollment.

Study Protocol

Patient study data were collected according to standard methods for retrospective chart reviews.[39] All study variables were defined a priori according to international definitions and itemized in a manual of operations with data source hierarchy for all data points. This manual was used by all site investigators. Given the variety of health care systems involved, the case report form was reviewed by co-investigators from all participating networks before the study initiation to assess feasibility and to maximize clarity. The site investigators were responsible for ensuring local data extractors reviewed the manual of operations and the standardization of data extraction procedures on site-specific terms that could be considered vague (such as dehydration).

At each hospital, we identified the medical records of consecutive infants who presented to the ED within the study period and had a discharge diagnosis of bronchiolitis or bronchiolitis caused by the respiratory syncytial virus according to the *International Classification of Diseases, Ninth and 10th Revisions* (codes J 21.0, 21.8, 21.9/466.1). Using a random number generator, each site identified a sample of records for review. Trained abstractors assessed eligibility and recorded data into a secure web-based database.

Extracted information included demographics, presenting symptoms and physical examination in the ED, and medications given before arrival and in the ED. Other data included vital signs and oxygen saturation measured on room air in triage, chest radiography in the ED, and disposition.

Outcome Measures

The primary outcome measure was hospitalization with EBST (versus hospitalization without EBST or discharged from the ED). The EBST was defined a priori as hospitalization plus any of the following interventions during the index ED visit or within 6 hours of hospitalization: (1) IV or NG fluids, (2) supplemental oxygen, or (3) airway support (ie, high-flow nasal cannula, noninvasive ventilation or mechanical ventilation). These measures constitute the key interventions encouraged by the major published bronchiolitis guidelines available at time of study initiation. These guidelines also discourage the routine use of pharmacotherapies, with small caveats.[6,9,10,40] Although the thresholds for the use of EBST vary between guidelines and local practice patterns, these therapies represent the main indications for hospitalization. For these reasons, we employed them to define EBST. Secondary outcomes included (1) administration of inhaled epinephrine, salbutamol, hypertonic saline, or systemic corticosteroids in the ED; and (2) use of chest radiography, neither of which are routinely recommended in bronchiolitis.

Analyses

The sample size was estimated to provide ≥80% power at a 5% significance level to assess the primary association between EBSTs and the postulated predictors thereof, using the multivariable logistic regression analysis. Based on a previous study,[41] we assumed that 30% of children would be hospitalized, with one-half of these also receiving EBST. Planning the examination of 10 independent variables and requiring 10 to 15 patients with the outcome per predictor variable and allowing for moderate average correlation between independent variables, we aimed to enroll ~3000 patients (with 15% or 450 patients with EBSTs), equivalent to 80 per site. Because of an a priori hypothesis that treatment in North America may be different from other regions, we aimed to recruit >1500 patients from North American and >1500 from non-North American sites.

We used proportions to describe categorical data and means with standard deviations or medians with interquartile ranges (IQRs) for continuous data. Relevant 95% confidence intervals (CIs) were calculated around proportions. The PEM-CRC and PECARN networks were treated as a single network in the analysis.

Univariate logistic regression was used to examine the association between each explanatory variable and EBST. Thereafter, a multivariable logistic regression analysis was performed to determine the association between the hospitalization with EBST as a binary dependent variable and the predictor variables with univariate $P < .2$ for the following variables: network, age, poor feeding by history, dehydration observed by ED treating physician, nasal flaring and/or grunting, chest retractions, apnea by history or in the ED, oxygen saturation, and respiratory rate, with the site as a random effect. To examine the clustering of pharmacotherapy and chest radiography use by site, multivariable logistic regression analyses were also done using network and the aforementioned patient-level variables, with the site as a random effect. The analyses were done using SAS version 9.4 and PROC GLIMMIX (SAS Institute, Inc, Cary, NC).

RESULTS

Study Population

A total of 5305 potentially eligible infants were identified at the 38 sites. Of these, 1580 fulfilled exclusion criteria, leaving 3725 eligible participants: 802 in 8 Canadian pediatric EDs (PERC), 978 in 10 EDs in the United States (PEM-CRC and PECARN), 805 children in 8 EDs in Australia and New Zealand (PREDICT), 841 in 9 EDs in the United Kingdom and Ireland (PERUKI), and 299 in 3 EDs in Spain and Portugal (REPEM). The number of patients ranged from 68 to 101 per ED. Thirty-four of the 38 EDs had bronchiolitis management guidelines in place.

The mean age was 4.5 ± 3.0 months and 2274 (61.1%) were boys (Table 1). Treatment before ED arrival included inhaled salbutamol in 632 (16.9%) patients, inhaled

TABLE 1 Demographic and Clinical Characteristics of the Study Population

Variables	Networks				
	Canada, N = 802	United States, N = 978	Australia and New Zealand, N = 805	United Kingdom and Ireland, N = 841	Spain and Portugal, N = 299
Age[a] (mo)	4.4 ± 3.1	4.5 ± 2.8	4.9 ± 3.1	4.3 ± 2.9	3.8 ± 2.9
Gender, N (% male)	496 (62)	577 (59)	503 (62)	514 (61)	184 (61)
Duration of distress[a] (d)	3.6 ± 2.9	3.1 ± 3.4	2.3 ± 1.9	2.6 ± 2.1	2.5 ± 2.6
History of poor feeding N (%)	455 (57)	455 (46)	451 (56)	475 (56)	114 (38)
Temperature[a] (°C)	37.4 ± 0.8	37.5 ± 0.9	37.0 ± 0.9	37.0 ± 0.8	37.4 ± 0.9
Respiratory rate[a] (bpm)	49 ± 14.8	51.5 ± 16.5	50.4 ± 12.9	47.6 ± 11.6	53.1 ± 11.1
Oxygen saturation[a] (%)	96.2 ± 4.8	96.4 ± 3.9	97.1 ± 2.0	97.0 ± 3.6	97.1 ± 2.3
Reported and observed apnea, N (%)	80 (10)	81 (8)	83 (10)	53 (6)	13 (4)
Dehydration, N (%)	87 (11)	107 (11)	145 (18)	49 (6)	7 (3)
Nasal flaring and/or grunting, N (%)	142 (18)	219 (22)	150 (19)	61 (7)	21 (7)
Chest retractions, N (%)	538 (67)	734 (75)	679 (84)	538 (64)	207 (69)

Differences between networks were significant for all variables (P < .001). bpm, breaths per minute.

[a] Mean ± SD.

TABLE 2 Association Between EBSTs and Patient Characteristics

Variables	Admission With Receipt of EBST, N = 1023	Admission With No EBST or Discharge From the Hospital, N = 2702	Unadjusted OR	95% CI	P
Age (mo ± SD)[a]	3.6 ± 3.1	4.8 ± 2.9	0.90[b]	0.84–0.88	.0001
Temperature in ED (°C ± SD)[a]	37.4 ± 1.0	37.2 ± 0.8	1.2[c]	1.1–1.3	.0001
Reported poor feeding[d]	709 (73)	1236 (51)	2.6	2.2–3.1	.0001
Respiratory rate in ED[a]	55.4 ± 16.1	47.6 ± 12.7	1.3[e]	1.22–1.30	.0001
Oxygen saturation in ED (%)[a]	94.1 ± 5.9	97.6 ± 2.9	1.33[f]	1.30–1.37	.0001
Dehydration in ED[d]	242 (24)	150 (6)	5.2	4.2–6.6	.0001
Nasal flaring and/or grunting in ED[d]	336 (33)	257 (10)	4.6	3.8–5.6	.0001
Reported and observed apnea in ED[d]	200 (20)	109 (4)	5.7	4.5–7.4	.0001
Chest retractions	896 (88)	1795 (66)	3.6	2.9–4.6	.0001

EBST in the ED or during inpatient stay. For no admission with EBST, patients were either discharged from the hospital or admitted without EBST.

[a] Mean (± SD).

[b] For every 1-mo increase in age, the odds of admission with EBST decreased by 10%.

[c] For every °C increase in temperature, the odds of admission with EBST increased by 20%.

[d] N (%).

[e] For every 5 breaths per minute increase in respiratory rate the odds of admission with EBST increased by 30%.

[f] For every 1 % decrease in saturation, the odds of admission with EBST increased by 33%.

epinephrine in 58 (1.5%) patients, and oral corticosteroids in 265 (7.1%) patients. Overall, 1466 out of 3725 children (39.4%) were hospitalized. Infants in the United Kingdom and Ireland and in Spain and Portugal had lower rates of dehydration and nasal flaring and/or grunting compared with their counterparts living elsewhere. A total of 1262 out of 1466 hospitalized infants (86%) were admitted to inpatient wards, and 204 infants (14%) were admitted to the ICU. Of note, 119 out of 1466 (8%) of participants were admitted directly to the ICU, and 85 (6%) were transferred to the ICU after initial hospitalization in the ward.

Hospitalization With EBST

A total of 1023 out of 1466 (69.8%) hospitalized infants received EBSTs and 30.2% of hospitalized infants did not. The rate of hospitalization with at least 1 EBST ranged from 20% in the United Kingdom and Ireland to 37% in the United States. Of the 1023 infants hospitalized with EBSTs, 240 (23.4%) received supplemental oxygen only and 660 (64.5%) received supplemental oxygen or IV and NG fluids. Children admitted with EBST had a considerably higher rate of apnea, dehydration, and nasal flaring and/or grunting compared with those without this outcome (Table 2).

The administration of EBSTs varied across sites (P < .001), with rates per site ranging from 6.1% to 99.0% (median 23.4%; 95% CI: 17.9%–28.3%; IQR 15%–33%). After adjustment for clustering by site and other covariates, the multivariable odds ratio (OR) for age was 0.90 (95% CI: 0.87–0.94; for each month increase in age, the odds of the outcome decreased by 10%); the OR for oxygen saturation was 1.32 (95% CI: 1.28–1.37; for each percentage point decrease in saturation <100%, the odds of the outcome increased by 32%); the OR for respiratory rate was 1.16 (95%: CI: 1.14–1.17; for each 5 breaths per minute increase in the respiratory rate, the odds of

TABLE 3 Use of Pharmacotherapies and Radiography Across Networks

Resource	Network						
	Canada, n = 802	United States, n = 978	Australia and New Zealand, n = 805	United Kingdom and Ireland, n = 841	Spain and Portugal, n = 299	Total, N = 3725	P
Epinephrine	200 (25)	109 (11)	7 (0.9)	3 (0.4)	77 (26)	396 (11)	<.0001
Salbutamol	135 (17)	232 (24)	38 (5)	27 (3)	87 (29)	519 (14)	<.0001
Hypertonic saline	110 (14)	7 (0.7)	11 (1.4)	81 (9.6)	71 (24)	280 (7.5)	<.0001
Corticosteroid	10 (1.2)	39 (4)	21 (2.6)	12 (1.4)	5 (1.7)	87 (2.3)	<.0001
Any of the above	369 (46)	363 (37)	74 (9)	120 (14)	173 (58)	1099 (29)	<.0001
Chest radiography	270 (34)	345 (35)	150 (19)	88 (10)	36 (12)	889 (24)	<.0001

Data are *n* (%).

the outcome increased by 16%); the OR for apnea was 3.40 (95% CI: 2.40–4.91); OR for dehydration was 3.22 (95% CI: 2.31–4.35); the OR for nasal flaring and/or grunting was 2.40 (95% CI: 1.91–3.32); the OR for chest retractions was 1.90 (95% CI: 1.41–2.52); and the OR for poor feeding was 2.11 (95% CI: 1.70–2.70). The association between the administration of EBSTs and network was not statistically significant (*P* = .20).

Use of Pharmacotherapy and Chest Radiography

Both the site and the network represented significant sources of variation in the use of pharmacotherapy and radiography, independent of patient-level characteristics (*P* < .001 for both). The proportional use of at least 1 aforementioned pharmacotherapy per site ranged from 2% to 79% (median 24.5%; 95% CI: 12.1%–40.3%; IQR: 7.5%–49%). The use of pharmacotherapy was associated with increasing age (OR: 1.15; 95% CI: 1.10–1.19), decreasing oxygen saturation (OR: 1.04; 95% CI: 1.01–1.08), respiratory rate (OR 1.04; 95% CI: 1.03–1.05), and chest retractions (OR: 2.2, 95% CI: 1.7–3.0).

Administration of pharmacotherapy in each network ranged from 9% in Australia and New Zealand to 58% in Spain and Portugal (Table 3). Although corticosteroids were uniformly used at a low rate, the use of epinephrine varied from <1% in Australia and New Zealand to 26% in Spain and Portugal. Likewise, inhaled salbutamol (albuterol) usage varied widely from 3% in the United Kingdom and Ireland to 29% in Spain and Portugal. Using Australia and New Zealand as a reference, the respective ORs for pharmacotherapy use were 22.7 for Spain and Portugal (95% CI: 4.5–111.0), 11.5 for Canada (95% CI: 3.7–35.9), 6.8 for the United States (95% CI: 2.3–19.8), and 1.4 for the United Kingdom and Ireland (95% CI: 0.4–4.2). Figure 1 illustrates the variation in the pharmacotherapy use between and within networks.

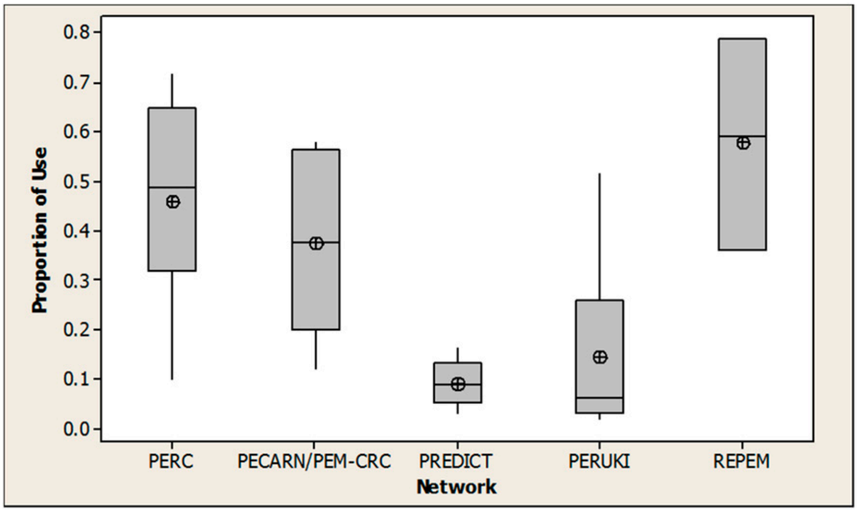

FIGURE 1
Variation in the use of pharmacotherapy between and within networks.

Chest radiography performance also varied between sites and networks (*P* < .001 and .002, respectively). The radiography rate per site ranged from 1.6% to 80.8% (median 22.4%; 95% CI 13.0%–25.2%; IQR: 11.6%–29.3%). The use of radiography was associated with increasing age (OR: 1.04; 95% CI: 1.0–1.08), decreasing oxygen saturation (OR: 1.08; 95%CI: 1.04–1.11), dehydration (OR: 2.1; 95% CI: 1.5–2.9), apnea (OR: 1.8; 95% CI: 1.3–2.6), and nasal flaring and/or grunting (OR 1.9; 95% CI: 1.5–2.5).The use of chest radiography in each network ranged from 10% (United Kingdom and Ireland) to 35% (United States). Using the United Kingdom and Ireland as a reference, the OR for radiography in the United States was 4.9 (95% CI: 2.0–12.2), Canada 4.9 (95% CI: 1.9–12.6), Australia and New Zealand 1.8 (95% CI: 0.7–4.7), and Spain and Portugal 2.4 (95% CI: 0.6–9.8). Figure 2 illustrates the variation in the chest radiography use between and within networks.

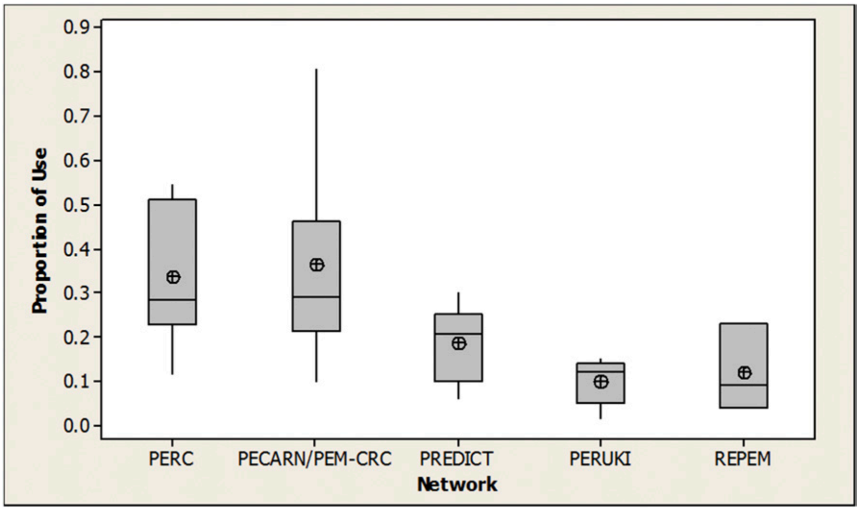

FIGURE 2
Variation in the use of chest radiography between and within networks.

DISCUSSION

In this large international study, we found that more than 30% of infants hospitalized for bronchiolitis did not receive any EBSTs. Hospitalization with the receipt of EBSTs, use of nonrecommended pharmacotherapies and chest radiography varied by site. The latter 2 interventions also varied by network, after adjustment for patient-level characteristics.

The decision to hospitalize a child with bronchiolitis is a complex process impacted by the course of the illness and other clinical, social, cultural, and geographic factors.[33] In this study, we highlight a high hospitalization rate similar to previous reports.[41–43] The relatively high rate of EBST use and the large site variation in this outcome may in part be explained by differences in the local culture of care, access to follow-up, and social factors. Although most sites had guidelines in place, their actual uptake and use may vary. Local staffing with pediatric ED versus adult ED-trained physicians may also vary, with the latter more likely to hospitalize infants with milder bronchiolitis.[44] Although inpatient observation is sometimes warranted for select infants with bronchiolitis, there may be an opportunity to optimize the use of inpatient resources. For example, the criteria for supplemental oxygen are variable between EDs, and reliance on oximetry may have altered the hospitalization criterion.[45] Using an oxygen saturation target lower than the present cutoffs for oxygen therapy results in a significantly higher safe discharge rate, shorter lengths of stay, and lower health care costs.[46,47] Additional research may further clarify the need for hospitalization and optimize the use of resources for bronchiolitis.

An important limitation of some previous studies of bronchiolitis treatments is lack of patient-level clinical data, and thus, the effect of these key variables on variation could not be examined.[3,14,15,48] Authors of a recent inpatient study of 16 hospitals in the United States found wide interhospital variation in the inpatient use of therapeutic interventions.[23] In our ED-focused study, we highlight the magnitude of variation on an international scale and confirm a previous opinion that bronchiolitis management is largely influenced by location of care, irrespective of disease severity.[49] In contrast to previous studies,[14,23,43] the administration of nonrecommended interventions in our study occurred at a more modest rate. Reported rates of bronchodilator use between 2007 and 2012 ranged up to 90%,[14,23] in contrast to the 25% rate found in our study. Likewise, our rate of radiography ranged up to 35%, in contrast to the 52% to 85% rate reported previously.[14,23,43] These resources were used particularly sparingly in Australia and New Zealand and in the United Kingdom and Ireland. Although increasing acceptance of the guideline-related message of nonintervention may be in part responsible for these results, it is possible that our colleagues in these regions practice in a less intervention-oriented milieu compared with the physicians in North America and Europe; the parental expectation "to do something" may also impact local practice differences.[50,51]

The guidelines developed by the American Academy of Pediatrics (AAP) and by experts elsewhere aim to minimize overtreatment by recommending against use of noneffective interventions.[6–12,40] Although guideline publication may result in a meaningful practice change,[21,52] authors of inpatient bronchiolitis studies published after the 2006 AAP bronchiolitis guideline have found a disappointingly high use of the nonrecommended resources.[14,48,53] Therefore, quality improvement experts[23] recommend standardization of bronchiolitis care through evidence-based quality improvement strategies, clinical practice pathways, and multisite quality collaboratives.[54] Multifaceted computerized point-of-care decision support systems for ED physicians combined with multidisciplinary institutional pathways may help us improve acute care of bronchiolitis further, as is the case in the inpatient setting.[55] Achievable benchmarks of care parameters help attain lower rates of unnecessary bronchiolitis care in inpatients.[52] Developing these benchmarks for ED management may further optimize resource use. In contrast to earlier versions, the current major bronchiolitis practice guidelines take a more definitive position against a trial of bronchodilators.[7,8,12] The future creation of an international practice guideline may help unify the standards of care for children with bronchiolitis.

Our study has several limitations. Some included patients may have had previous episodes of bronchiolitis that were not identified by our research approach. Furthermore, some infants who responded to bronchodilators or had abnormal radiographs may have been assigned alternate diagnoses. Some clinical characteristics may not have been documented despite being present. Criteria for subjective evaluations such as dehydration were lacking. Although the main admission indicators for bronchiolitis are the inability to self-hydrate or maintain adequate oxygenation, local practice may favor different criteria for EBST and indications for hospitalization. Also, we collected only oxygen saturation at triage and changes in subsequent oxygen saturation may have affected management. The REPEM network representation was limited to Spain and Portugal and related results may not be representative of other European countries. Because our study focused on the tertiary care pediatric EDs, our results may not be generalizable to community EDs.

CONCLUSIONS

In this multinational study, we found that a large proportion of infants with bronchiolitis who were hospitalized received no EBSTs. The ED at which the child presented constituted a significant source of variation in hospitalization with receipt of EBSTs, use of nonrecommended pharmacotherapies, and chest radiography. The network was also a predictor of the latter 2 outcomes, after adjustment for patient-level characteristics. International best practices need to be identified for the management of these patients.

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PERN NETWORKS

Participating networks include: PECARN, the PEM-CRC of the AAP, PERC, PERUKI, PREDICT, REPEM, and the Red de Investigación y Desarrollo de la Emergencia Pediátrica Latinoamericana, which means Research Network and Development of Pediatric Emergency Medicine in Latin America (Argentine-Uruguayan network).

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ABBREVIATIONS

AAP: American Academy of Pediatrics
CI: confidence interval
EBST: evidence-based supportive therapy
ED: emergency department
IQR: interquartile range
IV: intravenous
NG: nasogastric
OR: odds ratio
PECARN: Pediatric Emergency Care Applied Research Network
PEM-CRC: Pediatric Emergency Medicine Collaborative Research Committee
PERC: Pediatric Emergency Research Canada
PERN: Pediatric Emergency Research Network
PERUKI: Pediatric Emergency Research United Kingdom and Ireland
PREDICT: Pediatric Research in Emergency Departments International Collaborative
REPEM: Research in European Pediatric Emergency Medicine

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