Altitude and Environmental Climate Effects on Bronchiolitis Severity Among Children Presenting to the Emergency Department

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Abstract **Bronchiolitis, a respiratory illness, is the leading cause of hospitalization for infants. The authors examined whether environmental factors contributed to the severity of the bronchiolitis illness. They compiled environmental data (temperature, dew point, wind speed, precipitation, altitude, and barometric pressure) to augment clinical data from a 30-center prospective cohort study of emergency department patients with bronchiolitis. They analyzed these data using multivariable logistic regression. Higher altitude was modestly associated with increased retractions (odds ratio [*OR*] = 1.6; 95% confidence interval [*CI*] = 1.1–2.1; $p < .001$) and decreased air entry (*OR* = 2.0; 95% *CI* = 1.6–2.6; $p < .001$). Increasing wind speed had a minor association with more severe retractions (*OR* = 1.3; 95% *CI* = 1.1–1.7; $p = .02$). Higher dew points had a minor association with lower admission rates (*OR* = 0.9; 95% *CI* = 0.8–0.996; $p = .04$). Altitude and environmental climate variables appear to have modest associations with the severity of bronchiolitis in the emergency department. Further studies need to be conducted, however, on limiting exposure to these environmental variables or increasing humidity before making broad recommendations.**

Introduction

Bronchiolitis is the leading cause of hospitalization for infants (Zorc & Hall, 2010). Bronchiolitis is an acute lower respiratory tract infection in young children most commonly caused by seasonal viruses, such as respiratory syncytial virus (50%–80%), human rhinovirus, parainfluenza viruses, and human metapneumovirus (Zorc & Hall, 2010). An American Academy of Pediatrics clinical practice guideline defined bronchiolitis as the "constellation of clinical symptoms and signs including viral upper respiratory prodrome followed by increased respiratory effort and wheezing in children less than 2 years of age (Lieberthal et al., 2006)." Although multiple risk factors exist for hospitalization and increased severity (Lieberthal et al., 2006; Zorc & Hall, 2010), sparse data are available on how altitude and environmental climate may affect bronchiolitis severity.

Climate variables may contribute to other respiratory disease processes. For example, although low temperatures and decreased relative humidity favor transmission of influenza virus in animal models (Lowen, Mubareka, Steel, & Palese, 2007), absolute humidity is more strongly associated with influenza transmission and survival (Shaman & Kohn, 2009). Asthma severity in children has been associated with lower temperature (Hashimoto et al., 2004; Nastos, Paliatsos, Papadopoulos, Bakoula, & Priftis, 2008; Yuksel, Tanac, Tez, Demir, & Coker, 1996), humidity (Bar-Or, Neuman, & Dotan, 1977; Ehara et al., 2000; Hashimoto et al., 2004; Nastos et al., 2008), and increased wind speed (Nastos et al., 2008), but studies evaluating the effects of altitude (Gourgoulianis, Brelas, Hatziparasides, Papayianni, & Molyvdas, 2001; Kiechl-Kohlendorfer et al., 2007) and barometric pressure (Ehara et al., 2000; Hashimoto et al., 2004) have produced conflicting results. Choudhuri and colleagues reported that high altitude is a modest predictor for respiratory syncytial virus (RSV) bronchiolitis–associated hospitalization in Colorado (Choudhuri et al., 2006). RSV admission rates have also been associated with increased precipitation and lower mean temperatures (Chan, Chew, Tan, Chua, & Hooi, 2002).

Based on the associations between environmental factors and several respiratory diseases, we theorized that these factors might influence bronchiolitis severity. Many climate variables are readily available on a daily basis in newspapers and Internet weather sources. We surmised that these data could be applied to children at risk for severe disease. Therefore, we hypothesized that these environmental factors (altitude, temperature, dew point, wind speed, precipitation, and barometric pressure) could contribute to the severity of bronchiolitis presentation and to hospital admission rates.

Patients and Methods

Data Collection

We conducted a prospective cohort study during the 2004 to 2006 winter seasons as part of the Multicenter Airway Research Collaboration (MARC). MARC is a division of the Emergency Medicine Network (www.emnet-usa.org). A goal of this prospective cohort study was to create a large, comprehensive, and generalizable database to help improve our understanding of bronchiolitis. Personnel at 30 emergency departments (EDs) in 15 states across the U.S. enrolled patients for up to three weeks during consecutive winters. Collectively, patients were enrolled from January 3, 2005, to March 27, 2005, in the first year and from December 12, 2005, to April 29, 2006, in the second year. Efforts were made to screen all consecutive bronchiolitis patients during the study period. All bronchiolitis visits, including those not enrolled, were recorded and tracked in a bronchiolitis registry. Patients were managed per the discretion of the attending physician in the ED. The institutional review boards at Massachusetts General Hospital and Children's Hospital Boston initially approved the study protocol. Each participating ED adopted this protocol and obtained institutional review board approval at their respective institutions.

Patients were included in the study if they were <2 years old and if they were diagnosed with bronchiolitis by one of the ED physicians. For the prospective portion of the study, a parent or guardian consented to the study. The only exclusion criterion was previous enrollment in the study. Duplicate visits, however, were tracked in the bronchiolitis registry.

Data collection included an interview in the ED and chart review. On the day of enrollment, caretakers of patients underwent a 15-minute survey to obtain demographic data, medical history, and a detailed history of the current illness. Chart review was conducted by one of the study investigators for data concerning the patient's ED presentation, physical examination, and management.

Respiratory rates and oxygen saturation via pulse oximetry were recorded in the original MARC-25 database, but were not used as outcome variables for this study, since normal respiratory rates by age have significant variability, and children living at higher altitudes have a lower baseline oxygen saturation than children at sea level and relatively lower mean oxygen saturations at younger ages. Chest retractions and decreased air entry, which are more consistent across age groups and altitude, were used as the primary markers for bronchiolitis severity.

Chest retractions were defined as supraclavicular, intercostal, or subcostal retractions of the neck or chest wall, suggesting respiratory distress. Decreased air entry was determined by chest auscultation by the treating physician at the time of evaluation. Retractions and decreased air entry were originally recorded as categorical data: absent retractions/normal air entry versus mild, moderate, or severe retractions/decreased air entry. For data analysis, the retractions data were converted to a dichotomous variable, either absent or present. Air entry data were also analyzed as a dichotomous variable, either normal air entry or decreased air entry. For the current analysis, environmental factors were compared to the three severity outcomes: chest retractions, decreased air entry, and hospital admission rates.

Altitude and Climate Data

Environmental factors included altitude, temperature, dew point, wind speed, precipitation, and barometric pressure. Daily climate data are readily accessible on multiple public Web sites. The Google search engine was used to search for the altitude of the study site, using the key word "elevation" followed by the medical center zip code. If this search did not yield results, "elevation" and the city of the medical center were used. In some cases, the search yielded altitude results for other cities involved in our study. Results were used if they were comparable to searches using the other key words.

The remainder of the predictor variable data was obtained from the *Los Angeles Times* weather section online (2007), which utilizes data from the National Oceanic and Atmospheric Administration's National Weather Service. National data were collected using the corresponding dates of presentation to the ED for each of the centers of enrollment. For temperature, the mean, maximum, and minimum temperatures and daily change in temperature were abstracted for each day and city. The dew point and wind speed were presented as daily averages, and precipitation was given as a daily total. The National Weather Service reports barometric pressure readings in intervals throughout the day, though not as daily averages. The first barometric pressure reading of the calendar day was used in our study.

Altitude was defined as the height above sea level measured in feet, and temperature as degrees Fahrenheit (°F). The dew point is the temperature (°F) to which air must be cooled to produce dew (assuming a constant barometric pressure). Although dew point is associated with relative humidity, the relative humidity changes with temperature changes, while the dew point does not. As a result, dew point is a better indicator of moisture in the air and is preferred by most meteorologists. Also, the dew point does not vary much throughout a 24-hour period.

Wind speed is the rate at which air moves horizontally past a given point, reported as a two-minute average speed in miles per hour. Precipitation measured in inches includes rain, sleet, snow, or hail. Barometric pressure is the pressure exerted by the earth's atmosphere at a given point and is measured in inches.

Statistical Analysis

All data analyses were performed using STATA 9.0. Data are presented as medians with interquartile ranges. The unadjusted associations between environmental factors and clinical outcomes were examined using Kruskal-Wallis rank tests. All p-values are two-tailed, with $p < .05$ considered statistically significant. Multivariable logistic regression was used to evaluate independent associations between environmental factors and clinical outcomes (retractions, air entry, and hospital admission).

Factors were evaluated in the multivariable model if they had an unadjusted association with the outcome of interest at $p < .2$. The interval chosen for the multivariable analysis of altitude was one in which physiologic changes might be expected based upon prior literature (Choudhuri et al., 2006; de Meer, Heymans, & Zijlstra, 1995; Milledge, 2006). The intervals for the remainder of the climate variables were chosen after reviewing the distribution of the data. Because the outcomes of interest were common in this cohort and odds ratios (*OR*) of frequent outcomes do not approximate the relative risk, all analyses were repeated using a log-binomial model to obtain the relative risk. All of the major findings remained statistically significant regardless of technique used (data not shown), so results are presented as *OR* with 95% confidence intervals (*CI*).

Results

Demographic Data

A total of 1,459 patients were enrolled in the original prospective study. Demographic data were available for 1,456 (99%) patients. With regard to clinical outcomes, data on patient retractions were available for 1,384 (95%), air entry for 1,288 (88%), and ED disposition for 1,456 (99%). An overview of the demographic data is presented in Table 1. The mean age of patients in our study was 5.9 months and 851 (58%) patients were male.

Presentation Severity

Retractions were present for 61% of children (42% mild, 17% moderate, 2% severe). In the unadjusted analysis of retractions, significant predictors were higher altitudes, a higher minimum temperature, a higher dew point, increased precipitation, and a smaller change in temperature (Table 2). When these variables were analyzed in the multivariable model, increasing altitude (OR = 1.6; 95% CI = 1.1–2.1; $p < .001$) and increasing wind speed (OR = 1.3; 95% CI = 1.1–1.7; p = .02) remained statistically significant predictors of increased retractions.

Air entry was abnormal for 47% of children (36% mild, 11% moderate, 1% severe). In the unadjusted analysis of decreased air entry, significant predictors were higher altitude; higher mean, maximum, and minimum temperatures; and an increased change in temperature (Table 3). In the multivariable model, only increasing altitude was associated with a statistically significant decrease in air entry (OR = 2.0; 95% CI = 1.6–2.6; $p < .001$).

TABLE **1**

Demographic Data of Children Presenting to the Emergency Department With Bronchiolitis (*N* = 1,456)

Demographic Factors	#
Age (months), median (IQR[a])	5.9 (2.9–10.2)
Male	851 (58%)
Race/ethnicity	
Caucasian	558 (40%)
African-American	447 (32%)
Hispanic	382 (27%)
Estimated median household income ($), median (IQR)	43,810 (30,970–56,772)
Insurance	
Private	473 (33%)
Medicaid	860 (59%)
Public	68 (5%)
None	49 (3%)
Has primary care provider	1,418 (97%)
Environmental factors [metric equivalent]	
Altitude (ft.), median (IQR)	480 (20–792) [146.3 m (6–241.4)]
Mean temperature (°F), median (IQR)	38 (29–46) [3.3ºC (-1.6–7.8)]
Maximum temperature (°F), median (IQR)	44 (35–55) [6.7ºC (1.6–12.8)]
Minimum temperature (°F), median (IQR)	30 (24–38) [-1.1ºC (-4.4–3.3)]
Change in temperature (°F), median (IQR)	14 (10–20) [8ºC (6–11)]
Dew point (°F), median (IQR)	25 (16–34) [-3.9ºC (-8.9–1.1)]
Wind (mph), median (IQR)	8 (5–11) [12.9 kph (8–17.7)]
Precipitation (in.), median (IQR)	0 (0–0.06) [0 cm (0–0.15)]
Barometric pressure (in.), median (IQR)	30.06 (29.91–30.24) [76.35 cm (75.97–76.81)]
Clinical outcomes	
Admitted	619 (43%)
Retractions	
Absent	540 (39%)
Present	844 (61%)
Air entry	
Normal	684 (53%)
Abnormal	604 (47%)

[a]IQR = interquartile range.

Admission Rates

In the unadjusted analysis of hospital admission, significant predictors were lower altitudes; higher mean, maximum, and minimum temperatures; and a lower barometric pressure (Table 4). Although a higher dew point was associated with increased admission rates in the unadjusted analyses, controlling for other factors in the multivariable logistic regression analysis revealed that a higher dew point actually was associated with a lower risk of hospital admission (OR = 0.9; 95% CI = 0.8–0.996; p = .04).

Discussion

In our multivariable analysis of this large geographically diverse sample of children presenting to the ED with bronchiolitis, we found the following: 1) an increase in dew point was associated with lower admission rates; 2) an increase in altitude was associated with both an increase in severity of retractions and decreased air entry; and 3) increased wind speed was associated with an increase in severity of retractions. To our knowledge these data are the first multicenter, prospective data examining the

TABLE 2

Retractions: Multivariable Logistic Regression Model of Associations Between Environmental Factors and Retractions (Absent vs. Present) Among Children Presenting to the Emergency Department With Bronchiolitis

Environmental Factor	Univariable			Multivariable[a]
	None (n = 540)	+, ++, +++ (n = 844)	p-Value	Odds Ratio (95% CI[b])
Altitude, median (IQR[b])	200 (20–792)	480 (20–900)	<.001	1.6 (1.1–2.1)
Mean temperature, median (IQR)	37 (29–46)	38 (30–47)	.19	0.8 (0.6–1.1)
Maximum temperature, median (IQR)	43 (35–57)	45 (36–56)	.47	–
Minimum temperature, median (IQR)	30 (21–37)	32 (25–39)	.02	1.2 (0.9–1.6)
Change in temperature, median (IQR)	16 (11–21)	14 (9–20)	.04	1.1 (0.9–1.2)
Dew point, median (IQR)	24 (15–33)	26 (18–35)	.005	1.1 (0.9–1.3)
Precipitation, median (IQR)	0 (0–0.04)	0 (0–0.09)	.01	1.6 (0.9–3.0)
Wind, median (IQR)	7 (5–11)	8 (5–11)	.08	1.3 (1.1–1.7)
Pressure, median (IQR)	30.06 (29.94–30.25)	30.06 (29.90–30.24)	.26	–

[a]For multivariable model, odds ratio reflects a change in altitude per increase of 1,000 feet, temperature per increase of 1°F, dew point per increase of 10°F, precipitation per increase of 0.1 in., and wind per increase of 10 mph.

[b]CI = confidence interval; IQR = interquartile range.

TABLE 3

Air Entry: Multivariable Logistic Regression Model of Associations Between Environmental Factors and Air Entry (Normal vs. Abnormal) Among Children Presenting to the Emergency Department With Bronchiolitis

Environmental Factor	Univariable			Multivariable[a]
	Normal (n = 684)	-, --, --- (n = 604)	p-Value	Odds Ratio (95% CI[b])
Altitude, median (IQR[b])	126 (20–792)	600 (21–1080)	<.001	2.0 (1.6–2.6)
Mean temperature, median (IQR)	37 (29–46)	40 (32–48)	.002	0.9 (0.7–1.1)
Maximum temperature, median (IQR)	43 (35–56)	46 (37–58)	<.001	1.1 (0.9–1.2)
Minimum temperature, median (IQR)	30 (23–37)	32 (26–39)	.004	1.1 (1.0–1.3)
Change in temperature, median (IQR)	14 (9–20)	15 (11–22)	.006	–
Dew point, median (IQR)	25 (16–35)	26 (18–35)	.08	0.9 (0.8–1.1)
Precipitation, median (IQR)	0 (0–0.09)	0 (0–0.05)	.73	–
Wind, median (IQR)	8 (5–11)	7 (4–11)	.07	1.0 (0.8–1.2)
Pressure, median (IQR)	30.06 (29.91–30.24)	30.06 (29.91–30.24)	.78	–

[a]For multivariable model, odds ratio reflects a change in altitude per increase of 1,000 ft., temperature per increase of 1°F, dew point per increase of 10°F, and wind per increase of 10 mph.

[b]CI = confidence interval; IQR = interquartile range.

influence of daily environmental climate variables on the severity of a child's bronchiolitis.

In comparison to our study, a recent single-center study in Germany examined the association between climate variables and pediatric admissions for acute respiratory illnesses (du Prel et al., 2009). Of the 326 admissions for RSV, the investigators found weak correlations between wind velocity and admission, and an inverse association with humidity. These correlations were similar to those of our study. Compared to our larger study, however, the age of the patients was ≤16 years, instead of <2 years, and the environmental data were taken as 14-day averages instead of as daily data.

Our multivariable analysis of bronchiolitis hospital admissions revealed that patients

TABLE **4**

Hospital Admissions: Multivariable Logistic Regression Model of Associations Between Environmental Factors and Risk of Hospital Admissions Among Children Presenting to the Emergency Department With Bronchiolitis

Environmental Factor	Univariable			Multivariable[a]
	Sent Home (n = 837)	Admitted (n = 619)	p-Value	Odds Ratio (95% CI[b])
Altitude, median (IQR[b])	480 (20–792)	258 (20–792)	.04	0.9 (0.7–1.1)
Mean temperature, median (IQR)	36 (28–46)	39 (32–48)	<.001	1.0 (0.8–1.3)
Maximum temperature, median (IQR)	42 (34–55)	46 (37–57)	<.001	1.0 (0.9–1.1)
Minimum temperature, median (IQR)	30 (21–37)	32 (26–39)	<.001	1.0 (0.9–1.1)
Change in temperature, median (IQR)	14 (10–20)	14 (10–21)	.60	–
Dew point, median (IQR)	25 (15–34)	27 (18–35)	.02	0.9 (0.8–0.996)
Precipitation, median (IQR)	0 (0–0.05)	0 (0–0.09)	.39	–
Wind, median (IQR)	8 (5–11)	8 (5–11)	.77	–
Pressure, median (IQR)	30.07 (29.93–30.26)	30.05 (29.89–30.21)	.02	0.7 (0.4–1.0)

[a]For multivariable model, odds ratio reflects a change in altitude per increase of 1,000 ft., temperature per increase of 1°F, dew point per increase of 10°F, and pressure per increase of 1 in.
[b]CI = confidence interval; IQR = interquartile range.

were less likely to be admitted with an increasing dew point (higher moisture content). Limited data is available on the physiologic effects of dew point or relative humidity, although studies have addressed the effects of humidification on patients receiving respiratory support. These studies concur that an optimal high respiratory relative humidity exists (between 95% and 100%) above which and below which clinical problems may arise (Irlbeck, 1998; Sottiaux, 2006; Williams, 1998; Williams, Rankin, Smith, Galler, & Seakins, 1996). A relative humidity that is too low may lead to changes in airway surface tension and the alveolar-arterial oxygen gradient, osmotic challenges (Williams, 1998), retention of secretions (Sottiaux, 2006), and mucociliary dysfunction (Irlbeck, 1998; Sottiaux, 2006; Williams, 1998). As discussed in the Methods section, dew point is a better measure of moisture content of air compared to relative humidity, but its physiologic effects on respiration have not been well studied.

Other studies have evaluated the association between RSV bronchiolitis and relative humidity, but results are varied. Indeed, increased numbers of children with RSV bronchiolitis have been associated with higher relative humidity (du Prel et al., 2009; Meerhoff, Paget, Kimpen, & Schellevis, 2009; Omer et al., 2008), lower relative humidity (Chew, Doraisingham, Ling, Kumarasinhe, & Lee, 1998; Lapena et al., 2005), or relative humidity of 45%–65% (Welliver, 2007; Yusuf et al., 2007). Few studies, however, address the effects of either dew point or relative humidity on bronchiolitis severity, especially as measured clinically in the ED.

A study in Chile of 541 children aged <1 year with bronchiolitis demonstrated no association between humidity, temperature, or precipitation with the frequency of presentations to the ED or outpatient clinics (Zamorano, Marquez, Aranguiz, Bedregal, & Sanchez, 2003). The results of our study suggest a minor association between an increasing dew point and a decrease in admissions. As a possible practical application of this finding, humidifiers in the home may simulate the environmental effects of increased dew point, and should be studied further. In a recent Cochrane review, studies were found to be lacking, with a single study comparing three groups: nebulized salbutamol, nebulized saline, and humidification in a mist tent (Umoren, Odey, & Meremikwu, 2011). While the study did not show a decrease in respiratory distress score with humidification, the Cochrane review concluded that insufficient evidence exists to formulate conclusions about the utility of humidification.

While increasing altitude was modestly associated with increased retractions and decreased air entry, it was not associated with increased hospitalizations. High altitude climate therapy has been associated with reduced airway inflammation (Karagiannidis et al., 2006), and a recent review by Rijssenbeek-Nouwens and Bel suggests that the effects of high altitude might benefit those with severe refractory asthma (Rijssenbeek-Nouwens & Bel, 2011). Choudhuri and co-authors (2006) demonstrated that altitude above 2,500 m is a modest predictor for RSV bronchiolitis–associated hospitalization in a statewide study in Colorado. It should be noted, however, that most of the world's population lives well below the altitude defined as high altitude, and none of the centers in our study even reached the criteria that Choudhuri used for moderate altitude (1,500–2,500 m). Increasing altitude is associated with lower barometric pressure and a decreased partial pressure of inspired oxygen (de Meer et al., 1995). We had little variation in the barometric pressures or dew points, which may be explained by the relatively low altitudes of the centers in our study (Choudhuri et al., 2006).

An increase in wind speed had a minor association with patients presenting with chest retractions. The effect of wind speed on bronchiolitis has not been well studied, although an increase in circulating pollutants and allergens may be responsible for these findings. The pathophysiology of this finding was beyond the scope of our study, but may be valuable to investigate in the future.

Limitations

Our study is subject to several limitations. Although bronchiolitis is associated with multiple different viruses (Zorc & Hall, 2010), the diagnosis remains clinical (Lieberthal et al., 2006). Therefore, it is possible that children with bronchiolitis due to different viruses may respond differently to climate and altitude variables. To control for this potential variability, future studies could perform microbiological testing to determine the organisms associated with concurrent illnesses. Future studies could assess the living situations of patients to determine allergic or other environmental causes that may contribute to the intercurrent symptoms. Our study did not collect specific living environment data or whether or not the patients were exposed to many different settings.

Assessment of decreased air entry and chest retractions is inherently subjective (Wang et al., 1996), but physician subjectivity was minimized by dichotomizing the data so that any retractions or any decrease in air entry was compared to a normal examination. Furthermore, chest retractions in bronchiolitis are associated with increased hospital admission rates, need for supplemental oxygen (Mai, Selby, Simpson, & Isaacs, 1995), and duration of hospitalization (Weigl, Puppe, & Schmitt, 2004). Decreased air entry has been associated with degree of hypoxemia in hospitalized children with acute lower respiratory tract infections (Weber, Usen, Palmer, Jaffar, & Mulholand, 1997). Even though we did not analyze respiratory rate or room air saturation in our study, multivariable analysis in another study revealed that they were not independent predictors of severity of illness as defined by intensive care unit admission (Damore, Mansbach, Clark, Ramundo, & Camargo, 2008).

Other limitations exist in the collection of our climate data. We used daily means and points in time for some of the data, but weather patterns can change throughout a given day. This may change more frequently with wind speed and precipitation, but slower changes may also occur with the other variables. Analysis of each of these changing values would have been an excessively complex study, which we thought would not lead to clinically significant data. Furthermore, some climate data may not be relevant to the patients, such as in the case of wind speed and patients who spend all of their time indoors. It is possible that the effects of climate variables may not manifest their clinical effect until subsequent days. Future studies could be designed to prospectively assess the affects of climate variables at the time of bronchiolitis evaluation. Such “real time” studies would provide a more accurate assessment of the affects of climate variables on the disease presentation.

Using hospital rather than residential zip codes also added confounders that were not addressed. The residential zip code may have had different environmental variables and the travel distance to the study center was not accounted for in the analysis. Given the normal catchment area served by each medical center, however, it is unlikely that the differences in patient zip code were accompanied by significant differences in environmental climate variables for the majority of the patients enrolled in this study.

Internet searches for elevation data regularly yielded different results. For each city, multiple elevation values were found. No single source or Web site had all elevation data, and therefore multiple Web sites were necessary. We attempted to use the values that best approximated the area of the medical center. It is unlikely that this variability would have affected the results, since most of the values were within proximity of each other, and not disparate to the degree of being labeled moderate or high elevation (Choudhuri et al., 2006). For example, Toledo, Ohio, had elevation values of 183 m, 186 m, 187 m, 188 m, and 189 m.

Conclusion

Our data indicate that numerous environmental climate factors influence the severity of bronchiolitis for infants and children. Altitude is a predictor of severity of bronchiolitis presentation to EDs, even at altitudes lower than previously reported. Days with a higher wind speed may also be predictive of bronchiolitis severity; and the dew point appears to be inversely related to the frequency of bronchiolitis admissions. These climate data may help predict severity of bronchiolitis on a daily basis, and may help medical centers plan for days when bronchiolitis severity and admission rates may increase. While there are limited proven medications or other interventions to improve the care of children with bronchiolitis, parents could consider limiting their infants’ exposure to windy winter days or using a humidifier or vaporizer. Further studies need to be conducted on these interventions before making broad recommendations. These data, however, support further study of humidification, a simple, low-cost intervention, which may help improve the care of children with bronchiolitis.

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Valuable PowerPoint presentations covering several pertinent topics related to children's environmental health issues, such as body art, food, recreational water, methamphetamines, and safe sun exposure are available on NEHA's Web site at www.neha.org/childrens_eh/index.html. These presentations can be used for training or outreach programs within your community.