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Secondhand smoke exposure, illness severity, and resource utilization in pediatric emergency department patients with respiratory illnesses

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Abstract

Objective—Hospital-based data reveal that children who have secondhand smoke exposure (SHSe) experience severe respiratory illnesses and greater resource utilization. Our objective was to assess the relationship between SHSe and illness severity/resource utilization among children presenting to the pediatric emergency department (PED) with three common respiratory conditions —asthma, bronchiolitis, and pneumonia.

Methods—A retrospective review of a yearlong consecutive sample of PED patients with SHSe status documentation and asthma, bronchiolitis, or pneumonia diagnoses was performed. PED illness severity/resource utilization variables included triage categorization, initial oxygen saturation, evaluation/testing (influenza A & B, respiratory syncytial virus, chest X-ray), procedures/interventions performed (supplemental oxygen, suctioning, intubation), medications administered, and disposition. Logistic and linear regression models were conducted to determine differences in each diagnosis group while controlling for sociodemographics, medical history, seasonality, and insurance type.

Results—There were 3,229 children with documentation of SHSe status and an asthma (41%), bronchiolitis (36%), or pneumonia (23%) diagnosis. Across diagnosis groups, approximately 1/4 had positive documentation of SHSe. Asthmatic children with SHSe were more likely to receive corticosteroids (odds ratio (OR) = 1.71, 95% confidence interval (CI) = 1.19, 2.44) and/or magnesium sulfate (OR = 1.66, 95% CI = 1.14, 2.40). Children with SHSe and bronchiolitis were more likely to receive racemic epinephrine (OR = 2.48, 95% CI = 1.21, 5.08), have a chest X-ray (OR = 1.36, 95% CI = 1.00, 1.85), and/or be admitted (OR = 1.46, 95% CI = 1.09, 1.95). No differences in illness severity/resource utilization were identified for children with pneumonia.

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Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

Conclusions—SHS-exposed children with asthma or bronchiolitis have greater illness severity/resource utilization. Our findings highlight the importance of SHSe assessment, cessation, and research efforts in the PED setting.

Keywords

Admission; bronchiolitis; environmental tobacco exposure; health care utilization; pneumonia; tobacco abuse

Introduction

Secondhand smoke exposure (SHSe) is a preventable cause of childhood illness and death and contributes greatly to health care costs in the United States [1]. Each year, 24.2 million American children [2] are affected by this “pediatric disease,” as deemed by the American Academy of Pediatrics [3,4], and nearly 900 infants die prematurely [5]. Annual health care expenditures attributed to SHSe and smoking are $289–332.5 billion [1].

Children with respiratory conditions—such as asthma, bronchiolitis, and pneumonia—are significantly affected by exposure to SHS [6,7]. Research indicates that 54% of children with asthma [8], 37% of children with bronchiolitis [9], and 35% of children with pneumonia [10] are exposed to SHS. SHSe may contribute to increased illness severity and health care utilization in children nationwide, especially in emergency department (ED) settings [11].

ED data reveal that these three respiratory conditions contribute substantially to ED burden, accounting for 611,000 asthma visits [12], 290,000 bronchiolitis visits [13], and 555,842 pneumonia visits [14] annually. Of children discharged from EDs or pediatric practice with an acute respiratory infection, an estimated 13% have asthma, 20% have bronchiolitis, and 8% have pneumonia [15].

SHSe may be a contributing risk factor to increased illness severity for pediatric acute care visits [16–19]. Prior research indicates that SHS-exposed children with asthma have more frequent and severe exacerbations [17,20] and increased hospital admissions [17]. Children with bronchiolitis who are SHS-exposed have increased likelihood of hospitalization [21], including admission to the intensive care unit (ICU) [22]. SHS-exposed children with pneumonia have longer hospital lengths of stay and greater likelihood of being admitted to the ICU [10].

Although EDs care for a large number of children with asthma, bronchiolitis, and pneumonia [12], little attention has been given to pediatric SHSe and illness severity in this setting. Furthermore, existing literature evaluating associations between SHSe and ED utilization has produced inconsistent results. For example, one study found that SHSe is related to increased ED visits for children with respiratory symptoms [23], while another indicated that there is no relationship between child SHSe and ED visits [24].

Thus, the overall aim of this study was to examine the association between SHSe and pediatric illness severity among children presenting to the pediatric emergency department

(PED) with a primary diagnosis of asthma, bronchiolitis, or pneumonia. Recognizing that illness severity is not exclusive of resources used (i.e., more severe illnesses typically receive more resources), we assessed illness severity using variables such as triage categorization and initial oxygen saturation, as well as PED resource–based proxy variables of illness severity (i.e., evaluation/testing; procedures/interventions; medications administered; and disposition). We hypothesized that PED patients who were exposed to SHS would have higher illness severity and thus greater PED resource utilization as compared to unexposed children.

Methods

We abstracted and analyzed charts from a one-year consecutive sample of children presenting to the PED at Cincinnati Children's Hospital Medical Center (CCHMC), one of the nation's largest Level 1 pediatric trauma centers, from July 1, 2012 to June 30, 2013. Of the 4,779 PED patients with an assigned primary discharge diagnosis (*International Classification of Diseases, 9th Revision, Clinical Modification [ICD-9-CM]*) of asthma, bronchiolitis, or pneumonia (Table 1), 3,229 patients (67.5%) had SHSe documentation (positive or negative) and were included in the analysis. Inclusion ages were based on the most commonly associated age ranges for each condition (asthma: ≥2 to <19 years; bronchiolitis: 0 to ≤2 years; and pneumonia 0 to <19 years). All analyses were performed using SPSS (version 23.0). CCHMC's institutional review board approved this study.

Utilizing hospital-wide electronic medical records (EMRs), the following variables were extracted from PED patients' charts: sociodemographics (age, sex, race, ethnicity); past medical history; seasonality (visit date); insurance type; and discharge diagnosis. Illness severity and PED resource utilization variables abstracted/analyzed included: triage categorization (Emergency Severity Index, ESI) and initial oxygen saturation; PED evaluation/testing performed (influenza A & B, respiratory syncytial virus, chest X-ray); PED procedures/interventions (supplemental oxygen, suctioning [refers to baby booger grabber (BBG) suctioning, which is nasal suctioning using a mushroom tip aspirator that is attached to negative pressure from a vacuum system], intubation); PED medications administered (albuterol, epinephrine, magnesium sulfate, corticosteroids, antibiotics); and PED disposition (hospital admission).

SHSe status was determined via the "Social History" section of EMRs entitled "Tobacco/Smoke Exposure." Any health care provider could have completed SHSe documentation during the index visit or at any previous patient encounter in the hospital setting. Children with a "yes" response in this field were defined as having a positive SHSe; children with a "no" response were defined as having a negative SHSe status; children without responses in this EMR field were excluded from the analysis.

Statistical analysis

Descriptive statistics included frequencies and percentages for categorical variables and means and standard deviations for continuous variables. Chi-square tests, univariate logistic regression models, and *t* tests were used to examine bivariate differences between negative and positive SHSe status. Sociodemographics including statistically significant variables

from the bivariate analyses and covariates of interest were included in the multivariable logistic regression models. A series of multivariable logistic regression models were conducted to determine the differences between SHSe status based on illness severity/PED resource utilization metrics in each diagnosis group while controlling for sociodemographics, medical history, seasonality, and insurance type. Linear regression analyses were performed to determine differences between SHSe groups based on oxygen saturation and triage category while controlling for covariates.

Results

There were 3,229 children with any documentation of SHSe status and an asthma, bronchiolitis, or pneumonia diagnosis in this study: 41% were diagnosed with asthma, 36% were diagnosed with bronchiolitis, and 23% were diagnosed with pneumonia. Across diagnosis groups, approximately 1/4 of the cohort had positive documentation of SHSe.

Asthma

Of the 1,733 PED patients aged 2 to <19 years with an asthma diagnosis, 76.1% had SHSe documentation (n = 1,318) and were included in our analysis (Table 2). The mean age of these children was 7.43 years (SD ± 4.42 years); and 64% were men. The majority (77%) were non-white (i.e., black, other race); while 97% were of non-Hispanic origin. Seventy-nine percent of these patients had Medicare/Medicaid insurance. Presentation to the PED for asthma was highest (31%) during the Fall season, followed by Spring (26%) and Summer (23%).

Nearly one-third (32%) of this PED asthma cohort had positive SHSe status. Bivariate analysis of asthma and SHSe status revealed that Medicare/Medicaid insurance was a statistically significant predictor of an asthmatic child being exposed to SHS ($p < .001$), while Hispanic children with asthma were significantly less likely to have positive SHSe ($p = 0.02$) than non-Hispanic children.

Regression models of SHSe status and asthmatic children revealed that SHS-exposed children were significantly more likely to have received oral and intravenous (IV) corticosteroids for an acute exacerbation (odds ratio (OR) = 1.71; 95% confidence interval (CI) = 1.19, 2.44; $p = 0.004$) and/or have received IV magnesium sulfate for status asthmaticus (OR = 1.66; 95% CI = 1.14, 2.40; $p = = 0.008$).

Bronchiolitis

Of the 1,999 PED patients aged 0 to ≤2 years with a bronchiolitis diagnosis, 59% had SHSe documentation (n = 1,179) and were included in our analysis (Table 3). Mean age for these infants and toddlers with bronchiolitis was 252 days (SD ± 180 days); 61% were males. Fifty-nine percent were non-white (i.e., black, other race); 95% were of non-Hispanic origin; and 82% had Medicare/Medicaid insurance. The majority of children with bronchiolitis presented during the Winter (44%) and Fall months (30%).

Twenty-six percent of these children were exposed to SHS. Only Medicare/Medicaid insurance was a statistically significant predictor of a child having positive SHSe and being

diagnosed with bronchiolitis; though black children and children of other race with bronchiolitis were significantly less SHS-exposed ($p = 0.001$) than white children, as were Hispanic children ($p = 0.03$) compared to non-Hispanic children.

Regression models of SHSe status and children with bronchiolitis revealed that SHS-exposed children were significantly more likely to have had a chest X-ray performed (OR = 1.36, 95% CI 1.00, 1.85, $p = 0.05$) and to have received racemic epinephrine (OR = 2.48; = 95% CI = .21, 5.08; $p = 0.01$). Additionally, these SHS-exposed children were more likely than unexposed children to be admitted to the hospital (OR = 1.46, 95% CI = 1.09, 1.95, $p = 0.01$ than discharged home.

Pneumonia

Of the eligible 1,047 PED patients 0 to <19 years of age diagnosed with pneumonia, 69.9% had SHSe documentation ($n = 732$) and were included in our study (Table 4). The mean age of patients with pneumonia was 4.14 years (SD ± 4.06 years); 52% were males. Forty-nine percent were non-white (i.e., black, other race) and 94% were of non-Hispanic origin. Most (69%) had Medicare/Medicaid insurance, and most (34%) visits occurred in the Fall season.

Over one-fourth (27%) of children with pneumonia had a positive SHSe status. Medicare/Medicaid insurance was the only statistically significant predictor of a child diagnosed with pneumonia having been exposed to SHS ($p < 0.001$). Hispanic children with pneumonia were significantly less likely to have positive SHSe ($p = 0.02$). Multivariable analysis did not reveal significant differences in SHSe status and pneumonia illness severity/resource utilization.

Discussion

This study of several thousand children presenting to the PED with three major respiratory illnesses (asthma, bronchiolitis, or pneumonia) found that more than a quarter of children had positive documentation of SHSe. Though no statistical differences were found between SHSe and child age, sex, or seasonality among all three diagnoses, non-white children were less likely to be exposed to SHS overall than white children, and only Medicare/Medicaid insurance was a significant predictor of a child being exposed to SHS for asthma, bronchiolitis, and pneumonia.

Our study revealed an interesting relationship between SHSe status and illness severity/resource utilization in the PED that has not been previously described in children with asthma and bronchiolitis. We found that PED patients exposed to SHS had greater resource utilization. Specifically, SHS-exposed children with asthma had both a higher likelihood of receiving corticosteroids and/or IV magnesium sulfate in the PED than unexposed children. Current PED asthma management standard of care uses systemic corticosteroids as a first-line medication for moderate to severe asthma exacerbations [25,26] and IV magnesium sulfate for severe refractory asthma exacerbations (status asthmaticus) [27–29]. Given PED clinicians typically adhere to asthma management standards of care, these findings suggest that SHS-exposed children had more severe asthma exacerbations upon presentation to our PED.

We also found that infants and young children presenting to the PED with bronchiolitis had more severe illness, as demonstrated by a greater likelihood of being admitted to the hospital. Additionally, these SHS-exposed children were more likely to have received racemic epinephrine and have had chest X-rays performed in the PED. While the American Academy of Pediatrics has recently published bronchiolitis clinical practice guidelines [30], which discourage the use of racemic epinephrine and chest radiography, at the time of this study, use of racemic epinephrine for severe bronchiolitis in children's hospitals across the nation was variable, and some practitioners performed chest X-rays when evaluating patients with severe bronchiolitis. Thus, we posit that children with bronchiolitis that received these resources had more severe presentations to our PED.

Interestingly, our findings did not reveal any significant associations between SHSe and pneumonia severity/resource utilization in the PED. Thus, further research is warranted to better understand this complex association [10].

Overall, our findings contribute to the growing body of literature that SHSe increases health care resource utilization by specifically focusing on children cared for in the PED setting. Furthermore, our findings align with prior research, revealing greater illness severity among hospitalized children with SHSe and respiratory illnesses [10,20,31–34]. Although PED illness severity and resource utilization varied by diagnosis group in our study, the disproportionate rates of SHSe among certain populations underscore the importance of the Task Force on Smoking Cessation's call for PEDs to prioritize tobacco control efforts for caregivers to reduce child SHSe and associated illnesses [35]. Further, application of these endorsements will have significant health care implications given that low-income caregivers have relatively high rates of tobacco use [36–39], often bring their children to the PED for non-emergent acute care [40], and have increasing ED visit trends [41]. Implementation of SHSe screening and smoking cessation interventions in the PED setting may reach populations who do not have access to smoking cessation counseling in other settings.

Limitations

This study has several limitations. First, we conducted a chart review in the PED of a large, urban, freestanding children's hospital. Since most patients who visit this PED are of low socioeconomic status, our findings may have limited generalizability to other PED settings. Second, our SHSe metric was based on caregiver self-report. Patients who were SHS-exposed may have been misclassified due to caregivers under-reporting their smoking [42–44]. Children were excluded if they did not have SHSe documentation in the predetermined "Social History" EMR section. Specifically, only 59–76% of patients with a primary diagnosis of asthma, bronchiolitis, or pneumonia had documented SHSe. Thus, it is possible that some participants were missed if SHSe was documented elsewhere or was not assessed. Third, our study was of retrospective methodology and did not include all clinical aspects of PED care. Though prior inpatient studies have extrapolated severity of illness from resource utilization [20] in the context of SHSe, causal relationships cannot be concluded. Finally, children of caregivers who use tobacco may wait until the child's illness becomes more severe before seeking PED care, and/or SHSe could have been assessed more frequently in children who had greater illness severity in our PED. Since research indicates that the

assessment of SHSe in PED patients is relatively low [45], improved PED screening measures, including biochemical validation of SHSe, and prospective analysis determining illness severity outcomes in SHS-exposed children are warranted.

Conclusions/key findings

Our findings revealed that a substantial proportion of children presenting to the PED with respiratory illnesses are exposed to SHS, and these SHS-exposed children have greater illness severity/resource utilization for asthma and bronchiolitis, which is similar to prior research in other settings [46]. PED wait times provide an opportunity for SHSe screening and cessation interventions targeting caregivers of these at risk children. Furthermore, the study's results convey the need for continued SHSe research advancement in this opportune setting to help understand and prevent SHSe-related childhood morbidity and health care utilization.

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Table 1

Primary discharge diagnosis ICD-9-CM codes for asthma, bronchiolitis, and pneumonia.

Discharge diagnosis	ICD-9-CM code,
Asthma	493, 493.02, 493.2, 493.81, 493.82, 493.9, 493.91, 493.92, 519.11
Bronchiolitis	466.11, 466.19, 79.5999
Pneumonia	480.2, 480.9, 481, 482.1, 482.2, 482.4, 482.9, 486, 507, 511.89

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Table 2

SHSe status in PED patients with asthma based on illness severity/resource utilization.

Characteristics	Overall (n = 1,318)[c] n (%)	Negative SHSe (n = 896) n (%)	Positive SHSe (n = 422) n (%)	Multivariable analysis[d] OR	95% CI	p Value
Sex						
Male	839 (63.7)	578 (68.9)	261 (31.1)	(Ref)	(Ref)	
Female	479 (36.3)	318 (66.4)	161 (33.6)	1.12	(0.88, 1.42)	.35
Age in years, $M \pm$ SD	7.43 ± 4.42	7.29 ± 4.36	7.73 ± 4.51	—	—	.09
Race						
White	299 (22.7)	197 (65.9)	102 (34.1)	(Ref)	(Ref)	
Black	939 (71.2)	642 (68.4)	297 (31.6)	0.89	(0.68, 1.17)	.42
Other	80 (6.1)	57 (71.3)	23 (28.7)	0.78	(0.45, 1.34)	.37
Ethnicity						
Non-Hispanic	1,277 (97.2)	862 (67.5)	415 (32.5)	(Ref)	(Ref)	
Hispanic	37 (2.8)	32 (86.5)	5 (13.5)	0.33	(0.13, 0.84)	.02
Insurance type						
Commercial	275 (21.2)	214 (77.8)	61 (22.2)	(Ref)	(Ref)	
Medicare/Medicaid	1,024 (78.8)	669 (65.3)	355 (34.7)	1.86	(1.36, 2.54)	<.001
Season						
Fall	413 (31.3)	294 (71.2)	119 (28.8)	(Ref)	(Ref)	
Winter	248 (18.8)	163 (65.7)	85 (34.3)	1.29	(0.92, 1.81)	.14
Spring	348 (26.4)	233 (67.0)	115 (33.0)	1.22	(0.90, 1.66)	.21
Summer	309 (23.4)	206 (66.7)	103 (33.3)	1.24	(0.90, 1.70)	.19
Medical history						
No	102 (7.7)	70 (68.6)	32 (31.4)	(Ref)	(Ref)	
Yes[a]	1,216 (92.3)	826 (67.9)	390 (32.1)	1.03	(0.67, 1.60)	.88
Severity/resource variables						
Triage category, $M \pm$ SD	2.86 ± 0.71	2.89 ± 1.23	2.97 ± 1.27	—	—	.75
Oxygen saturation, $M \pm$ SD	98.03 ± 3.26	97.96 ± 3.70	98.19 ± 2.02			.24
Supplemental oxygen						
No	1,297 (98.4)	884 (68.2)	413 (31.8)	(Ref)	(Ref)	

Characteristics	Overall (n = 1,318)[c] n (%)	Negative SHSe (n = 896) n (%)	Positive SHSe (n = 422) n (%)	Multivariable analysis[d] OR	95% CI	p Value
Yes[b]	21 (1.6)	12 (57.1)	9(42.9)	1.53	(0.63, 3.75)	.35
Disposition						
Discharge to home	907 (69.0)	630 (69.5)	277 (30.5)	(Ref)	(Ref)	
Admit	407 (31.0)	263 (64.6)	144 (35.4)	1.28	(0.99, 1.65)	.06
Flu test obtained						
No	1,309 (99.3)	891 (68.1)	418 (31.9)	(Ref)	(Ref)	
Yes, negative test result	1 (0.6)	5 (62.5)	3(37.5)	1.31	(0.30, 5.67)	.72
Yes, positive test result	1 (0.1)	0 (0.0)	1 (100.0)	—	—	—
Chest X-ray obtained						
No	994 (75.4)	677 (68.1)	317(31.9)	(Ref)	(Ref)	
Yes	324 (24.6)	219 (67.6)	105 (32.4)	1.03	(0.78, 1.37)	.82
Albuterol administered						
No	320 (24.3)	227 (70.9)	93 (29.1)	(Ref)	(Ref)	
Yes	998 (75.7)	669 (67.0)	329 (33.0)	1.22	(0.91,1.62)	.18
Albuterol, no. of treatments, $M \pm$ SD	2.92 ± 1.24	2.89 ± 1.23	2.97 ± 1.27	—	—	.18
Epinephrine administered						
No	1,313 (99.6)	893 (68.0)	420 (32.0)	(Ref)	(Ref)	
Yes, IM Route	5 (0.4)	3 (60.0)	2 (40.0)	1.44	(0.23, 8.95)	.70
Magnesium sulfate administered						
No	1,180 (89.5)	814 (69.0)	366 (31.0)	(Ref)	(Ref)	
Yes, IV Route	138 (10.5)	82 (59.4)	56 (40.6)	1.66	(1.14,2.40)	.008
Steroids given in the PED						
No	1,111 (84.3)	777 (69.9)	334 (30.1)	(Ref)	(Ref)	
Yes, Oral and IV Route	207 (15.7)	119 (57.5)	88 (42.5)	1.71	(1.19, 2.44)	.004

Ref, referent; IM, intramuscular; IV, intravenous; RSV, respiratory syncytial virus; SHSe, secondhand smoke exposure; PED, pediatric emergency department.

[a] Previous medical history of asthma, bronchiolitis, pneumonia, or prematurity.

[b] Nasal cannula, non-rebreather mask, simple mask.

[c] Includes only patients with asthma who had SHSe documentation.

[d] Adjusted for sex, age, race, ethnicity, insurance type, season, and medical history.

The following variables were not included in this table as there were too few cases: RSV test (n =0), respiratory assistance via CPAP, BiPAP, or high flow nasal cannula (n =1) and intubation (n =0).

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Table 3

SHSe status in PED patients with bronchiolitis based on illness severity/resource utilization.

Characteristics	Overall (*n* = 1,179)[d] *n* (%)	Negative SHSe (*n* = 872) *n* (%)	Positive SHSe (*n* = 307) *n* (%)	Multivariable analysis[e] OR	95% CI	*p* Value
Sex						
Male	714 (60.6)	534 (74.8)	180 (25.2)	(Ref)	(Ref)	
Female	465 (39.4)	338 (72.7)	127 (27.3)	1.12	(0.86, 1.45)	.42
Age in days, *M* ± SD	252.89 ± 179.65	250.30 ± 5.97	260.24 ± 10.78	—	—	.41
Race						
White	488 (41.4)	317 (65.0)	171 (35.0)	(Ref)	(Ref)	
Black	568 (48.2)	458 (80.6)	110 (19.4)	0.45	(0.34, 0.59)	<.001
Other	123 (10.4)	97 (78.9)	26 (21.1)	0.50	(0.31, 0.80)	.004
Ethnicity						
Non-Hispanic	1,101 (94.7)	804 (73.0)	297 (27.0)	(Ref)	(Ref)	
Hispanic	62 (5.3)	53 (85.5)	9 (14.5)	0.46	(0.22, 0.94)	.03
Insurance type						
Commercial	209 (18.0)	189 (90.4)	20 (9.6)	(Ref)	(Ref)	
Medicare/Medicaid	955 (82.0)	673 (70.5)	282 (295)	3.96	(2.45, 6.41)	< .001
Season						
Fall	351 (29.8)	267 (76.1)	84 (23.9)	(Ref)	(Ref)	
Winter	515 (43.7)	367 (71.3)	148 (28.7)	1.28	(0.94, 1.75)	.12
Spring	219 (18.6)	164 (74.9)	55 (25.1)	1.07	(0.72, 1.58)	.75
Summer	94 (8.0)	74 (78.7)	20 (21.3)	0.86	(0.50, 1.49)	.59
Medical history						
No	1,104 (93.6)	820 (74.3)	284 (25.7)	(Ref)	(Ref)	
Yes[a]	75 (6.4)	52 (69.3)	23 (30.7)	1.28	(0.77, 2.13)	.35
Severity/resource variables						
Triage category, *M* ± SD	2.90 ± 0.78	2.93 ± 0.79	2.83 ± 0.76	—	—	.09
Oxygen saturation, *M* ± SD	97.41 ± 2.25	97.49 ± 2.26	97.21 ± 2.23	—	—	.13
Respiratory assistance						
No	1,170 (99.2)	865 (73.9)	305 (26.1)	(Ref)	(Ref)	

Characteristics	Overall (*n* = 1,179)[d] *n* (%)	Negative SHSe (*n* = 872) *n* (%)	Positive SHSe (*n* = 307) *n* (%)	Multivariable analysis[e] OR	95% CI	*p* Value
Yes[b]	8 (0.7)	7 (77.8)	2 (22.2)	0.98	(0.19, 5.11)	.98
BBG suctioning						
No	337 (28.6)	245 (72.7)	92 (27.3)	(Ref)	(Ref)	
Yes	842 (71.4)	627 (74.5)	215 (25.5)	0.91	(0.67, 1.24)	.55
Supplemental oxygen						
No	1,027 (87.1)	771 (75.1)	265 (24.9)	(Ref)	(Ref)	
Yes[c]	152 (12.9)	101 (66.4)	51 (33.6)	1.40	(0.93, 2.11)	.11
Disposition						
Discharge to home	705 (59.8)	542 (77.0)	162 (23.0)	(Ref)	(Ref)	
Admit	473 (40.2)	328 (69.3)	145 (30.7)	1.46	(1.09, 1.95)	.01
Flu test obtained						
No	1,163 (98.6)	859 (73.9)	304 (26.1)	(Ref)	(Ref)	
Yes, negative test result	16 (1.4)	13 (81.3)	3 (18.8)	0.62	(0.16, 2.42)	.49
Yes, positive test result	0 (0.0)	0 (0.0)	0 (0.0)	—	—	—
RSV Test obtained						
No	1167 (99.0)	861 (73.8)	306 (26.2)	(Ref)	(Ref)	
Yes, negative test result	3(0.3)	3 (100.0)	0 (0.0)	—	—	—
Yes, positive test result	9 (0.8)	8 (88.9)	1 (11.1)	0.43	(0.48, 3.87)	.45
Chest X-ray obtained						
No	828 (70.2)	626 (75.6)	202 (24.4)	(Ref)	(Ref)	
Yes	351 (29.8)	246 (70.1)	105 (29.9)	1.36	(1.00, 1.85)	.05
Antibiotics administered						
No	1,110 (94.1)	823 (74.1)	287 (25.9)	(Ref)	(Ref)	
Yes, Oral, IM, or IV Route	69 (5.9)	49 (71.0)	20 (29.0)	1.19	(0.66, 2.14)	.57
Albuterol administered						
No	722 (61.2)	534 (74.0)	188 (26.0)	(Ref)	(Ref)	
Yes	457 (38.8)	338 (74.0)	119 (26.0)	1.16	(0.86, 1.58)	.34
Albuterol, no. of treatments, *M* ± SD	1.42 ± 1.00	1.42 ± 0.99	1.44 ± 1.05	—	—	.18
Epinephrine administered						
No	1,142 (96.9)	851 (74.5)	291 (25.5)	(Ref)	(Ref)	

Characteristics	Overall (*n* = 1,179)[d] *n* (%)	Negative SHSe (*n* = 872) *n* (%)	Positive SHSe (*n* = 307) *n* (%)	Multivariable analysis[e] OR	95% CI	*p* Value
Yes, Racemic Route	37 (3.1)	21 (56.8)	16 (43.2)	2.48	(1.21, 5.08)	.01
Steroids administered						
No	1,175 (99.7)	869 (74.0)	306 (26.0)	(Ref)	(Ref)	
Yes, Oral or IV Route	4(0.3)	3 (75.0)	1 (25.0)	1.25	(0.08, 18.74)	.87

Ref, referent; OR, odds ratio; CI, confidence interval; IM, intramuscular; IV, intravenous; RSV, respiratory syncytial virus; SHSe, secondhand smoke exposure; PED, pediatric emergency department.

[a] Previous medical history of asthma, bronchiolitis, pneumonia, or prematurity.

[b] CPAP, BiPAP, High Flow Nasal Cannula.

[c] Blowby, handheld nebulizer, nasal cannula, other supplemental oxygen source.

[d] Includes only patients with bronchiolitis who had SHSe documentation.

[e] Adjusted for sex, age, race, ethnicity, insurance type, season, and medical history.

The following variable was not included in this table as there were too few cases: intubation (*n* =0).

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Table 4

SHSe status in PED patients with pneumonia based on illness severity/resource utilization.

Characteristics	Overall (n = 732)[d] n (%)	Negative SHSe (n = 532) n (%)	Positive SHSe (n = 200) n (%)	Multivariable analysis[e] OR	95% CI	p Value
Sex						
Male	383 (52.3)	287 (74.9)	96 (25.1)	(Ref)	(Ref)	
Female	349 (47.7)	245 (70.2)	104 (29.8)	1.27	(0.92, 1.76)	.15
Age in years, $M \pm$ SD	4.14 ± 4.06	4.02 ± 0.18	4.45 ± 0.28	—	—	.21
Race						
White	372 (50.8)	270 (72.6)	102 (27.4)	(Ref)	(Ref)	
Black	299 (40.8)	213 (71.2)	86 (28.8)	1.07	(0.76, 1.50)	.70
Other	61 (8.3)	49 (80.3)	12 (19.7)	0.65	(0.66,1.27)	.21
Ethnicity						
Non-Hispanic	686 (94.0)	491 (71.6)	195 (28.4)	(Ref)	(Ref)	
Hispanic	44 (6.0)	39 (88.6)	5 (11.4)	0.32	(0.13, 0.83)	.02
Insurance type						
Commercial	224 (31.2)	189 (84.4)	35 (15.6)	(Ref)	(Ref)	
Medicare/Medicaid	495 (68.8)	333 (67.3)	162 (32.7)	2.63	(1.75, 3.95)	<.001
Season						
Fall	247 (33.7)	174 (70.4)	73 (29.6)	(Ref)	(Ref)	
Winter	197 (26.9)	142 (72.1)	55 (27.9)	0.92	(0.61, 1.40)	.71
Spring	170 (23.2)	129 (75.9)	41 (24.1)	0.76	(0.49, 1.18)	.22
Summer	118 (16.1)	87 (73.7)	31 (26.3)	0.85	(0.52, 1.39)	.52
Medical history						
No	498 (68.0)	379 (76.1)	119 (23.9)	(Ref)	(Ref)	
Yes[a]	234 (32.0)	153 (65.4)	81 (34.6)	1.69	(1.20, 2.37)	.003
Severity/resource variables						
Triage category, $M \pm$ SD	2.90 ± 0.85	2.87 ± 0.86	2.98 ± 0.83	—	—	.12
Oxygen saturation, $M \pm$ SD	96.78 ± 2.66	96.78 ± 2.56	96.79 ± 2.89	—	—	.70
Respiratory assistance						
No	712 (97.3)	515 (72.3)	197 (27.7)	(Ref)	(Ref)	

Characteristics	Overall (n = 732)[d] n (%)	Negative SHSe (n = 532) n (%)	Positive SHSe (n = 200) n (%)	Multivariable analysis[e] OR	95% CI	p Value
Yes[b]	20 (2.7)	17 (85.0)	3(15.0)	0.43	(0.12, 1.58)	.20
BBG suctioning						
No	611 (83.5)	440 (72.0)	171 (28.0)	(Ref)	(Ref)	
Yes	121 (16.5)	92 (76.0)	29 (24.0)	0.82	(0.49, 1.36)	.44
Supplemental oxygen						
No	618 (84.4)	443 (71.7)	175 (28.3)	(Ref)	(Ref)	
Yes[c]	114 (15.6)	89 (78.1)	25 (21.9)	0.68	(0.41, 1.14)	.14
Disposition						
Discharge to home	386 (52.9)	279(72.3)	107 (27.7)	(Ref)	(Ref)	
Admit	344 (47.1)	252 (73.3)	92 (26.7)	1.00	(0.71, 1.42)	.99
Flu test obtained						
No	695 (94.9)	502 (72.2)	193 (27.8)	(Ref)	(Ref)	
Yes, negative test result	33 (4.5)	27 (81.8)	6 (18.2)	0.45	(0.60, 6.41)	.13
Yes, positive test result	4 (0.5)	3 (75.0)	1 (25.0)	0.62	(0.06, 6.41)	.69
Chest X-ray obtained						
No	87 (11.9)	66 (75.9)	21 (24.1)	(Ref)	(Ref)	
Yes	645 (88.1)	466 (72.2)	179 (27.8)	1.10	(0.64, 1.90)	.73
Antibiotics administered						
No	426 (58.2)	302 (70.9)	124 (29.1)	(Ref)	(Ref)	
Yes, Oral, IM, or IV Route	306 (41.8)	230 (75.2)	76 (24.8)	0.80	(0.57, 1.14)	.22

Ref, referent; OR, odds ratio; CI, confidence interval; IM, intramuscular; IV, intravenous; SHSe, secondhand smoke exposure; PED, pediatric emergency department.

[a] Previous medical history of asthma, bronchiolitis, pneumonia, or prematurity.

[b] CPAP, BiPAP, High Flow Nasal Cannula.

[c] Blowby, handheld nebulizer, nasal cannula, non-rebreather mask, simple mask, trach collar, other supplemental oxygen source.

[d] Includes only patients with pneumonia who had SHSe documentation.

[e] Adjusted for sex, age, race, ethnicity, insurance type, season, and medical history.

The following variable was not included in this table as there were too few cases: RSV test (n =7) and intubation (n =0).