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Tobacco Smoke Exposure-Related Illnesses among Pediatric Emergency Department Patients

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Abstract

Introduction—This study aimed to determine the relationship between patients presenting to the pediatric emergency department (PED) and potential TSE-related illnesses.

Methods—A retrospective review of electronic medical records of PED patients ($N=116,084$) was conducted. Sociodemographic characteristics, TSE-related illnesses, and TSE documentation were extracted. Logistic regression models were performed.

Results—More than one-fifth (21.7%) of patients had TSE-related illnesses. Patients who were younger, male, non-white, Hispanic; had Medicaid/Medicare insurance, low triage acuity; were admitted to any non-intensive care unit (ICU) or admitted to the ICU were significantly more likely to have TSE-related illnesses. Twenty-eight percent of patients with TSE documentation had positive TSE status. Though regression models for positive TSE indicated similar findings, no difference was found based on ethnicity.

Discussion—PEDs, especially those that care for large numbers of children, should offer tobacco interventions, targeting at risk populations and caregivers most likely not receiving interventions in other healthcare settings.

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Ashley L. Merianos reports no financial interests or potential conflicts of interest.

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Keywords

Emergency department; pediatrics; secondhand smoke; tobacco use

Smoking and tobacco smoke exposure (TSE) are together the most preventable cause of death in the United States (U.S. Department of Health and Human Services, 2014). Although TSE has decreased over the years, a recent national study reveals that an estimated 24.9 million children and adolescents are still exposed to smoke annually (Homa et al., 2015). It is well known that TSE is associated with adverse health effects; and among children these include increased infections, respiratory symptoms and attacks, and sudden infant death syndrome (U.S. Department of Health and Human Services, 2006; U.S. Department of Health and Human Services, 2010; U.S. Department of Health and Human Services, 2014). Thus, the U.S. Department of Health and Human Services (U.S. Department of Health and Human Services, 2014) concludes that there is no risk-free TSE level, and even little exposure is known to cause harm in children.

The American Academy of Pediatrics (2009) considers tobacco use a pediatric disease and exhorts implementing initiatives during all healthcare visits to decrease TSE and associated harms. Children continue to account for a large number of visits to our nation's emergency departments (EDs), and in 2010 alone, there were over 25 million ED visits for children (Wier, Yu, Owens, & Washington, 2013). Given the high burden of pediatric tobacco-related morbidity, the American College of Emergency Physicians Task Force on Smoking Cessation has highlighted the need for tobacco control efforts in pediatric emergency departments (PEDs) (Bernstein et al., 2006). Thus, PEDs may be an opportune, yet underused venue to decrease TSE-related illnesses among children by providing tobacco prevention interventions for caregivers (Mahabee-Gittens & Gordon, 2008; Mahabee-Gittens, Gordon, Krugh, Henry, & Leonard, 2008; Mahabee-Gittens, Khoury, Ho, Stone, & Gordon, 2015). Smoking rates are high among low-income caregivers who bring their children to the PED and their children have high rates of TSE (Mahabee-Gittens, Stone, & Gordon, 2013), thus identifying populations at risk for TSE-related illnesses may assist in developing tailored PED cessation interventions to decrease their associated TSE-related PED visits and costs.

The purpose of this study was to determine the relationship between potential TSE-related illnesses and patients presenting to the PED. Based on prior research (Bernstein, 2002), we hypothesized that the use of the PED for potential TSE-related illnesses would be high and certain populations would be most at risk of presenting to the PED for TSE-related illnesses.

METHODS

Study design

We conducted a secondary analysis on data obtained from a prior cross-sectional, retrospective study. Data was captured from electronic medical records (EMR). The institutional review board approved this study.

Participants and Study Setting

Our sample consisted of 0–18 year old patients ($N=116,084$) who presented to the PED at a Level 1 pediatric trauma center in between March 2012 –August 2013.

Measures

Sex and age of patients were extracted from the EMRs using Epic – the institution’s medical software program. For statistical purposes, race categories included: white/Caucasian, black/African American, and other (i.e., Asian, American Indian and Alaska Native, Native Hawaiian and Other Pacific islander, multiple races, other, and unknown). Ethnicity categories were: non-Hispanic and Hispanic origins. Insurance type was classified as commercial and Medicaid/Medicare. The five-level Emergency Severity Index (ESI) triage tool used by the PED was dichotomized into two acuity groups: low acuity (ESI levels 3–5) who were at low risk of clinical deterioration (e.g., earaches) and high acuity patients (ESI levels 1–2) who were at high risk of clinical deterioration (e.g., respiratory distress). Disposition was categorized as (1) discharge to home; (2) admission to any non-intensive care unit (ICU) service; and (3) admission to the ICU.

TSE status was extracted from the Epic social history section that documented caregiver’s responses to “tobacco/smoke exposure”. Patients with a “yes” response were defined as having a positive TSE status and those with a “no” response were defined as having a negative TSE status. Our outcome variable, TSE-related illnesses, was based on the *International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM)* and extracted from patients’ EMRs. Discharge diagnoses were classified as potential non TSE-related illnesses or TSE-related illnesses. The Surgeon General and other studies indicate that the following are potential TSE-related illnesses: otitis media, otorrhea, otalgia, rhinitis, asthma, all respiratory infections, respiratory failure, cough, wheeze, shortness of breath, throat pain, laryngeal spasm, tachypnea, SIDS, apnea, and hypoxemia (Anderson & Cook, 1997; Jones et al., 2011; Lakshmiopathy, Bokesch, Cowan, Lisman, & Schmid, 1996; U.S. Department of Health and Human Services, 2014; Weinstock et al., 2014; Willatt, 1986).

Statistical Analysis

Descriptive statistics including frequencies and cross-tabulations were performed to determine the frequency of assessed patient characteristics, TSE status, TSE-related illnesses, and the top five TSE-related illnesses by patient characteristics. Univariate logistic regression models were performed to assess patient differences based on TSE-related illnesses among all participants regardless of TSE status. These differences were also examined in a subsequent series of univariate logistic regression models among patients who had a positive TSE status. Then, two multivariable logistic regression models were conducted to determine the effect all patient characteristics had on TSE-related illnesses among all patients in one model and among patients who had a positive TSE status in another model. All data were entered and analyzed using IBM SPSS software (version 23.0).

RESULTS

A total of 116,084 PED patients aged 0–18 years were included in our analysis. The mean age of patients was 6.20 years ($SD \pm 5.63$ years) and sex had near equal distribution: 52.1% were males and 47.9% were females. The majority of patients were white/Caucasian (45.1%) and black/African American (42.8%); 12.1% were other races. Most patients were non-Hispanic origin (95.2%), had Medicaid/Medicare insurance (69.7%), and were triaged as low acuity (80.2%). A total of 85.0% were discharged home; 12.8% were admitted to any non-ICU service, and 1.7% were admitted to the ICU.

Based on ICD-9 coded discharge diagnoses, 21.7% of all PED patients had a potential TSE-related illness. The most common TSE-related illnesses evaluated in the PED were: (1) otitis media (19.5%; ICD-9 code: 382.9), (2) acute upper respiratory infections (18.2%; ICD-9 code: 465.9), (3) asthma, with exacerbation (12.4%; ICD-9 code: 493.92), (4) cough (8.8%; ICD-9 code: 786.2), and (5) acute bronchiolitis (8.3%; ICD-9 code: 466.19) (Table 1). Patients who were male, aged 0–5 years, non-Hispanic; had Medicaid/Medicare insurance, low triage acuity; and were discharged home had high rates across all five of the most common TSE-related illnesses. African American patients represented the highest proportion of these TSE-related illnesses, with the exception of bronchiolitis.

A series of univariate and multivariable logistic regression models revealed similar statistically significant predictors of being evaluated in the PED for potential TSE-related illnesses: sex, age, race, ethnicity, insurance type, triage level, and disposition. Specifically, both univariate and then multivariable models, indicated that patients who were male, 0–5 years old, African American or other races, Hispanic; had Medicaid/Medicare insurance, low triage acuity; were admitted to any hospital service or admitted to the ICU were significantly more likely to have TSE-related illnesses in the PED (Table 2).

Nearly half of all patients ($n=63,399$) had documentation of TSE in the EMR. Of these, 28.4% ($n=17,986$) reported positive TSE status. Univariate logistic regression models indicated that patients with a positive TSE status who were male, 0–5 years old, African American or other races, Hispanic; had Medicaid/Medicare insurance, low triage acuity; were admitted to any non-ICU service or admitted to the ICU were more likely to have TSE-related illnesses. Multivariable analysis indicated similar findings – however no statistically significant difference was found between TSE-related illness and ethnicity (see Table 3).

DISCUSSION

To our knowledge, this study is the first of its kind to evaluate the impact of potential TSE-related illnesses among children in the PED setting. We found that nearly a quarter of children presenting to the PED were diagnosed with TSE-related illnesses. Furthermore, we identified the five most common TSE-related diagnoses evaluated in the PED, three of which were for non-emergent illnesses (i.e., otitis media, upper respiratory infection, and cough). Nearly one-third of PED patients were both exposed to tobacco smoke and diagnosed with TSE-related illnesses. Such high rates of TSE and TSE-related illnesses support the task

force's position (Bernstein et al., 2006) – that PEDs should prioritize tobacco control efforts, such as cessation interventions.

Similar to other literature (U.S. Department of Health and Human Services, 2014), our study also revealed that certain PED populations were most at risk for TSE-related illnesses. We found that younger patients were at increased risk of TSE-related illnesses; and children less than six years old who were exposed to tobacco smoke were three times more likely to have TSE-related illnesses than their older counterparts. Caregivers of these younger children could benefit from smoking cessation interventions.

We also noted that children who were African American and lower socioeconomic status (SES; i.e., Medicaid/Medicare insurance) had increased risk for having a TSE-related discharge diagnosis. These findings are particularly significant; given that low-income caregivers have disproportionately high rates of tobacco use (Fagan, Moolchan, Lawrence, Fernander, & Ponder, 2007; Hiscock, Bauld, Amos, Fidler, & Munafò, 2012; Mahabee-Gittens et al., 2013; National Center for Health Statistics, 2012) and often utilize the PED (as opposed to their primary care physician's office) for non-emergent care (Brousseau, Nimmer, Yunk, Nattinger, & Greer, 2011). Since national PED visit trends are increasing, especially among low-income populations (Tang, Stein, Hsia, Maselli, & Gonzales, 2010), PED smoking interventions may be especially impactful for such populations who are likely not receiving primary care-based tobacco cessation interventions.

Lastly, our study revealed that patients with low triage acuity were at high risk for TSE-related illnesses. The National Hospital Ambulatory Medical Care Survey found emergency department patients who were triaged as non-urgent were seen within 2–24 hours, suggesting there is ample time during the PED visit to deliver tobacco interventions to high risk populations (Niska, Bhuiya, & Xu, 2010). Prior research supports caregiver willingness to participate in such interventions during wait times; practitioners and caregivers alike endorse the PED as a good place to screen for tobacco use and offer cessation advice (Mahabee-Gittens & Gordon, 2008).

Limitations

Several study limitations should be noted. First, just over half of participants had documentation of TSE in the EMR. Though it is possible that TSE status was assessed and not documented or was documented elsewhere, standardized TSE screening practices would aid in capturing the full extent of TSE in our population. Second, this study was conducted in one of the largest PEDs in the nation located in a large, urban, freestanding Midwestern children's hospital where most patients have a low SES; thus, generalizability may be limited. Third, caregivers may have underreported their child's TSE status (Avila-Tang et al., 2013; Prochaska, Grossman, Young-Wolff, & Benowitz, 2015). The use of biomarkers (i.e., cotinine) to measure TSE would have provided a more precise determination of TSE, however the study's retrospective methodology precluded this approach; thus, causality of the data cannot be determined.

Implications for Practice

Despite national tobacco prevention efforts, TSE remains a prevalent problem in children. Specifically, this study reveals high rates of TSE-related illnesses among children presenting to the PED and certain PED patients who are most at risk for TSE-related illnesses. ED settings, especially those caring for large numbers of children, should offer tobacco interventions, targeting the most at risk populations (children who are younger, black, of low SES; or children with low acuity illnesses) and those caregivers who are most likely not to have interventions in other healthcare settings.

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Participant characteristics by the five most common tobacco smoke exposure-related illnesses based on discharge diagnoses

Table 1

Variable	Top 5 Tobacco Smoke Exposure-Related Illnesses				
	Otitis Media (n=4,902)	Acute Upper Respiratory Infections (n=4,577)	Asthma, with exacerbation (n=3,124)	Cough (n=2,217)	Acute Bronchiolitis (n=2,087)
Sex					
Male	2,647 (54.0)	2,421 (52.9)	1,948 (62.4)	1,214 (54.8)	1,226 (58.7)
Female	2,255 (46.0)	2,156 (47.1)	1,176 (37.6)	1,003 (45.2)	861 (41.3)
Age					
0–5 years old	4,368 (89.1)	4,028 (88.0)	1,740 (55.7)	1,755 (79.2)	2,086 (100)
6–18 years old	534 (10.9)	549 (12.0)	1,384 (44.3)	462 (20.8)	1 (0.0)
Race					
White	1,289 (26.3)	1,238 (27.1)	773 (24.8)	852 (38.5)	922 (44.2)
Black	2,789 (57.0)	2,624 (57.4)	2,060 (66.0)	976 (44.1)	820 (39.3)
Other	816 (16.7)	710 (15.5)	289 (9.3)	387 (17.5)	342 (16.4)
Ethnicity					
Non-Hispanic	4,424 (91.6)	4,220 (93.8)	3,024 (97.5)	2,031 (93.0)	1,912 (94.2)
Hispanic	407 (8.3)	281 (6.2)	79 (2.5)	154 (7.0)	117 (5.8)
Insurance Type					
Commercial	538 (11.3)	532 (11.9)	647 (21.2)	452 (21.0)	446 (21.7)
Medicaid/Medicare	4,220 (88.7)	3,931 (88.1)	2,407 (78.8)	1,699 (79.0)	1,611 (78.3)
Triage Level					
Low Acuity	4,815 (98.3)	4,276 (93.5)	2,322 (74.4)	2,031 (91.6)	1,378 (66.2)
High Acuity	84 (1.7)	297 (6.5)	801 (25.6)	186 (8.4)	705 (33.8)
Disposition					
Discharge Home	4,871 (99.5)	4,292 (94.1)	2,555 (82.1)	2,124 (99.3)	1,138 (54.7)
Admit Non-ICU	21 (0.4)	232 (5.1)	540 (17.4)	14 (0.7)	873 (41.9)
Admit ICU	4 (0.1)	38 (0.8)	16 (0.5)	0 (0.0)	71 (3.4)

Tobacco smoke exposure-related illnesses based on characteristics of all pediatric emergency department patients

Table 2

Variable	Non TSE-Related Illness		TSE-Related Illness		Univariate Regression		Multivariable Regression	
	n (%)	n (%)	n (%)	n (%)	OR	95% CI	AOR	95% CI
Sex								
Female	44,156 (79.5)	11,420 (20.5)	(Ref)	(Ref)	(Ref)	(Ref)	(Ref)	(Ref)
Male	46,731 (77.2)	13,764 (22.8)	1.14***	(1.11, 1.17)	1.11***	(1.08, 1.15)		
Age								
0–5 years old	45,205 (70.6)	18,829 (29.4)	3.00***	(2.90, 3.09)	2.75***	(2.66, 2.84)		
6–18 years old	45,695 (87.8)	6,355 (12.2)	(Ref)	(Ref)	(Ref)	(Ref)		
Race								
White	44,068 (84.4)	8,154 (15.6)	(Ref)	(Ref)	(Ref)	(Ref)		
Black	36,221 (73.1)	13,359 (26.9)	1.99***	(1.93, 2.06)	1.69***	(1.63, 1.76)		
Other	10,423 (74.1)	3,636 (25.9)	1.89***	(1.80, 1.97)	1.45***	(1.38, 1.53)		
Ethnicity								
Non-Hispanic	85,699 (78.6)	23,351 (21.4)	(Ref)	(Ref)	(Ref)	(Ref)		
Hispanic	3,993 (72.8)	1,495 (27.2)	1.37***	(1.29, 1.46)	1.08*	(1.00, 1.16)		
Insurance Type								
Commercial	29,495 (86.7)	4,536 (13.3)	(Ref)	(Ref)	(Ref)	(Ref)		
Medicaid/Medicare	58,306 (74.5)	19,974 (25.5)	2.23***	(2.15, 2.31)	1.56***	(1.50, 1.63)		
Triage Level								
Low Acuity	70,535 (76.8)	21,275 (23.2)	1.47***	(1.42, 1.53)	1.36***	(1.30, 1.42)		
High Acuity	18,807 (83.0)	3,859 (17.0)	(Ref)	(Ref)	(Ref)	(Ref)		
Disposition								
Discharge Home	74,560 (77.9)	21,190 (22.1)	(Ref)	(Ref)	(Ref)	(Ref)		
Admit Non-ICU	11,729 (78.9)	3,143 (21.1)	0.94**	(0.90, 0.98)	1.43***	(1.36, 1.51)		
Admit ICU	1,413 (70.0)	606 (30.0)	1.51***	(1.37, 1.66)	2.27***	(2.04, 2.53)		

Note.

Abbreviations: AOR, adjusted odds ratio; CI, confidence interval; ICU, intensive care unit; OR, odds ratio; Ref, referent; TSE, tobacco smoke exposure.

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 $p < .001$
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 $p < .01$
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 $p < .05$

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Table 3

Tobacco smoke exposure-related illnesses based on characteristics of patients with positive tobacco smoke exposure status

Variable	Non TSE-Related Illness		TSE-Related Illness		Univariate Regression		Multivariable Regression	
	n (%)	n (%)	n (%)	OR	95% CI	AOR	95% CI	
Sex								
Female	6,706 (77.9)	1,902 (22.1)	(Ref)	(Ref)	(Ref)	(Ref)	(Ref)	
Male	7,028 (74.9)	2,350 (25.1)	1.18***	(1.10, 1.26)	1.09*	(1.01, 1.17)		
Age								
0–5 years old	6,254 (67.1)	3,061 (32.9)	3.07***	(2.85, 3.31)	2.93***	(2.70, 3.17)		
6–18 years old	7,480 (86.3)	1,191 (13.7)	(Ref)	(Ref)	(Ref)	(Ref)		
Race								
White	7,589 (81.8)	1,684 (18.2)	(Ref)	(Ref)	(Ref)	(Ref)		
Black	4,845 (70.5)	2,026 (29.5)	1.88***	(1.75, 2.03)	1.86***	(1.72, 2.02)		
Other	1,289 (70.6)	538 (29.4)	1.88***	(1.68, 2.11)	1.52***	(1.34, 1.73)		
Ethnicity								
Non-Hispanic	13,279 (76.5)	4,083 (23.5)	(Ref)	(Ref)	(Ref)	(Ref)		
Hispanic	375 (71.4)	150 (28.6)	1.30**	(1.07, 1.58)	1.14	(0.92, 1.41)		
Insurance Type								
Commercial	2,577 (84.9)	460 (15.1)	(Ref)	(Ref)	(Ref)	(Ref)		
Medicaid/Medicare	10,770 (74.5)	3,690 (25.5)	1.92***	(1.73, 2.13)	1.31***	(1.17, 1.47)		
Triage Level								
Low Acuity	10,404 (75.0)	3,464 (25.0)	(Ref)	(Ref)	(Ref)	(Ref)		
High Acuity	3,273 (80.8)	778 (19.2)	1.40***	(1.29, 1.53)	1.35***	(1.22, 1.50)		
Disposition								
Discharge Home	10,751 (76.4)	3,329 (23.6)	(Ref)	(Ref)	(Ref)	(Ref)		
Admit Non-ICU	2,386 (76.1)	750 (23.9)	1.02	(0.93, 1.12)	1.54***	(1.38, 1.71)		
Admit ICU	232 (65.2)	124 (34.8)	1.73***	(1.39, 2.15)	2.48***	(1.94, 3.18)		

Note.

Abbreviations: AOR, adjusted odds ratio; CI, confidence interval; ICU, intensive care unit; OR, odds ratio; Ref, referent; TSE, tobacco smoke exposure.

*** $p < .001$.

** $p < .01$.

* $p < .05$.

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