POLLEN EXPOSURE AND ASTHMA-RELATED HEALTHCARE RESOURCE UTILIZATION IN CHILDREN WITH ASTHMA: AN ANALYSIS OF PATIENT-LEVEL CLAIMS AND LINKED WEATHER DATA

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Background

- Asthma is a common, chronic, respiratory condition that affects about 6 million children in the United States; 1 in 6 visit the emergency department, and 1 in 20 are hospitalized for asthma annually [1].
- Previous ecologic studies have shown increased asthma-related healthcare resource use during periods of high pollen counts. Grass pollen levels in particular have been associated with increased asthma-related healthcare utilization [2-4], though some studies have identified an association between tree pollen and asthma-related healthcare resource use [5].
- Linking weather data to patient-level claims may improve understanding of ecologic risk factors for asthma exacerbations and provide providers insights that allow for further customization of asthma management strategies based on weather conditions and patient characteristics.

Objective

- This study's objective was to characterize the rate of asthma-related inpatient (IP) admissions and emergency department (ED) visits in children with asthma using patient-level claims and linked weather data.

Methods

Study Design and Data Source

- Data for this study were extracted from IBM® MarketScan® Weather and the IBM MarketScan Commercial Claims and Encounters (Commercial) databases.
- The Commercial database was accessed using Treatment Pathways 4.0 and the data was linked to the data from the Weather Database using WPS 4.1.
- Children aged 12 or younger on 1/1/2016 in the IBM MarketScan Commercial Database that met the following criteria were included in the study:
  - ≥1 IP claim with a primary diagnosis of asthma (ICD-10-CM: J45xx) or ≥2 non-diagnostic outpatient claims with a diagnosis of asthma in any position at least seven days apart
  - Continuously enrolled between 1/1/2016 and 12/31/2016
  - Link to the IBM MarketScan Weather Database during 2016 for days with recorded pollen level

Patient Characteristics

- Demographic characteristics, including age, gender, and region were assessed on 1/1/2016.
- Presence of selected comorbidities were assessed by presence of a non-diagnostic medical claim for acute sinusitis, chronic sinusitis, upper respiratory infection (URI), and allergic rhinitis (AR) during 2016.
- Use of asthma medications was assessed by presence of medical or pharmacy claims for any corticosteroids, short acting beta agonist medications (SABA), or inhaled corticosteroids (ICS) during 2016.

Outcomes and Analyses

- IP admission with an asthma diagnosis in the primary position and ED visits with an asthma diagnosis in any position were identified during 2016.
- Grass and tree pollen levels were assessed as a categorical variable (none, low, moderate, high/very high) using the maximum pollen level in the five days prior to the inpatient admission or ED visit.
- Patient-days of exposure during 2016 were tabulated as the number of days of exposure per patient for each pollen type (grass or tree) and pollen level (none, low, moderate, high/very high).
- Incidence rates (IR) of IP admissions and ED visits per 100 person-years (PY) were calculated by pollen level for each pollen.
- Incidence rate ratios (IRR) and 95% confidence intervals (95% CI) were used to compare IR by pollen level using 'none' as the referent group.
- Analyses were also conducted in the subgroup of patients with an AR diagnosis during the study period.

Results

Table 1. Demographic Characteristics of Asthma Patients

	All Patients (n=225,776)	IP Patients (n=937)	ED Patients (n=11,831)
Age Categories (%)			
<2	8.3%	21.1%	11.4%
2-5	23.3%	31.2%	26.2%
6-12	68.5%	47.7%	62.5%
Sex (%)			
Male	60.6%	64.0%	64.1%
Geographic Region (%)			
Northeast	18.0%	18.7%	15.3%
North Central	18.0%	18.8%	22.2%
South	45.7%	43.3%	45.9%
West	18.3%	19.2%	16.4%
Unknown	0.1%	0.0%	0.1%

Patient Characteristics

- A total of 225,776 children with asthma and weather data available were included in this study; 61% were male, 69% were aged 6-12, and most were in the south (46%) (Table 1)
- URI and AR were both more common in children with an asthma-related IP admission (URI: 75%, Allergic rhinitis: 53%) or an ED visit (URI: 67%, Allergic rhinitis: 42%) (Figure 1)
- Use of asthma medications was more common in children with an asthma-related IP admission (Any CS: 96.7%, SABA: 91.9%, ICS: 71.6%) or an ED visit (Any CS: 74.4%, SABA: 75.1%, ICS: 46.6%) (Figure 2)

Figure 1. Prevalence of comorbid conditions during the study period

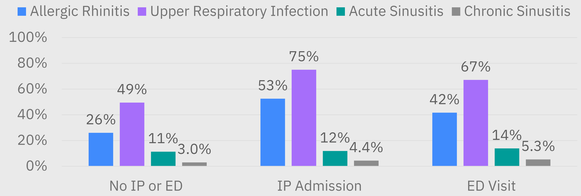
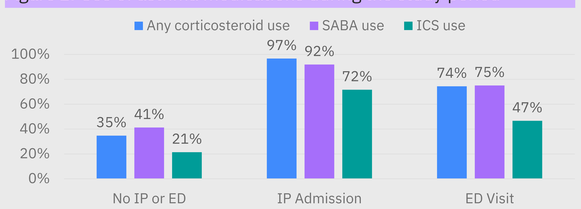


Figure 2. Use of asthma medications during the study period



Results Cont.

Outcomes

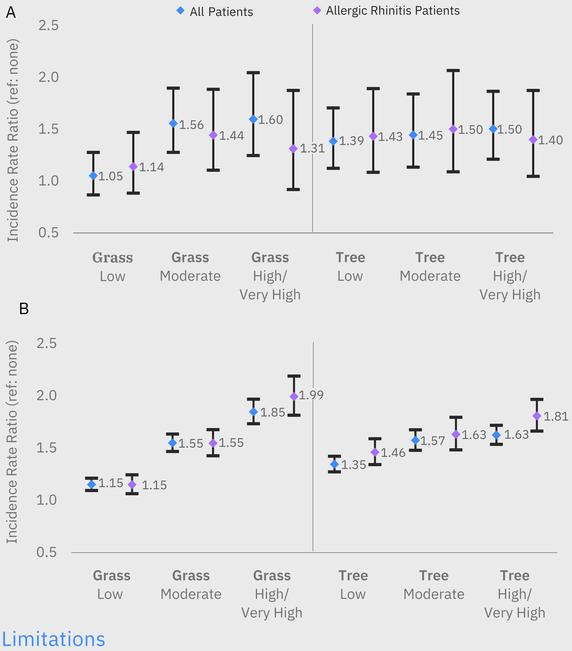
- Increased IR of both asthma-related IP admissions and ED visits was observed with increasing pollen levels for both pollen types. For the subgroup of patients with AR, this relationship was more pronounced for asthma-related ED visits. IR were highest on high/very high grass and tree pollen days (Table 2)

Table 2. Rate of asthma-related inpatient admission and ED visits per 100 person years by pollen index

	IP Admission			ED Visit		
	N	IR (All)	IR (AR)	N	IR (All)	IR (AR)
Grass Pollen Index						
None	288	0.55	1.13	3,907	7.48	11.79
Low	159	0.58	1.29	2,361	8.62	13.57
Moderate	149	0.86	1.63	2,011	11.59	18.24
High/Very High	80	0.88	1.48	1,255	13.83	23.50
Tree Pollen Index						
None	165	0.44	0.90	2,367	6.38	9.62
Low	189	0.62	1.29	2,634	8.59	14.05
Moderate	109	0.64	1.35	1,703	10.05	15.70
High/Very High	164	0.67	1.26	2,542	10.37	17.40

- Relative to no pollen days the rates of asthma-related IP admissions were significantly higher on moderate (IRR: 1.56; 95% CI: 1.28-1.90) or high/very high (IRR: 1.60; 95% CI: 1.25-2.05) grass pollen days and low (IRR: 1.39; 95% CI: 1.12-1.71), moderate (IRR: 1.45; 95% CI: 1.14-1.84), or high/very (IRR: 1.50; 95% CI: 1.21-1.87) tree pollen days (Figure 3A)
- Similarly, rates of asthma-related ED visits were significantly higher on low (IRR: 1.15; 95% CI: 1.09-1.21), moderate (IRR: 1.55; 95% CI: 1.47-1.63), or high/very (IRR: 1.85; 95% CI: 1.73-1.97) grass pollen days and low (IRR: 1.35; 95% CI: 1.27-1.42), moderate (IRR: 1.57; 95% CI: 1.48-1.68), or high/very (IRR: 1.63; 95% CI: 1.54-1.72) tree pollen days (Figure 3B)
- In the subgroup of asthma patients with AR, the relationship between pollen levels and incidence of asthma-related and ED visits was even more pronounced then observed in the full patient cohort

Figure 3. IRR for asthma-related (A) inpatient admission and (B) ED visit by pollen type and index (ref: none)



Limitations

- This analysis was conducted on a commercially-insured population and may not be generalizable to patients with other or no insurance coverage.
- As with all claims data, there is a potential for misclassification from diagnostic coding errors, potentially resulting in misclassification of diagnosis, treatments, and study outcomes.
- Weather data were only available for urban areas, therefore results may not be generalizable to patients living in rural areas. Weather conditions are linked to patients at the MSA level and are based on the zip code of the primary beneficiary which may or may not be the same location a patient is residing.

Conclusions

- A dose-response relationship was observed between pollen levels and both asthma-related IP admissions and ED visits in this cohort of commercially insured children with asthma. This relationship was more pronounced for ED visits in the subgroup of patients with AR.
- Several prior studies have demonstrated an association between grass pollen and healthcare utilization in patients with asthma; studies describing the relationship between tree pollen levels and healthcare utilization in patients with asthma have shown mixed results. In the current study, there was significant association between tree pollen levels and increased incidence of asthma-related IP admissions and ED visits in children with asthma.
- Though not evaluated as an outcome, ICS use was less common than SABA use in this population and many of the children with an asthma-related IP or ED visit did not have any ICS during the study period, which may indicate suboptimal ICS use and inappropriate SABA use in this population.
- Further research is necessary to evaluate the impact of suboptimal ICS and inappropriate SABA use during periods with high pollen levels on asthma-related healthcare resource use in children with asthma.

References

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Disclosure

- Elizabeth Packnett, Caroline Henriques, and Debra Irwin are employees of IBM Watson Health. This study was funded by IBM Watson Health.