



Assessment of asthma outcomes among children with and without a timely physician diagnosis of asthma

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Background

- A number of studies have assessed asthma diagnosis and found that asthma is frequently underdiagnosed and undertreated.
- Untimely diagnosis of asthma becomes a significant concern
 - If it results in delays in assessing health services for asthma
 - If such a delay adversely affects asthma illness and complications.
- Our previous studies reported about delay in a diagnosis of asthma with the following different points:
 - Not differentiated between without physician diagnosis and delayed physician diagnosis
 - Limited patients during 2002-2006
- This study aims : to compare asthma outcomes between children with and without a timely physician diagnosis of asthma among those with recurrent asthma-like symptoms

Methods

- Study design and setting**
 - A retrospective cohort study
 - Olmsted County, Minnesota (MN): medical care is virtually self-contained within two medical center (Mayo Clinic and the Olmsted Medical Center) with a unified medical record system for research
 - Asthma status of children born in Olmsted County Birth Cohort was ascertained by the Natural language program (NLP) algorithm for Predetermined Asthma Criteria (PAC).
 - Period : From birth to last follow-up (August 2015)
- Study subjects**
 - Inclusion criteria**
 - Meeting the asthma criteria (PAC) with physician diagnosis
 - Having at least 5 consecutive years of follow-up after the index date of PAC (i.e., the first date one met PAC)

Methods

- Categorization of subjects**
 - Timely diagnosis group (TD) : Children with a physician diagnosis of asthma within 4 weeks of index date
 - Delayed diagnosis group (DD) : Children with a physician diagnosis of asthma beyond 4 weeks of index date
- Asthma Outcome events**
 - Asthma specific emergency department (ED) visits
 - Hospitalizations during the first 5 years after index date
- Statistical analysis**
 - Descriptive analysis for baseline sociodemographic and clinical characteristics
 - Logistic regression model adjusting for potential confounders
- Predetermined asthma criteria (PAC)**
 - Definite asthma : If a physician had made a diagnosis of asthma and/or if each of the following three conditions were present
 - Probable asthma : Only the first two conditions were present;

- History/exam: wheezing with cough and/or dyspnea
 - Recurrent and variable symptoms and 23 weeks of absent symptoms between episodes
 - Sleep disturbance by cough/wheeze
 - Non-smoker (age≥14)
 - Nasal polyps
 - Serum eosinophil count > 300/μL
 - Positive wheal and skin flare tests OR 1lgE
 - Two or more of the following:
 - History of allergic rhinitis or eczema OR cough, dyspnea, wheezing on exposure to antigen
 - PFT showing FEV1/FVC < 70% predicted + another with ≥12% improvement OR methacholine challenge test ≥ 20% decline
- Favorable clinical response to bronchodilator (i.e., increase of ≥12% FEV1)

Results

Table 1. Comparison Demographics and Clinical Characteristics between Timely diagnosis and Delayed diagnosis

	Timely diagnosis (N=808)	Delayed diagnosis (N=590)	p value
Age at index date			<0.0001 [†]
N	808	590	
Median (IQR)	3.2 (1.3, 6.0)	1.4 (0.8, 2.8)	
Well child visits per year			<0.0001 [†]
N	808	590	
Median (IQR)	0.9 (0.7, 1.1)	0.9 (0.7, 1.1)	
Number of days between PAC index and Physician diagnosis			<0.0001 [†]
N	808	590	
Median (IQR)	0.0	462.0 (179.0, 1252.0)	
Gender			0.3973 [†]
Male	479 (59%)	363 (62%)	
Female	329 (41%)	227 (39%)	
Race/Ethnicity			0.3701 [†]
White	632 (78%)	472 (80%)	
African American	49 (6%)	33 (6%)	
Hispanic	35 (4%)	14 (2%)	
Asian	32 (4%)	28 (5%)	
HOUSES Birth Quartiles			0.9292 [†]
Missing	45	18	
Q1	186 (24%)	147 (25%)	
Q2	180 (24%)	129 (22%)	
Q3	189 (25%)	138 (24%)	
Q4	208 (27%)	158 (28%)	
Family History of Asthma			0.8482 [†]
No	537 (67%)	395 (67%)	
Yes	271 (34%)	195 (33%)	
Mother smoking during pregnancy			0.2715 [†]
Missing	99	87	
No	645 (81%)	448 (89%)	
Yes	64 (9%)	55 (11%)	
Atopic Status			<0.0001 [†]
No	645 (80%)	537 (91%)	
Yes	163 (20%)	53 (9%)	

†Timely diagnosis group (TD); Children with a physician diagnosis of asthma within 4 weeks of index date, Delayed diagnosis group (DD); Children with a physician diagnosis of asthma beyond 4 weeks of index date

Results

Table 2 & Figure 1. Comparison Asthma outcomes between Timely diagnosis and Delayed diagnosis

	Timely diagnosis (N=808)	Delayed diagnosis (N=590)	p value
Asthma outcomes within 1 year after index date			0.2575
No	599 (74%)	453 (77%)	
Yes	209 (26%)	137 (23%)	
Asthma outcomes within 2 years after index date			0.8185
No	572 (71%)	421 (71%)	
Yes	236 (29%)	169 (29%)	
Asthma outcomes within 3 years after index date			0.9489
No	541 (67%)	396 (67%)	
Yes	267 (33%)	194 (33%)	
Asthma outcomes within 5 years after index date			0.4532
No	513 (64%)	363 (62%)	
Yes	295 (37%)	227 (39%)	

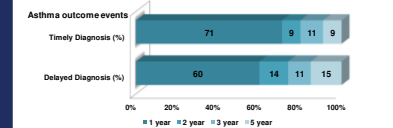


Table 3. Unadjusted and adjusted association analysis of asthma outcomes with delayed diagnosis comparing with timely diagnosis

	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Asthma outcomes within 1 year after index date	0.867 (0.677 to 1.110)	0.664 (0.498 to 0.885)
Asthma outcomes within 2 years after index date	0.973 (0.770 to 1.232)	0.740 (0.563 to 0.973)
Asthma outcomes within 3 years after index date	0.993 (0.792 to 1.244)	0.802 (0.615 to 1.045)
Asthma outcomes within 5 years after index date	1.087 (0.873 to 1.354)	0.903 (0.699 to 1.168)

Adjusting factor: age, well child visits per year, race/ethnicity, HOUSES index, family history of asthma and mother smoking during pregnancy

Discussion

- Delayed diagnosis of asthma is common among children with recurrent asthma-like symptoms.
- Over 60% of total asthma ED visit and/or hospitalization is happening in the first year after asthma index date, but median days between index date and physician diagnosis is 462 days.
- Compared to TD, while DD group had a lower odds of poor asthma outcome events at 1 year after index date, this gap seems to catch up gradually.
- Given significant number of delayed diagnosis despite of recurrent asthma symptoms, long-term and broad range of impact of delayed diagnosis on asthma morbidities and comorbidities may be warranted.
- If clinically less frequent manifestation of asthmatic children is one of main reasons of delayed diagnosis, an innovative tool to capture asthma symptoms/signs documented in medical records such as Natural Language Processing for automated chart review may be helpful and necessary.
- Strengths:** This was a population-based birth cohort study that used NLP algorithm for ascertaining asthma and asthma exacerbation in timely manner
- Limitations:**
 - Not including all patients in cohort
 - Only limited asthma outcomes to ED/hospitalization. Other measures including lung function measure, ACT, oral corticosteroids use and flu vaccine etc. were not including

Conclusions

- A delayed diagnosis of asthma is common. Longer-term studies assessing a broad range of preventive and therapeutic interventions among a delayed diagnosis group are needed to capture its long-term impact given increasing tendency of poor outcomes in delayed asthma diagnosis group.

Acknowledgement

National Institute of Health (NIH)-funded R01 grant (R01 HL126667). We thank the original project staff and Ms. Kelly Oleson for her administrative assistance.