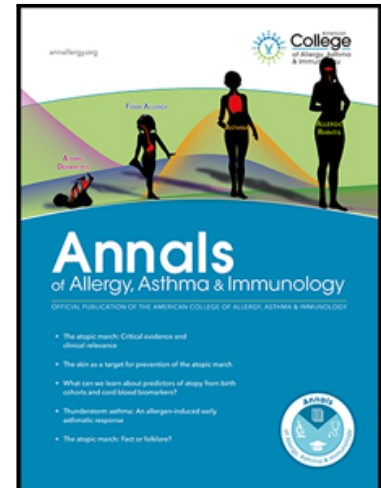


National decline in asthma exacerbations in US during COVID19 pandemic

Regina W Lam BA , Jonathan W Inselman MS ,
Molly M Jeffery PhD , Jacob T Maddux MD , Matthew A Rank MD

PII: S1081-1206(21)01113-3
DOI: <https://doi.org/10.1016/j.anai.2021.09.017>
Reference: ANAI 3719



To appear in: *Annals of Allergy, Asthma Immunology*

Received date: 19 May 2021
Revised date: 27 August 2021
Accepted date: 21 September 2021

Please cite this article as: Regina W Lam BA , Jonathan W Inselman MS , Molly M Jeffery PhD , Jacob T Maddux MD , Matthew A Rank MD , National decline in asthma exacerbations in US during COVID19 pandemic, *Annals of Allergy, Asthma Immunology* (2021), doi: <https://doi.org/10.1016/j.anai.2021.09.017>

This is a PDF file of an article that has undergone enhancements after acceptance, such as the addition of a cover page and metadata, and formatting for readability, but it is not yet the definitive version of record. This version will undergo additional copyediting, typesetting and review before it is published in its final form, but we are providing this version to give early visibility of the article. Please note that, during the production process, errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

© 2021 American College of Allergy, Asthma & Immunology. Published by Elsevier Inc. All rights reserved.

National decline in asthma exacerbations in US during COVID19 pandemic

Regina W Lam, BA ¹; Jonathan W Inselman, MS ²; Molly M Jeffery, PhD ²; Jacob T Maddux, MD ³;

Matthew A Rank, MD ^{3,4}

¹ *Mayo Clinic Alix School of Medicine, Scottsdale, AZ*

² *Division of Health Care Delivery Research, Robert D. and Patricia E. Kern Center for the Science of Health Care Delivery, Mayo Clinic, Rochester, MN*

³ *Division of Allergy, Asthma, and Clinical Immunology, Mayo Clinic, Scottsdale, AZ*

⁴ *Division of Pulmonology, Phoenix Children's Hospital, Phoenix, AZ*

Corresponding author:

Matthew A Rank, MD

13400 E Shea Blvd

Scottsdale, AZ 85259

Rank.matthew@mayo.edu

Number of Figures/Tables: 1 figure

The authors report no conflicts of interest.

Funding: National Institutes of Health, National Heart, Lung, and Blood Institute (NIH R21 HL140287) and the Mayo Clinic Robert D. and Patricia E. Kern Center for the Science of Health Care Delivery.

Infection with COVID-19 has led to over 4 million deaths worldwide, challenging our healthcare systems.

At the same time, it has also led to an increased use of non-pharmaceutical interventions (NPIs) to minimize disease spread. COVID-era NPIs such as physical distancing are associated with an unprecedented decrease of non-COVID-19 viral respiratory diseases.¹⁻³

Viral respiratory infections are a common cause for asthma exacerbations that lead to ED and hospital use. There are now several reports suggesting that the rates of asthma hospitalizations and ED visits have decreased during COVID-19.⁴⁻⁶ In this letter, we present trends of ED and hospital use for asthma exacerbations in a sample of people from across the US.

We used the Optum Labs Data Warehouse (OLDW), a database of healthcare claims for over 200 million privately insured and Medicare Advantage enrollees, to build the cohort, starting with all enrollees who had a diagnosis of asthma using diagnostic codes from 2007-2020.⁷ We defined ED and hospitalization events due to asthma as those where asthma was in the first diagnostic position for the claim or secondary position if the first diagnosis was respiratory infection. We reported asthma exacerbation rates per 100 people with asthma, and analyzed them in 2007-2017, 2018-March 2020, and March 2020-December 2020 to correspond to 2007 release of NHLBI updated asthma guideline, 2018 long acting β -agonist black box removal, and the March 2020 onset of the COVID19 pandemic in the US. We conducted a simple general linear model to compare the mean number of exacerbations between each time period and checked with Poisson regression using a spline for time and knots at guideline release, black box warning removal, and COVID pandemic start.

We observed a general decline in the number of claims-computable asthma exacerbations (ED or hospitalization) from 2007-2020, with the largest decline occurring after March 2020. The mean exacerbation rates per 100 people with asthma were 0.92 (95% CI 0.87, 0.97), 0.62 (95% CI 0.56, 0.67), and 0.36 (95% CI 0.27, 0.44) for 2007-2017, 2018-March 2020, and March 2020-December 2020

($p=0.0008$). Hospitalization rates per 100 people with asthma were 0.48 (95% CI 0.22, 0.74), 0.21 (95% CI 0.19, 0.22), and 0.12 (95% CI 0.10, 0.14) for 2007-2017, 2018-March 2020, and March 2020-December 2020 ($p=0.0035$). The results from the Poisson regression confirmed a statistically significant decline in asthma exacerbations ($p<.0001$) after the COVID pandemic onset and the pseudo-R-squared for the regression of 0.85 suggested that the model matches the data well.

Our findings suggest that the decline in asthma exacerbations during the COVID19 pandemic are not unique to specific hospital systems or geographic locations. A study in Philadelphia, PA, found an 84% decrease in the emergency and inpatient settings, a study in Orange County, CA, found a 78% decrease in hospitalization and 90% decrease in emergency visits, and a prospective study in multiple US locations found a 41% reduction in asthma exacerbations using composite, patient-informed definition.^{8,9,10}

The significant decline in asthma exacerbations during the COVID-19 pandemic suggests, but does not prove, a causal relationship between physical distancing practices and reduced asthma exacerbations. Our results do not exclude the possibility that patients and families chose to avoid ED and hospital care for asthma during COVID. However, Saliccioli et al describe a similar trend in a prospective study that captured both remote and in-person asthma exacerbations, making it less likely for the result to be influenced by healthcare system avoidance.¹⁰ Also, when they controlled for medication use and for air quality values, the decrease in asthma exacerbation rates were still observed.¹⁰ Similarly, another study found that increased asthma medication adherence during the COVID-19 pandemic was not observed, at least in that population.⁸ While we cannot exclude the possible influence of healthcare avoidance, air quality, or medication-taking behavior, these other studies suggest these factors are unlikely to be primary drivers of the decrease in asthma exacerbations rates. Our data, showing this trend in a large sample in the US, are consistent with previous studies demonstrating this trend, and further extend previous observations by comparing rates to 13 prior years and by using participants who were not enrolled in research studies.

Our findings, together with other related studies, call for further research to better understand which NPIs may be most effective at reducing asthma exacerbations. Prospective trials of different NPI approaches (e.g., wearing facemasks during fall-winter respiratory infection season) could isolate interventional effects and potentially provide new management options for our patients with asthma.

References:

- 1-Huh K, Kim YE, Ji W, et al. Decrease in hospital admissions for respiratory diseases during the COVID-19 pandemic: a nationwide claims study. *Thorax* 2021 epub Mar 29.
- 2-Olsen SJ, Azziz-Baumgartner E, Budd AP, et al. I. Decreased influenza activity during the COVID-19 pandemic—United States, Australia, Chile, and South Africa, 2021. *Am J Transplant* 2020; 20:3681-3685.
- 3-Tan JY, Conceicao EP, Sim XYJ, Wee, LEI, Aung MK, Venkatachalam I. Public health measures during COVID-19 pandemic reduced hospital admissions for community respiratory viral infections. *J Hosp Infect* 2020; 106(2):387-389.
- 4-Kenyon CC, Hill DA, Henrickson SE, Bryant-Stephens TC, Zorc JJ. Initial effects of the COVID-19 pandemic on pediatric asthma emergency department utilization. *J Allergy Clin Immunol Pract* 2020;8(8):2774-2776.
- 5-Krivec U, Kofol Seliger A, Tursic J. COVID-19 lockdown dropped the rate of paediatric asthma admissions. *Archives of Disease in Childhood* 2020;105:809-810.
- 6-Simoneau T, Greco KF, Hammond A, Nelson K, Gaffin JM. Impact of the COVID-19 Pandemic on Pediatric Emergency Department Use for Asthma. *Ann Am Thorac* 2021;18(4):717-719.

7-Wallace PJ, Shah ND, Dennen T, Bleicher PA, Crown WH. Optum Labs: Building A Novel Node In The Learning Health Care System. *Health Aff (Millwood)*. 2014 Jul;33(7):1187-94.

8-Taquechel K, Diwadkar AR, Sayed S, et al. Pediatric Asthma Health Care Utilization, Viral Testing, and Air Pollution Changes During the COVID-19 Pandemic. *J Allergy Clin Immunol Pract* 2020;8(10):3378-3387.

9-Guijon OL, Morpew T, Ehwerhemuepha L, Galant SP. Evaluating the impact of coronavirus disease 2019 on asthma morbidity: A comprehensive analysis of potential influencing factors. *Ann Allergy Asthma Immunol*. 2021 Mar 26:S1081-1206(21)00219-2.

10-Salciiccioli JD, She L, Tulchinsky A, Rockhold F, Cardet JC, Israel E. Effect of COVID19 on asthma exacerbation. *J Allergy Clin Immunol: Pract* 2021, epub April 26.

Figure 1: Emergency department and hospitalizations for asthma from 2007-2020

