BMJ Paediatrics Open

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Journal:	*BMJ Paediatrics Open*
Manuscript ID	bmjpo-2020-000876
Article Type:	Original research letter
Date Submitted by the Author:	18-Sep-2020
Complete List of Authors:	Graciano, Ana Lia; University of Maryland School of Medicine, Pediatrics/Critical Care Bhutta, Adnan; University of Maryland School of Medicine, Pediatrics/Critical Care Custer, Jason; University of Maryland School of Medicine, Pediatrics/Critical Care
Keywords:	Epidemiology, Health services research, Virology

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Impact of non-pharmaceutical interventions against COVID-19 on admissions to a pediatric intensive care unit in the state of Maryland, USA

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Keywords: children, critical care, respiratory infections, COVID-19, epidemiology

Word count: 732

Funding: This research received no specific grant from any funding agency in the public, commercial or not-for-profit sector

Competing interest: none

Patient Consent for Publication: not required

Contributor statement

AB, JC and ALG contributed to the conception and design of the study. ALG and AB contributed to data analysis and interpretation of the results. AG drafted the manuscript. All authors contributed to the interpretation of the results. All authors had full access to the data and take responsibility for the integrity and accuracy of the analysis. All authors read, contributed to and approved the final manuscript

To the Editor,

The global COVID-19 pandemic caused by SARS-CoV-2 virus has led to a reduction in the number of adult patients being admitted for common conditions.(1) As in other locales, the state of Maryland implemented a series of non-pharmacologic interventions beginning on March 5, 2020. Public transportation was sharply curtailed, social distancing was encouraged and schools were closed for the balance of the school year. With the implementation of these interventions, we have observed a striking decline in admissions to our pediatric intensive care unit (PICU).

The University of Maryland (UM) Health System is a health-care system aligned with the University of Maryland School of Medicine with its main hospital in downtown Baltimore and ten sister hospitals throughout the state. The Pediatric Intensive Care Unit (PICU) based at the Children's Hospital (UMCH) in Baltimore is a 19-bed mixed unit that serves as a referral center throughout the state. We queried the UMCH data entered in the Virtual PICU System, (VPS) LLC. This database contains clinical data on all children admitted to our PICU. We examined admissions between March 1st and May 31st 2020 and compared them with the same time period during 2016-2019. Patients were identified by most common admitting categories.

Between March 1st and May 31st, 2020 there were 101 PICU admissions, reflecting a decrease of 48.2 % when compared with the same period during 2019 (n=195) and a decrease of almost 70 % when compared with 2016-2018. When collated by the most frequent admitting diagnosis, the decline in total admissions was due to a decrease in respiratory illnesses. Furthermore, 87% of the respiratory admissions in 2020 occurred in March with only one respiratory admission in May in a child with chronic lung disease and ventilator dependency. Admissions associated with other common pediatric diagnoses such as congenital heart disease or diabetic ketoacidosis remained at the usual rate. Table 1 shows the number of admissions based on the most common categories (A) and a breakdown of the respiratory diagnosis (B). During the study period there were a total of 283 status asthmaticus admissions from which only six (2%) occurred during March-May 2020. Similar trends are seen for bronchiolitis and pneumonia admissions.

Governments around the world instituted a variety of interventions to "flatten the curve" during the pandemic. The government of Maryland instituted similar stepwise measures including closure of schools and non-essential businesses and institution of stay at home orders. Viral respiratory tract infections are the leading cause of pediatric intensive care unit admissions, representing an enormous economic and disease burden.(2) Transmission of respiratory viruses is complex and depends on many variables such as environmental factors, crowding, and host response. Schools and day care centers are major sources of common viral infections and children attending day care are at higher risk of having respiratory tract infections than those staying at home.(3) The temporal association of reduction in PICU admissions from acute respiratory illnesses and closure of schools and daycare centers is certainly clear.

An unexpected benefit of the non-pharmaceutical interventions has been an improvement in air quality which could certainly be an additional factor in the dramatic reduction of pediatric asthma admissions.(4,5) Studies have shown that during lockdown air quality was significantly improved. In urban areas nitrogen dioxide (NO_2) and carbon monoxide are mainly emitted from combustion sources, particularly diesel and, gasoline engines, manufacturing industry and power plants. During the lockdown period all of these sectors had reduced operation, contributing to a decrease in environmental pollutants.(6) NASA satellite images show a dramatic drop in air pollution during the lockdown period compared to previous years. March 2020 showed the lowest NO_2 monthly atmospheric level of any March since 2015 (Figure 1).

While the human and economic costs of the COVID-19 pandemic are devastating, we are witnessing a significant decrease in the number of PICU admissions, especially those resulting from respiratory illnesses. It is unclear if this is a temporary reduction or whether this will last for a longer period as the use of virtual learning and social distancing is encouraged and renewed emphasis on hand hygiene is incorporated into daily routines. We remain concerned though that children may not be brought in to seek appropriate medical attention due to the anxiety related to visiting a health care facility during the pandemic. If that is indeed the case, then it can certainly have profound short-term and long-term effects on the health of these children.

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1. Kansagra AP, Goyal MS, Hamilton S, Albers GW. Collateral Effect of Covid-19 on Stroke Evaluation in the United States. N Engl J Med. 2020 Jul 23;383(4):400–1.

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Table 1. PICU Admissions March 1st-May 31st, 2016-2020

A- Admissions March 1st-May 31st, 2016-2020 (most common categories)

Category	2016	2017	2018	2019	2020
Respiratory	138	177	133	106	30
Cardiovascular	51	34	47	57	56
Endocrine	12	12	14	8	7
Neurologic	25	16	21	5	6
Other	73	70	60	19	2
Total	**299**	**309**	**275**	**195**	**101**

B-Respiratory diagnosis, March 1st-May 31st, 2016-2020

Respiratory Diagnosis	2016	2017	2018	2019	2020	Total
Status asthmaticus	76	81	72	51	6	286
Bronchiolitis	24	39	31	29	8	131

Pneumonia	24	25	14	15	4	82
Croup	5	8	1	4	0	18
Tracheitis	3	9	7	3	3	25
Other*	6	15	8	4	9	42
Total	**138**	**177**	**133**	**106**	**30**	**584**

*Other: acute chest syndrome, congenital lung malformation, obstructive sleep apnea, subglottic cyst, subglottic stenosis, aspiration pneumonitis, asphyxia.

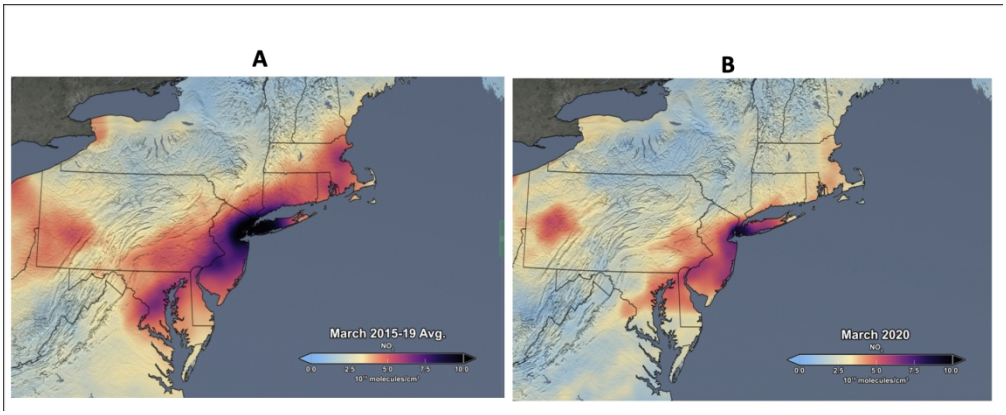
Figure 1

NASA satellite measurements revealed significant reductions in air pollution over major metropolitan areas of the Northeast United States

Panel A: average NO_2 concentrations in March 2015-2019.

Panel B: average NO_2 concentrations in March 2020 during the strict lockdown period.

Source:
NASA Aura: https://aura.gsfc.nasa.gov


A
March 2015-19 Avg.
B
March 2020

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Patient Consent for Publication: not required

Contributor statement

AB, JC and ALG contributed to the conception and design of the study. ALG and AB contributed to data analysis and interpretation of the results. AG drafted the manuscript. All authors contributed to the interpretation of the results. All authors had full access to the data and take responsibility for the integrity and accuracy of the analysis. All authors read, contributed to and approved the final manuscript

Abstract

As a public health measure during the COVID-19 pandemic, governments around the world instituted a variety of interventions to “flatten the curve”. The government of Maryland instituted similar measures. We observed a striking decline in PICU admissions during that period, mostly due to a decreased in respiratory infections. We believe this decline is multifactorial: less person-to-person contact, better air quality and perhaps “fear” of going to a hospital during the pandemic. We report an analysis of our PICU admissions during the lockdown period and compared them with the same time period during the four previous years.

To the Editor,

The global COVID-19 pandemic caused by SARS-CoV-2 virus has led to a reduction in the number of adult patients being admitted for common conditions.(1) The state of Maryland implemented a series of interventions on March 5, 2020. Public transportation was sharply curtailed, social distancing was encouraged and schools were closed for the balance of the school year. We observed a striking decline in pediatric intensive care unit (PICU) admissions during this period.

The PICU at the University of Maryland Children's Hospital (UMCH) in Baltimore is a 19-bed mixed unit that serves as a referral center throughout the state. We examined PICU admissions between March 1st and May 31st 2020, using the UMCH database and compared them with the same time period during 2015-2019. Patients were identified by most common admitting categories.

Between March 1st and May 31st, 2020 there were 101 PICU admissions, reflecting a decrease of 48.2 % when compared with the same period during 2019 (n=195) and a decrease of almost 70 % when compared with 2015-2018. When collated by the most frequent admitting diagnosis, the decline in total admissions was due to a decrease in respiratory illnesses. Furthermore, 87% of the respiratory admissions in 2020 occurred in March with only one respiratory admission in May in a child with chronic lung disease and ventilator dependency. Admissions associated with other common pediatric diagnoses such as congenital heart disease or diabetic ketoacidosis remained at the usual rate. During the study period there were a total of 355 status asthmaticus admissions from which only six (1.7%) occurred during March-May 2020. Similar trends are seen for bronchiolitis and pneumonia admissions. (Table 1 A and B)

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Neurologic	29	25	16	21	5	6
Other	81	73	70	60	19	2
Total	308	299	309	275	195	101

* Planned surgical procedures excluded from the analysis

B-Respiratory diagnosis, March 1st-May 31st, 2016-2020

Respiratory Diagnosis	2015	2016	2017	2018	2019	2020	Total

Status asthmaticus	69	76	81	72	51	6	355
Bronchiolitis	26	24	39	31	29	8	157
Pneumonia	23	24	25	14	15	4	105
Croup	5	5	8	1	4	0	23
Tracheitis	4	3	9	7	3	3	29
Other*	7	6	15	8	4	9	49
Total	**134**	**138**	**177**	**133**	**106**	**30**	**718**

*Other: acute chest syndrome, congenital lung malformation, obstructive sleep apnea, subglottic cyst, subglottic stenosis, aspiration pneumonitis, asphyxia.

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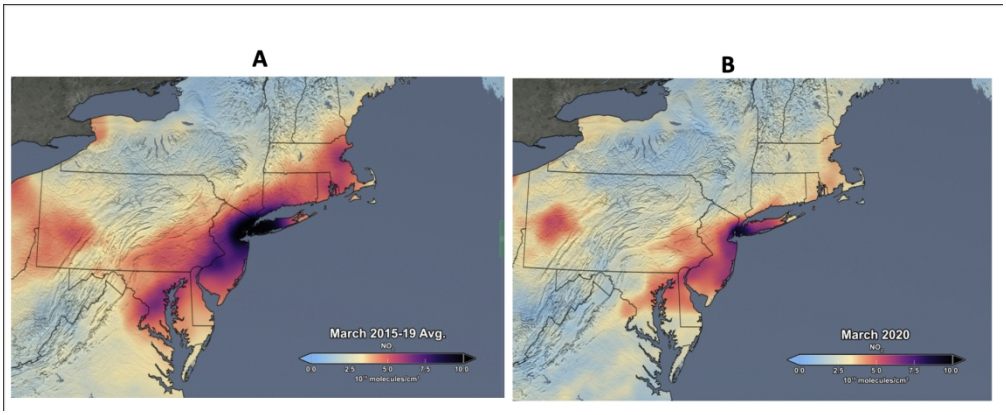
A
March 2015-19 Avg.
B
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