

Brief Report

Cite this article: Lau N, Patterson S, Kim S, Kim TY. Emergency department volumes after state-wide lockdown orders across the United States during the COVID-19 pandemic: COVID-19 lockdown and emergency volume. *Disaster Med Public Health Prep.* 18(e29), 1–3. doi: <https://doi.org/10.1017/dmp.2024.22>.

Keywords:

covid-19; lockdown; emergency department; volume

Abbreviations:

COVID-19, Coronavirus Disease 2019; ED, Emergency Department; US, United States

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Emergency Department Volumes After State-Wide Lockdown Orders Across the United States During the COVID-19 Pandemic: COVID-19 lockdown and emergency volume

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Abstract

Objective: The objective of this study was to describe changes in emergency department volumes after statewide lockdown in a network of hospitals across the United States during the COVID-19 global pandemic.

Methods: A retrospective study was performed utilizing data on daily volumes across multiple emergency departments from a centralized data warehouse from a private for-profit hospital system during the COVID-19 pandemic. The mean daily volumes of 148 emergency departments were evaluated across 16 states in relation to each state's governmental statewide lockdown orders. Comparisons of the same period in the prior year were evaluated for percent changes in volumes. We also compared pre-lockdown to post-lockdown volumes. A separate analysis was made for the pediatric ED volumes.

Results: The 2020 post-lockdown volumes compared to the same 2019 dates revealed a mean percent change of -43.09% . The overall post-lockdown volumes compared to the pre-lockdown volumes had a mean percent change of -45.00% . The pediatric data revealed a greater mean percentage change in volumes of -71.52% (post-lockdown compared to 2019) and -69.03% (post-lockdown compared to pre-lockdown).

Conclusions: This study found an overall decrease in volumes among 148 emergency departments across 16 states when compared to the comparable period pre-global pandemic.

Covid-19 Pandemic

At the beginning of the Coronavirus Disease 2019 (COVID-19) pandemic, nations started mandating lockdown orders to decrease the spread of the virus and decrease the strain placed on medical facilities worldwide. Prior to the lockdown orders, medical facilities became overrun with patients which created a burden on the availability of emergency department (ED) beds and allocation of medical equipment used to resuscitate critical patients. A few studies have evaluated the effect of lockdown orders on the ED volumes in different countries including the United States (US),^{1–4} but none have shown the changes in multiple regions across the US. The objective of this study was to describe changes in ED volumes after statewide lockdown orders in a network of hospitals across the US during the COVID-19 pandemic.

Methods

This was a retrospective study evaluating the mean volumes in EDs across a for-profit hospital network comprised of both academic and community-based hospitals. We obtained data for 148 EDs across 16 states: State (number of hospitals) - California (5); Colorado (6); Florida (43); Georgia (7); Idaho (2); Indiana (1); Kansas (4); Kentucky (2); Louisiana (3); Missouri (5); Nevada (3); New Hampshire (2); South Carolina (3); Tennessee (11); Texas (41); and Virginia (10).

The main objective was to describe changes in ED volumes after statewide lockdown orders during the COVID-19 pandemic. We compared the mean daily volumes for all combined EDs across the US, and for each individual state from the post-lockdown period to the same period from the previous year and compared the post-lockdown to the pre-lockdown period. Pre-lockdown was defined as the time from the first confirmed case of COVID-19 in the US on Jan 20, 2020, to the first effective date of a statewide lockdown order for each state. The post-lockdown period was defined as 1 month after the first effective date of a statewide lockdown order.

Each state's effective date for their lockdown order was referenced online from the New York Times: State (effective date of state order) - California (March 19, 2020); Colorado (March 26, 2020); Florida (April 3, 2020); Georgia (April 3, 2020); Idaho (March 25, 2020); Indiana (March 24, 2020); Kansas (March 30, 2020); Kentucky (March 26, 2020); Louisiana (March 23, 2020); Missouri (April 6, 2020); Nevada (April 1, 2020); New Hampshire (March 27, 2020);

Table 1. Statewide mean Emergency departments' daily volumes 2020 post-lockdown* compared to 2019 similar dates comparisons (*pediatrics in italics*)

State (number of EDs)	2020	2019	% Change
California (5)	550	1075	-48.84
<i>California-Peds</i>	52	225	-76.89
Colorado (6)	549	957	-42.63
<i>Colorado-Peds</i>	47	177	-73.45
Florida (43)	3968	7233	-45.14
<i>Florida-Peds</i>	353	1319	-73.24
Georgia (7)	657	1234	-46.76
<i>Georgia-Peds</i>	64	233	-72.53
Idaho (2)	129	219	-41.10
<i>Idaho-Peds</i>	21	49	-57.14
Indiana (1)	40	70	-42.86
<i>Indiana-Peds</i>	5	12	-58.33
Kansas (4)	325	609	-46.63
<i>Kansas-Peds</i>	49	152	-67.76
Kentucky (2)	110	213	-48.36
<i>Kentucky-Peds</i>	12	40	-70.00
Louisiana (3)	202	433	-53.35
<i>Louisiana-Peds</i>	19	84	-77.38
Missouri (5)	324	527	-38.52
<i>Missouri-Peds</i>	27	75	-64.00
Nevada (3)	499	848	-41.16
<i>Nevada-Peds</i>	63	205	-69.27
New Hampshire (2)	104	166	-37.35
<i>New Hampshire-Peds</i>	8	22	-63.64
South Carolina (3)	460	923	-50.16
<i>South Carolina-Peds</i>	56	191	-70.68
Tennessee (11)	831	1448	-42.61
<i>Tennessee-Peds</i>	85	263	-67.68
Texas (41)	3343	6023	-44.50
<i>Texas-Peds</i>	403	1389	-70.99
Virginia (10)	837	1527	-45.19
<i>Virginia-Peds</i>	83	293	-71.67

*Post-lockdown defined as 1 month after the first effective date of a statewide lockdown order.

South Carolina (April 7, 2020); Tennessee (March 31, 2020); Texas (April 2, 2020); and Virginia (March 30, 2020).⁵

The percentage change was calculated using the formula, % change = $([V1 - V2]/V2) \times 100$, where V1 = post-lockdown and V2 = pre-lockdown or 2019 comparable period. Lastly, we compare the same analysis of the above data for the pediatric population defined as patients < 18 years of age. This study was determined to be exempt by our regional institutional review board.

Results

This study found the 2020 post-lockdown mean volume of all the EDs across the hospital network of 12 929 visits/ day. In comparison, a mean volume of 22 718 visits/ day for the 2019 dates and 23 506 visits/ day for the pre-lockdown period was calculated, resulting in a percentage change of -43.09% and -45.00%, respectively. The pediatric 2020 post-lockdown mean volume was 1347 visits/ day. In comparison, a mean pediatric volume of 4729 visits/ day was determined for the 2019 dates and 4349 visits/ day for the pre-lockdown period, resulting in a

Table 2. Statewide mean Emergency departments' daily volumes in 2020 post-lockdown* compared to 2020 pre-lockdown** comparisons (*pediatrics in italics*)

State (number of EDs)	2020 Post-	2020 Pre-	% Change
California (5)	550	1075	-48.84
<i>California-Peds</i>	52	219	-76.26
Colorado (6)	549	951	-42.27
<i>Colorado-Peds</i>	47	176	-73.30
Florida (43)	3968	7080	-43.95
<i>Florida-Peds</i>	353	1188	-70.29
Georgia (7)	657	1128	-41.76
<i>Georgia-Peds</i>	64	192	-66.67
Idaho (2)	129	199	-35.18
<i>Idaho-Peds</i>	21	45	-53.33
Indiana (1)	40	65	-38.46
<i>Indiana-Peds</i>	5	14	-64.29
Kansas (4)	325	575	-43.48
<i>Kansas-Peds</i>	49	142	-65.49
Kentucky (2)	110	198	-44.44
<i>Kentucky-Peds</i>	12	40	-70.00
Louisiana (3)	202	405	-50.12
<i>Louisiana-Peds</i>	19	72	-73.61
Missouri (5)	324	484	-33.06
<i>Missouri-Peds</i>	27	59	-54.24
Nevada (3)	499	844	-40.88
<i>Nevada-Peds</i>	63	196	-67.86
New Hampshire (2)	104	175	-40.57
<i>New Hampshire-Peds</i>	8	25	-68.00
South Carolina (3)	460	755	-39.07
<i>South Carolina-Peds</i>	56	145	-61.38
Tennessee (11)	831	1325	-37.28
<i>Tennessee-Peds</i>	85	228	-62.72
Texas (41)	3343	5925	-43.58
<i>Texas-Peds</i>	403	1306	-69.14
Virginia (10)	837	1533	-45.40
<i>Virginia-Peds</i>	83	302	-72.52

*Post-lockdown defined as 1 month after the first effective date of a statewide lockdown order.

**Pre-lockdown defined as the time from the first confirmed case of COVID-19 in the US on Jan 20, 2020 to the first effective date of a statewide lockdown order.

pediatric percentage change of -71.52% and -69.03%, respectively. Each state comparison can be found in Tables 1 and 2.

Discussion

In the early period of COVID-19, medical facilities worldwide quickly became overrun with patients, which soon created a massive strain on the availability of Intensive Care Unit beds, ED beds, and allocation of medical equipment used to resuscitate these critical patients. Globally, lockdown orders were initiated in attempts to decrease the strain on the healthcare system. Few studies specifically evaluated the impact of ED visits in relation to lockdown orders, and most referred to either a single center or several EDs within a regional geographic location, limiting the generalizability of their findings. Giannouchos et al studied 3 different time periods within a major tertiary referral center from 5 surrounding states. They found an 8.1% decrease in ED visits during the pandemic over an 8- month period, but the largest

decrease of 30.4% was in the month following lockdown orders.³ In 1 urban ED in California, Lam et al found a decrease of 37% after a statewide lockdown order.⁴ The results of our study showed a greater overall decrease in the impact on ED volumes of 43.09%. In California alone, our study showed a change of -48.84% , compared to Lam et al's result of -37% .

Studies that have evaluated changes in ED volumes for pediatric patients have shown a greater decrease in ED visits during the pandemic. After lockdown orders, Cozzi et al found a pediatric decline of 76.3% in Italy, and Dopfer et al found a 63.8% drop in Germany.^{1,2} Finkelstein et al evaluated pediatric ED visits across 11 Canadian tertiary-care pediatric centers during the early phase of the pandemic and found a reduction of 58% in the number of ED visits.⁶ Goldman et al evaluated pediatric cases across 18 EDs in British Columbia and found a reduction of 57% in children's hospitals after stay-at-home orders were declared.⁷ Our study revealed a larger impact in the decrease in pediatric ED volumes in every ED across the US ranging from 57.14% to 77.38%.

Limitations

While this study sought to evaluate the effect of statewide lockdown orders on COVID-19 ED volumes, some limitations were also noted. The data was taken exclusively from a national for-profit HCA hospital system data warehouse, which may not accurately capture all the COVID-19 pandemic data that was available to other hospitals outside of this network in the US. Additionally, this study shows trends in the ED volumes, but cannot determine if the lockdown orders were the direct causation for decreased volumes. Lastly, there are many other confounding variables that may have affected the decrease in ED volumes that were not evaluated in our study.

Conclusions

This study highlights the magnitude of lockdown orders in ED volumes for healthcare providers, administrators, and public health officials. In a network of EDs across the US within a for-profit hospital system, this study had an overall mean percentage change of -43.09% for general ED volumes and -67.14% for

pediatric ED volumes for the 2020 post-lockdown versus 2019 comparable dates.

Acknowledgement. This research was supported (in whole or in part) by HCA Healthcare and/ or an HCA Healthcare affiliated entity. The views expressed in this publication represent those of the author(s) and do not necessarily represent the official views of HCA Healthcare or any of its affiliated entities.

Author contributions. Nicole Lau: Writing – Original Draft, Data Curation, Visualization; Stephen Patterson: Writing – Review and Editing, Conceptualization, Supervision; Steven Kim: Writing – Review and Editing, Conceptualization, Supervision; Tommy Kim: Writing – Supervision, Conceptualization, Methodology, and Formal analysis, as well as Review and Editing.

Funding statement. This research received no specific grant from any funding agency.

Competing interests. The authors declare no conflict of interest.

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