

# Analysis of Emergency Department Patient-Visit Volumes in an Academic Health System During a COVID-19 Pandemic Statewide ‘Safer at Home’ Order

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## ABSTRACT

**Background:** We describe patient-visit volumes, patient acuity, and demographics in our 4 academic health system emergency departments (ED) before, during, and after implementation of a COVID-19 pandemic safer-at-home order.

**Methods:** Data were collected from the electronic health record, including patient-visit volumes, chief complaint, Emergency Severity Index (ESI), and patient demographics. Descriptive statistics were performed.

**Results:** There was a 37% decrease in combined ED patient-visit volume during the safer-at-home order period (42% at the academic medical center). ED patient-visit volumes increased after the safer-at-home order concluded. During the safer-at-home order period, there was an increase in the proportion of ESI-2 visits and admission rates from EDs across the system.

**Conclusions:** Significant differences in ED patient-visit volumes and patient acuity were associated with a safer-at-home order in our academic health system. These differences are similar to experiences of other hospital systems across the country.

## BACKGROUND

On January 30, 2020, the World Health Organization declared the novel coronavirus outbreak a global public health emergency. According to the Centers for Disease Control and Prevention (CDC), by October 10, 2021, there had been over 44.4 million cases in the United States, with 840,810 cases and 9,054 confirmed and probable deaths in Wisconsin.<sup>1</sup> Eighteen percent (148,023) of cases and 17% (1,584) of deaths occurred in Milwaukee County.<sup>2</sup>

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This proportion is greater than Milwaukee County's share of the Wisconsin population, which was 15.9% in 2020.<sup>3</sup> To combat the spread of infection early in the pandemic, a statewide “safer-at-home” (SAH) order issued by Wisconsin's governor went into effect on March 25, 2020.<sup>4</sup> This original order was extended through May 26, 2020, but was struck down by the Wisconsin Supreme Court on May 13, 2020.<sup>5</sup>

Many hospital systems reported predictable declines in emergency department (ED) patient-visits during the COVID-19 pandemic and specifically during times when “shelter-in-place” orders were in effect.<sup>6</sup> We sought to analyze if our local

experience reflected national trends. Specifically, we evaluated ED patient-visit volumes, patient acuity, and patient demographics within our academic health system during the period of the statewide SAH order. Though the scope and enforcement of government orders meant to prevent nonessential social gatherings varied upon locality, we refer primarily to the state of Wisconsin's SAH order and use that term for similar policies in general, unless specifically stated.

There are complex explanations why the pandemic and SAH orders may affect patient acuity or types of patients presenting to the ED. For example, such orders led to cancellation of sports-related activities and possibly contributed to a decrease in sports-related injury.<sup>7</sup> Additionally, the rise in people working from home, going on furlough, or becoming unemployed led to decreased time spent driving and, thus, a decreased risk of motor vehicle crash-related injury.<sup>8</sup> While there have been observed decreases in patient presentations across all patient acuity levels and many emergent diagnoses,<sup>9</sup> this has not been uniform across

**Table 1.** Total Emergency Department Patient-Visits Per Site During the Three Time Periods Studied

| Site            | 2019 <sup>a</sup> |              |              | 1/1–12/31            | 2020 <sup>b</sup>       |                          |                          | 1/1–12/31                               |
|-----------------|-------------------|--------------|--------------|----------------------|-------------------------|--------------------------|--------------------------|---|
|                 | 1/1–3/24          | 3/25–5/13    | 5/14–12/31   |                      | 1/1–3/24<br>Pre-SAH     | 3/25–5/13<br>SAH         | 5/14–12/31<br>Post-SAH   |   |
| AMC             | 17,096 (203)      | 10,726 (215) | 48,181 (208) | <b>76,003 (208)</b>  | 16,094 (192)<br>(-5.4%) | 6,204 (124)<br>(-42.3%)  | 43,210 (186)<br>(-10.6%) | <b>65,508 (179)</b><br><b>(-13.9%)</b>  |
| AACH #1         | 6,114 (74)        | 3,704 (74)   | 17,747 (77)  | <b>27,565 (76)</b>   | 6,418 (76)<br>(2.7%)    | 2,699 (54)<br>(-27.0%)   | 16,432 (71)<br>(-7.8%)   | <b>25,549 (70)</b><br><b>(-7.9%)</b>    |
| AACH #2         | 4,041 (49)        | 2,500 (50)   | 11,716 (51)  | <b>18,257 (50)</b>   | 4,022 (48)<br>(-2.0%)   | 1,702 (34)<br>(-32.0)    | 11,021 (48)<br>(-5.9%)   | <b>16,745 (46)</b><br><b>(-8.0%)</b>    |
| Freestanding ED | 1,949 (24)        | 1,213 (24)   | 5,964 (26)   | <b>9,126 (25)</b>    | 2,208 (26)<br>(8.3 %)   | 882 (18)<br>(-25.0%)     | 5,875 (25)<br>(-3.8%)    | <b>8,965 (24)</b><br><b>(-4.0%)</b>     |
| Total           | 29,200 (352)      | 18,143 (363) | 83,608 (360) | <b>130,951 (359)</b> | 28,742 (342)<br>(-2.8%) | 11,487 (230)<br>(-36.6%) | 76,527 (330)<br>(-8.3%)  | <b>116,767 (319)</b><br><b>(-10.8%)</b> |

Abbreviations: SAH, safer-at-home; AMC, urban academic medical center; AACH, academic-affiliated community hospital; ED, emergency department.

<sup>a</sup>N (average/day).

<sup>b</sup>N (average/day) (% change in average/day).

all centers. Westgard et al reported no significant change in the proportion of patient acuity levels at their hospital,<sup>10</sup> however, national trends indicate fewer ED visits for life-threatening diagnoses, such as myocardial infarction, stroke, and hyperglycemic crisis.<sup>11</sup>

The goal of this study was to assess the local impact of Wisconsin's SAH order on ED patient-visit volume, patient acuity, and demographics in our academic health system EDs before, during, and after implementation of a stay-at-home order.

## METHODS

This observational study examined patient encounter data from 4 EDs in our academic health system—1 urban academic medical center (which includes an adult level 1 trauma center), 2 academic-affiliated community hospitals (AACH), and 1 freestanding ED in southeast Wisconsin—during 3 time periods in 2019 and 2020. The time periods were defined by the governor's SAH order, which began March 24, 2020, and extended through May 13, 2020, when it was nullified by the Wisconsin Supreme Court. The calendar year preceding the SAH order (pre-SAH), the period of the order itself, and the remainder of the calendar year after the order was struck down (post-SAH) were used as the 3 time periods for this study. Data for 2020 and 2019 (for comparison) across all 4 sites were obtained through a systematic query of the electronic health record. This database was queried for daily patient-visit volumes, chief complaint, and Emergency Severity Index (ESI). The ESI triage system is a 5-level system that assigns a score to patients arriving in the ED based on patient condition, vital signs, and predicted resource need, with lower scores indicating higher patient acuity presentations. Proportions of ESI scores were compared across the defined time periods for 4 sites. This project was approved through our institution's Institutional Review Board.

All patients presenting to the 4 EDs during the study period time intervals were included.

## RESULTS

### Patient Demographics

The median patient age was 49 years across all 4 EDs during the study periods. Female patients comprised 55% of all patients presenting to the study sites, and there was no significant change in this proportion during the SAH period. Similarly, there were no significant changes in the proportions of White (59%), Black (35%), Hispanic (5%), or other (6%) patients across the 3 study periods.

### ED Patient-Visit Volumes

A total of 116,756 ED patient-visits in 2020 and 130,951 in 2019 were included in the study across all 4 sites (Table 1). After the SAH order was declared, the participating EDs experienced a decline from an average of 342 combined daily patient-visits prior to the SAH (January 1-March 24, 2020) to an average of 230 visits for the duration of the SAH order (March 25 – May 13, 2020). This represented a 37% decrease in combined patient-visit volume across all 4 sites during the SAH period compared to 2019. The largest proportional decrease in volume during the SAH occurred at the academic medical center (42%), with decreases at the AACHs and the freestanding ED ranging between 25% and 32%.

From the end of the SAH order (May 13, 2020) to the end of 2020, patient-visit volumes began to increase at all 4 sites but remained, on average, lower than 2019 census levels. Specifically, ED patient-visits at the academic medical center during the post-SAH period remained 11% below 2019 levels. AACH-1, AACH-2, and the freestanding ED also remained below 2019 census levels, but to a lesser extent, during the post-SAH period (8%, 6%, and 4%, respectively).

**Table 2.** Number of Emergency Department Patient-Visits by Emergency Severity Index (ESI) Designation at All Sites From Highest Acuity (ESI-1) to Lowest Acuity (ESI-5)

| ESI   | 2019           |               |                |                       | 2020                        |                            |                             |                                   |
|-------|----------------|---------------|----------------|-----------------------|-----------------------------|----------------------------|-----------------------------|-----------------------------------|
|       | 1/1–3/24       | 3/25–5/13     | 5/14–12/31     | 1/1–12/31             | 1/1–3/24<br>Pre-SAH         | 3/25–5/13<br>SAH           | 5/14–12/31<br>Post-SAH      | 1/1–12/31                         |
| ESI-1 | 384 (1.3%)     | 272 (1.5%)    | 1,144 (1.4%)   | <b>1,800 (1.4%)</b>   | 423 (1.5%)                  | 213 <sup>a</sup> (1.9%)    | 1,266 <sup>b</sup> (1.7%)   | <b>1,902<sup>b</sup> (1.6%)</b>   |
| ESI-2 | 9,665 (33.1%)  | 6,092 (33.6%) | 28,644 (34.3%) | <b>44,401 (33.9%)</b> | 10,157 <sup>b</sup> (35.3%) | 4,230 <sup>b</sup> (37.1%) | 27,324 <sup>b</sup> (36.1%) | <b>41,711<sup>b</sup> (35.9%)</b> |
| ESI-3 | 14,833 (50.8%) | 9,137 (50.4%) | 41,002 (49.0%) | <b>64,972 (49.6%)</b> | 14,017 <sup>b</sup> (48.8%) | 5,542 <sup>b</sup> (48.5%) | 36,424 <sup>b</sup> (48.1%) | <b>55,983<sup>b</sup> (48.3%)</b> |
| ESI-4 | 3,855 (13.2%)  | 2,351 (13.0%) | 11,332 (13.6%) | <b>17,538 (13.4%)</b> | 3,666 (12.8%)               | 1,316 <sup>a</sup> (11.5%) | 9,407 <sup>b</sup> (12.4%)  | <b>14,389<sup>b</sup> (12.4%)</b> |
| ESI-5 | 319 (1.1%)     | 179 (1.0%)    | 910 (1.1%)     | <b>1,408 (1.1%)</b>   | 303 (1.1%)                  | 115 (1.0%)                 | 776 (1.0%)                  | <b>1,067<sup>b</sup> (0.9%)</b>   |
| Total | 29,200         | 18,143        | 83,608         | <b>130,951</b>        | 28,742                      | 11,416                     | 75,724                      | <b>115,882</b>                    |

Abbreviation: SAH, safer-at-home.

<sup>a</sup>Statistically significant at  $P < 0.05$ .<sup>b</sup>Statistically significant at  $P < 0.0001$ .**Table 3.** Rate of Hospital Admission of All Patients Seen by Site

| Site            | 2019                              |               |                |                       | 2020                       |                            |                             |                                   |
|-----------------|-----------------------------------|---------------|----------------|-----------------------|----------------------------|----------------------------|-----------------------------|-----------------------------------|
|                 | 1/1–3/24                          | 3/25–5/13     | 5/14–12/31     | 1/1–12/31             | 1/1–3/24<br>Pre-SAH        | 3/25–5/13<br>SAH           | 5/14–12/31<br>Post-SAH      | 1/1–12/31                         |
|                 | <b>N (% Total Patient-Visits)</b> |               |                |                       |                            |                            |                             |                                   |
| AMC             | 5,245 (30.7%)                     | 3,295 (30.7%) | 14,725 (30.6%) | <b>23,265 (30.6%)</b> | 5,201 <sup>a</sup> (32.3%) | 2,251 <sup>b</sup> (36.3%) | 15,063 <sup>b</sup> (34.9%) | <b>22,515<sup>b</sup> (34.4%)</b> |
| AACH #1         | 1,761 (28.8%)                     | 1,058 (28.6%) | 4,985 (28.1%)  | <b>7,804 (28.3%)</b>  | 1,913 (29.8%)              | 888 <sup>b</sup> (32.9%)   | 5,022 <sup>b</sup> (30.6%)  | <b>7,823<sup>b</sup> (30.7%)</b>  |
| AACH #2         | 895 (22.1%)                       | 521 (20.8%)   | 2,632 (22.5%)  | <b>4,048 (22.2%)</b>  | 1,003 <sup>a</sup> (24.9%) | 427 <sup>a</sup> (25.1%)   | 2,703 <sup>a</sup> (24.5%)  | <b>4,133<sup>b</sup> (24.7%)</b>  |
| Freestanding ED | 86 (4.4%)                         | 66 (5.4%)     | 323 (5.4%)     | <b>475 (5.2%)</b>     | 91 (4.1%)                  | 37 (4.2%)                  | 254 (5.0%)                  | <b>382 (4.7%)</b>                 |
| Total           | 7,987 (27.4%)                     | 4,940 (27.2%) | 22,665 (27.1%) | <b>35,592 (27.2%)</b> | 8,208 (28.6%)              | 3,603 (31.4%)              | 23,042 (30.4%)              | <b>34,853<sup>b</sup> (30.1%)</b> |

Abbreviations: SAH, safer-at-home; AMC, urban academic medical center; AACH, academic-affiliated community hospital; ED, emergency department.

<sup>a</sup>Statistically significant at  $P < 0.05$ .<sup>b</sup>Statistically significant at  $P < 0.0001$ .

## Patient Acuity

There was a statistically significant increase in the proportion of patient-visits with an ESI-1 and ESI-2 designation and decreases in the number of patients assigned ESI-3 and ESI-4 during the SAH order (Table 2). During the post-SAH period, there remained a statistically significant increase in the proportion of ED patient-visits with an ESI-2 designation compared to 2019 at each site, as well as a significant decrease in patient-visits with an ESI-4 designation at each site.

There were statistically significant increases in patient admission rates at the 3 largest sites during the SAH period (Table 3), with the largest increase in admission rate at the academic medical center. Admission rates generally declined after the end of the SAH order, though remained elevated compared to the 2020 pre-SAH period. There were no statistically significant changes in admission rates of patients at the freestanding ED.

## DISCUSSION

ED patient-visit volumes in our academic health system decreased by just over one-third during the SAH period. This decrease was not uniform across all clinical sites, with the sharp

decline (42%) occurring at the academic medical center and the smallest decline (25%) at the freestanding ED. Of note, the freestanding ED transitioned to a microhospital model and gained limited inpatient capabilities in December 2020, towards the end of the post-SAH period, though we believe this did not have any significant effects on volume or acuity during this time. We also experienced a variation in the overall distribution of patient acuity, with a trend toward higher acuity patient presentations. This may indicate that lower-acuity patients were choosing not to seek care in an ED. The percentage of patients admitted to the hospital from the ED increased from 28.6% to 31.4% during the SAH order, further reflecting overall increase in acuity in patients presenting to the ED. Moreover, admission rates for the remainder of the calendar year remained elevated above pre-SAH order levels, which is likely the result of a variety of factors including the ongoing effects of the pandemic, as COVID-19 cases and hospitalizations increased in the region to greater levels than experienced during the SAH period. A prolonged increase in admission rates from baseline could also reflect effects from patients not able to appropriately manage chronic conditions in the outpatient setting or delaying seeking

emergent care for other acute medical complaints,<sup>11</sup> especially early in the pandemic.

Defining the study period and comparison periods was challenging because the pandemic does not have a well-defined start date. While we decided to use Wisconsin's "safer-at-home" order as the start date, initial examination of the overall trends of the data show that patient-visit volumes began declining prior to the SAH order. On March 13, 2020, Wisconsin Governor Tony Evers declared that public and private schools were to close March 18. When examining the week of March 18-24, prior to the SAH order, the average number of combined ED patient-visits per day decreased to 270 compared to an average of 341 visits per day during the week prior.

When the "safer-at-home" order was overturned by the Wisconsin Supreme Court on May 13, 2020, ED patient-visit volumes across the system had already begun increasing from their combined nadir of 185 patient-visits per day on April 11 and continued to trend upward after the order was lifted. While the end of the order itself may have had an impact on patient volumes, it is difficult to determine a direct relationship between volume and the termination of the order.

Based on analysis of patient-visit volumes coupled with significant fluctuations in ESI designation distribution, it is possible that reduced ED patient-visit volumes during the early part of the pandemic and SAH order reflected patient concerns about potential exposure to COVID-19 in the ED. This has been described in the literature, with fewer admissions observed for acute myocardial infarction, stroke, and other emergent conditions during the first months of the pandemic in the United States and abroad.<sup>11</sup> However, it is notable that as our academic health system experienced a more severe surge in COVID-19 patients in the ED later in the year, we did not see a similar change in patient volume and acuity during the post-SAH time period as we defined it. Several patient- and community-level factors likely affected patient-visit volumes during the SAH order, including (1) patient concern for contracting COVID-19 while seeking emergency care for non-pandemic-related conditions; (2) patient hesitancy caused by media portrayals of EDs overcrowded with COVID-19 patients; (3) increased, non-ED options for symptom- and non-symptom-related COVID-19 testing; (4) financial and/or logistical barriers (eg, transportation needs, employment demands, etc); (5) increased ambulatory care access through virtual visits; and (6) potential deprioritization of routine self-care during a historic pandemic. It is also possible that other communicable diseases were in decline (such as influenza) due to public health efforts to decrease the spread of COVID-19, and fewer patients were at risk of injuries due to motor vehicle crashes while working from home and not engaging in social gatherings. While many of these factors may have contributed to fluctuation in ED patient-visit volumes and acuity, it is challenging to quantify their effects specifically. Having

said this, the financial impact of such sharply reduced patient-visits (to EDs and beyond) to our academic health system and parent health sciences university was clear with a resultant dramatic decrease in clinical revenue during the SAH order period.

### Limitations

Our data represent ED patient-visits from 1 academic health system in primarily urban and suburban areas in southeast Wisconsin, so the findings may not be generalizable to other areas and communities. However, our findings in overall patient-visit volume and ESI designation distribution are consistent with data published previously.<sup>6-9,11</sup> Our use of 2019 as a comparison was based on a general trend of increasing patient-visit volumes, broader reach of new community ED locations such as the freestanding ED, and increasing capacity in the years prior to 2019 that may have distorted our findings.

The admission rate data in Table 3 show a statistically significant increase in admission rates at the academic medical center during the pre-SAH period compared to 2019. Specific reasons for this are unclear at this time with our data set. Furthermore, the persistent increase in admission rates at the academic medical center above pre-SAH levels may reflect specific effects of the significant fall increase in COVID-19 presentations and hospitalizations, in addition to other trends previously discussed. As our initial aim was to define effects on our hospital system EDs using the SAH as a reference point, further study should be done to elucidate any differences in patient-visit volumes, acuity, or other characteristics during different phases and waves of the COVID-19 pandemic.

### CONCLUSIONS

Our urban, academic health system experienced decreases in ED patient-visit volumes and increases in patient acuity and admission at multiple sites during a statewide SAH order early in the spread of COVID-19 in the region. Due to the complex interactions of the pandemic with governmental policy, public perceptions, and health care systems, more study is warranted to assess direct causal relationship between SAH orders and ED utilization. However, our experiences are comparable to other studies, and our findings could prove useful in informing public health, health system, and hospital planning in future instances where "safter-at-home" or similar orders are instituted.

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### REFERENCES

- Centers for Disease Control and Prevention. COVID data tracker. Accessed October 10, 2021. <https://covid.cdc.gov/covid-data-tracker>
- Wisconsin Department of Health Services. COVID-19: Wisconsin summary data. Accessed October 10, 2021. <https://www.dhs.wisconsin.gov/covid-19/data.htm>

3. United States Census Bureau. QuickFacts Milwaukee County, Wisconsin. United States Census Bureau. Accessed October 10, 2021. <https://www.census.gov/quickfacts/fact/table/milwaukeecountywisconsin,WI/PST0452>
4. Palm A. Emergency order #12: safer at home order. Wisconsin Department of Health Services. March 24, 2020. <https://evers.wi.gov/Documents/COVID19/EMO12-SaferAtHome.pdf>
5. Schulz Z. Update: Supreme Court strikes down 'Safer at Home' order. *PBS Wisconsin*. May 13, 2020. Accessed October 4, 2021. <https://pbswisconsin.org/news-item/breaking-supreme-court-strikes-down-safer-at-home-order>
6. Lucero AD, Lee A, Hyun J, et al. Underutilization of the emergency department during the COVID-19 pandemic. *West J Emerg Med*. 2020;21(6):15-23. doi:10.5811/westjem.2020.8.48632
7. van Aert GJJ, van der Laan L, Boonman-de Winter LJM, et al. Effect of the COVID-19 pandemic during the first lockdown in the Netherlands on the number of trauma-related admissions, trauma severity and treatment: the results of a retrospective cohort study in a level 2 trauma centre. *BMJ Open*. 2021;11(2):e045015. doi:10.1136/bmjopen-2020-045015
8. Boserup B, McKenney M, Elkbuli A. The impact of the COVID-19 pandemic on emergency department visits and patient safety in the United States. *Am J Emerg Med*. 2020;38(9):1732-1736. doi:10.1016/j.ajem.2020.06.007
9. Garcia S, Albaghdadi MS, Meraj PM, et al. Reduction in ST-segment elevation cardiac catheterization laboratory activations in the United States during COVID-19 pandemic. *J Am Coll Cardiol*. 2020;75(22):2871-2872. doi:10.1016/j.jacc.2020.04.011
10. Westgard BC, Morgan MW, Vazquez-Benitez G, Erickson LO, Zwank MD. An analysis of changes in emergency department visits after a state declaration during the time of COVID-19. *Ann Emerg Med*. 2020;76(5):595-601. doi:10.1016/j.annemergmed.2020.06.019
11. Lange SJ, Ritchey MD, Goodman AB, et al. Potential indirect effects of the COVID-19 pandemic on use of emergency departments for acute life-threatening conditions - United States, January-May 2020. *MMWR Morb Mortal Wkly Rep*. 2020;69(25):795-800. doi:10.15585/mmwr.mm6925e2

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