

## ORIGINAL ARTICLE

# COVID-19 hospital designation: Effect on emergency department patient self-selection and volume

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## ABSTRACT

**Objective:** Combating Coronavirus 2019 has stretched hospital resources to the extreme. In an effort to cohort personnel and equipment, NorthShore University HealthSystem (NSUHS) designated Glenbrook Hospital (GBH) as our “COVID hospital”, which became public knowledge on April 6, 2020. We hypothesize that with this public declaration our emergency department (ED) total volumes and COVID-19 related visits would be affected.

**Methods:** We performed a retrospective analysis of our total ED volumes and COVID-19 related ED visits from March 12, 2020 until April 30, 2020. The pre-public declaration timeframe of March 12-April 5, 2020 acted as our control whereas the post-public declaration acted as the testing group (April 6-April 30, 2020). NSUHS four primary hospitals were included in the analysis. We ran a chi-squared analysis on both groups to determine if there was statistical significance.

**Results:** Both total ED volumes and COVID-19 related ED visits, when comparing pre VS post-public declaration of GBH as the “COVID hospital”, showed statistical significance ( $p < .001$ ). Three of the four hospitals had a decrease in total ED volumes, whereas the COVID-19 related ED visits increased at two hospitals and decreased at the others.

**Conclusions:** Our results support our hypothesis that after the public declaration of Glenbrook Hospital as the “COVID hospital”, patients’ decision making regarding which ED to visit was significantly affected. Certain limitations, including socioeconomic status and a small geographical footprint of NSUHS, may have affected our results. Further work should be done to reproduce these results to ensure replication.

**Key Words:** Coronavirus, Hospital designation, Pandemic, Hospital resources, Emergency department, Covid-19, Coronavirus 19, Emergency department volumes

## 1. INTRODUCTION

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), originating in Wuhan, China, was declared a worldwide pandemic by the World Health Organization (WHO) on March 11, 2020.<sup>[1,2]</sup> Dubbed coronavirus disease 2019 (COVID-19), COVID-19 has spread across the globe with the current worldwide cases totaling 23,462,707 and 809,484 deaths, with the United States leading the world in both to-

tal cases (5,705,455) and deaths (176,816), as of August 24, 2020.<sup>[3]</sup> Influx of COVID-19 patients into hospitals has been shown to significantly stretch hospital resources with regards to personal protective equipment (PPE), hospital personnel, medical equipment, intensive care unit (ICU) beds and ventilators.<sup>[4]</sup>

Our system, NorthShore University Hospital System (NSUHS), is a five-hospital system located primarily in the

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northern suburbs of Chicago with our most recent acquisition, Swedish Hospital, acting as a safety-net hospital for the population on the north side of Chicago. In response to COVID-19 and in an effort to cohort resources and personnel, NSUHS designated Glenbrook Hospital (GBH), located in Glenview, Illinois, as our “COVID hospital” catering specifically to COVID-19 patients. Specialized care teams, consisting of hospitalists, intensivists, anesthesiologists, respiratory therapists and nurses were all trained in specific protocols regarding COVID-19 patient care. GBH intensive care unit (ICU) was expanded to include an area called the Glenbrook Aggregate Unit (GAU), which acted as a step-down unit from the traditional ICU and a higher level of care relative to the general wards. The primary goal of the GAU was to have the patients at highest risk of decompensating from a respiratory standpoint being in close proximity to the ICU. This is where all the patients on high-flow nasal cannula were admitted. In terms of the admissions process, all patients admitted to GBH were confirmed positive by COVID-19 reverse transcription polymerase chain reaction (RT-PCR) or else were a high-risk patient under investigation (PUI). High risk criteria, described in Table 1, necessitated that the patient exhibited typical COVID-19 symptoms, coupled with having a high risk exposure, and/or have objective clinical or radiographic data that is consistent with COVID-19 infection. The final decision regarding GBH admission was designated to our COVID-19 Hospitalist team, which oversaw all COVID-19 patient admissions across NSUHS.

Glenbrook Hospital became designated within our system as our “COVID hospital” on April 1, 2020, for sole hospital admission of PUI/COVID-positive patients, with the public announcement of this designation on April 6, 2020.<sup>[5]</sup> With the specialization designation of GBH as the “COVID hospital” we had two theories. First, we theorized that with this declaration, patients would self-select in their emergency department (ED) visits and, as such, the ED visits related to confirmed/suspected COVID-19 would differ when compared with the pre-COVID designation of GBH amongst our different pavilions. Secondly, after the public declaration, we suspected that our total ED volume at each pavilion would be affected, as patients may opt to visit a specific ED and possibly opt away from the “COVID hospital” in an effort to not contract the virus themselves.

We received institutional review board approval for this study #EH20-313.

## 2. METHODS

To evaluate the effect of Glenbrook Hospital being designated as the “COVID hospital”, we performed a retrospective analysis of our ED patient volumes over a specific time-period.

NorthShore University HealthSystem started on-site PCR testing for COVID-19 on March 12, 2020, which we designated as the start date for our data collection. We collected all ED visit numbers from our four EDs (Swedish Hospital, as a recent acquisition into our health system, was not included as their electronic medical record is not yet integrated into the overarching NSUHS), from March 12 through April 30, 2020. We opted to end by April 30 to have an equal number of days before & after the public announcement.

Data were then separated based on whether or not a patient had a COVID-19 test ordered by the date of their ED visit (e.g. COVID vs Non-COVID). The result of their COVID-19 test was not taken into account in our analysis as our goal was to capture patient’s actions regarding their own concern for COVID-19 for themselves, irrespective of their true COVID-19 status.

**Table 1.** High risk criteria for PUI

<ul style="list-style-type: none"> <li>• Exhibits Traditional COVID-19 Symptoms                             <ul style="list-style-type: none"> <li>○ Cough, shortness of breath or other lower respiratory symptoms</li> <li>○ Unexplained Hypoxemia (discordant exam with hypoxemia)</li> <li>○ Fever/chills (<math>T \geq 100.4</math> <math>^{\circ}\text{F}/38</math> <math>^{\circ}\text{C}</math>) with no alternate diagnosis</li> <li>○ Myalgias</li> <li>○ Anosmia/Ageusia (loss of taste or smell)</li> <li>○ GI symptoms: including diarrhea, nausea, and vomiting</li> </ul> </li> </ul>
<b>PLUS</b>
<ul style="list-style-type: none"> <li>• High-Risk Exposure                             <ul style="list-style-type: none"> <li>○ High-risk job (eg healthcare worker, grocery store employee, etc).</li> <li>○ Recently exposed to large gatherings (eg travel in airports, concerts, religious ceremonies, etc)</li> <li>○ Known COVID-19 exposure within past 14 days</li> <li>○ Residents in Congregate Living Facility with or without known COVID-19 patients</li> </ul> </li> </ul>
<b>AND/OR</b>
<ul style="list-style-type: none"> <li>• Objective Laboratory/Imaging Suggestive of COVID-19                             <ul style="list-style-type: none"> <li>○ Elevated CRP, D-Dimer, Ferritin, LDH</li> <li>○ Elevated LFTs (e.g. AST, ALT)</li> <li>○ Leukopenia, atypical lymphocytes, or lymphocytopenia</li> <li>○ Thrombocytopenia</li> <li>○ Radiographic findings: bilateral pneumonia, interstitial infiltrates, ground glass opacities</li> </ul> </li> </ul>

We had two control groups. Our first control group had total ED volumes at each of the four hospitals from March 12, 2020 through April 5, 2020. Our second control group had ED COVID-related patient volumes from March 12, 2020 through April 5, 2020. We compared these to their respective counterparts, total ED volumes from April 6-April 30, 2020 and ED COVID-related patient volumes from the same comparison timeframe. Figures 1 and 2 display the ED total

patient volumes and ED COVID-related patient volumes, respectively, for each pavilion, pre and post-declaration.

We ran a chi-squared test analysis on each of the groups with the results described below.

### 3. RESULTS

The distribution of ED patient volume, across the four pavilions, before and after the public declaration, was found to be statistically significant ( $p < .001$ ). Evanston Hospital (EV), Skokie Hospital (SK) and GBH all saw a decrease in total ED patient volumes. Only Highland Park Hospital (HPH)

saw an increase in volume.

Additionally, the number of ED COVID-related patient visits, across the four pavilions, before and after the public declaration, was found to be statistically significant ( $p < .001$ ). EV and SK both saw decreases in COVID-related visits at 16% and 15%, respectively. Whereas both GBH and HPH saw an increase in COVID-related visits, 20% and 71% respectively.

The percentage change in patient volumes, both total ED volumes and ED COVID-related volumes, is detailed in Table 2.

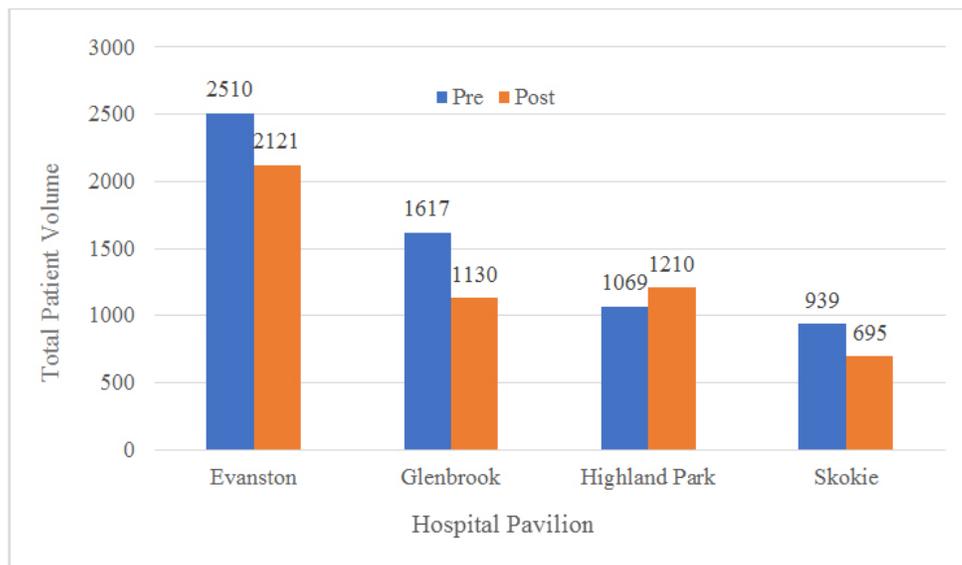


Figure 1. ED total patient volume

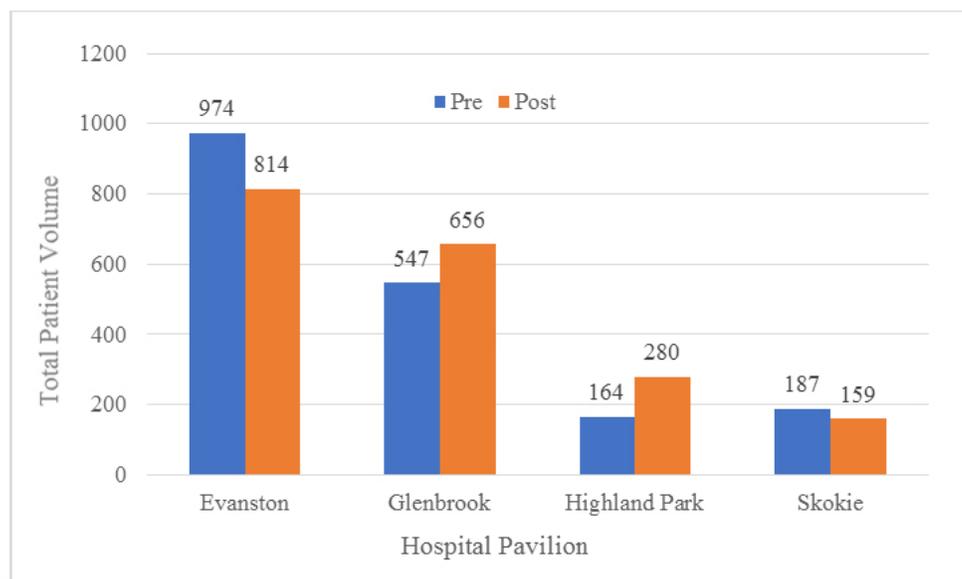


Figure 2. ED COVID-related patient volume

**Table 2.** Percentage change in ED patient volume

	Total	COVID-related
Evanston	-15%	-16%
Glenbrook	-30%	20%
Highland Park	13%	71%
Skokie	-26%	-15%

#### 4. DISCUSSION

Our results showed that after the public announcement of Glenbrook Hospital as the “COVID hospital” designation, our ED volumes, in regards to total patients and visits related to COVID-19, were significantly affected. We’re able to extrapolate that patients’ decision-making regarding which ED to visit was influenced by one hospital being designated as the pandemic hospital of the health system.

As expected, the overall ED volumes to GBH decreased the most relative to the other pavilions (-30%) whereas the COVID-19 related visits to GBH increased (20%). Though the pavilion with the highest percentage increase in COVID-19 visits was not GBH but rather HPH (70% increase in COVID-19 patients). This was unexpected as HPH was known within the community as the only “clean” hospital within the system, which housed no COVID-19 inpatients. While total ED volumes to HPH volumes increased after the declaration (13%, the only pavilion which saw an increase in total ED patient volumes), the fact that COVID-19 patients increased the most to HPH was unanticipated. We theorize this occurred because even though people may have concerns for COVID-19 personally, their first priority was being evaluated away from the “COVID hospital”. We suspect patients were not aware that while HPH had no COVID-19 patients on the inpatient side, there were and could be COVID-19 patients present within the HPH ED at any given time. An additional possibility of this finding could be our emergency medical services (EMS) protocols, which detail that patients were taken to the closest ED, regardless of preference.

Additionally, the separation of COVID vs Non-COVID related ED visits should be addressed. We determined an ED visit to be related to COVID if a COVID-19 RT-PCR had been ordered by the date of the patient’s ED visit, regardless of the test result. Our reasoning for this approach was to capture all patients who were concerned for COVID-19

themselves, which we presumed if they had a COVID-19 test ordered, to see which ED they opted to visit. With the significant variation of false-negative rate of RT-PCR results, we didn’t want to miss any potential COVID-19 related visits.<sup>[6]</sup> However, this approach may have overestimated the COVID-related ED visits if patients had a COVID test prior and their visit was truly unrelated to COVID-19.

Furthermore, our study is not without limitations. Our hospital system is set within an upper middle-class socioeconomic area of the state, with patients having regular access to primary doctors, transportation, and overall increased access to resources when compared to the general United States population. This allows them the ability and option to travel farther to different hospitals when desired, which likely positively influenced our statistically significant conclusions. Whereas in other areas with a lower socioeconomic patient population, there may not be an option to visit alternate hospitals and thus, volumes likely would not be as significantly affected.

In regards to location, our hospital system is within a close geographical range. The distance from Glenbrook Hospital to each of the three other pavilions ranges from 8.1 miles to 11.4 miles, so the difference in travel for patients is not drastic. In other health systems, the geographical footprint of their hospitals can be far greater and thus limiting patients’ ability to readily travel between sites when they seek ED care. The larger the geographical area of the hospital system, it is likely the less significant swings in ED volumes would be with a “pandemic” hospital designation.

#### 5. CONCLUSIONS

In conclusion, it’s our hope that with these results, approaches to future pandemic responses can take into account the effect in ED volumes. Designating a hospital as the “pandemic” hospital will most likely affect the ED visits across the hospital system. Staffing, PPE distribution, provision of specialized care, and overall resource allocation can be prepped in advance to plan for the shift in ED volumes and pandemic-related visits. Future work needs to be done to reproduce these findings to ensure replication in a wide variety of socioeconomic and geographical areas.

#### CONFLICTS OF INTEREST DISCLOSURE

The authors declare they have no conflicts of interest.

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