Practical Implementation of Nursing Science

Evaluation of Emergency Department Surge Spaces During the COVID-19 Crisis

ORIGINAL PROJECT

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ABSTRACT

Background: In response to the surge of COVID-19 patients in March and April 2020, our emergency department in New York City implemented a novel triage screening process to identify low acuity patients who could be diverted from the emergency department to a surge space. Patients who were (1) ≤ 70 years old; (2) triaged as Emergency Severity Index category 4 or 5, and (3) not requiring use of a stretcher (4) displaying mild COVID-19 symptoms were diverted to one of two surge spaces [West Surge Space (WSS) or Ambulatory Clinic Surge Space (ACSS)], where a complete set of vital signs were taken and an exam by a medical provider was conducted.

Methods: From March 12 to April 20, 2020, we analyzed the total volume of patients diverted to the surge space and their discharge disposition (i.e., admitted to hospital, transfer to main emergency department, left against medical advice, discharged from a surge space, or expired). A receiver operator curve (ROC) was calculated to predict discharge disposition based on triage diversion to either surge space.

Results: There were 6,241 patients triaged during the study period, in which one-quarter [n = 1,753 (26%)] were diverted to a surge space. The average number of patients per day was 141.8 (standard deviation [SD] 54.5) in the main emergency department and 39.8 (SD 29.9) in the surge spaces. Of the patients triaged and diverted to a surge space, a large proportion were successfully discharged from those areas without entering the main emergency department (84%, n = 866 in WSS and 94%, n = 745 in ACSS). Very few signed out against medical advice (3%, n = 26 in WSS and 2%, n = 12 in ACSS), transferred

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to the main emergency department (1%, n = 8 in WSS and 0.4%, n = 3 in ACSS), or admitted (13%, n = 130 in WSS and 4%, n = 30 in ACSS]. No patients expired in either surge space. The ROC analysis showed that the model had excellent discrimination power, with an area under the curve of 0.97 for WSS and 0.96 for ACSS.

Conclusion: A novel triage screening process successfully diverted 26% of low acuity patients with mild symptoms of COVID-19 to surge spaces. Nearly 92% of these patients were successfully discharged without entering the main emergency department footprint.

INTRODUCTION

The COVID-19 pandemic placed unprecedented strain on healthcare systems worldwide, particularly on emergency departments , which have been at the forefront of the pandemic response (Rehder et al., 2023). Emergency departments experienced surges in patient volumes, resulting in overcrowding and extended wait times for patients seeking care (Cohen et al., 2021). This surge in patient volumes presented an urgent need for emergency clinicians to expand their capacity and resources to provide care for the increased patient load (Savioli et al., 2022). One of the ways that healthcare providers have addressed this challenge is by creating surge spaces. Surge spaces are temporary, scalable, and adaptable areas designed to care for the influx of patients during a crisis (O'Donoghue et al., 2021).

Surge spaces can take many forms, ranging from tents or hotels to repurposed areas within existing healthcare facilities, such as unused wards or conference rooms (Kerlin et al., 2021). These spaces can be equipped with essential medical equipment, such as ventilators, beds, and monitors, to provide lifesaving care for critically ill patients (Kerlin et al., 2021). Additionally, surge spaces can be used to isolate patients who are suspected or confirmed to have COVID-19, reducing the risk of transmission to other patients and healthcare workers (Kerlin et al., 2021).

In response to the surge of COVID-19 patients, our emergency department implemented a novel triage screening process to identify low-acuity patients who could be diverted from the emergency department to a surge space where they would be cared for and discharged without entering the main emergency department footprint. This process was implemented immediately before the peak of the first wave of the COVID-19 pandemic at the epicenter, New York City. The purpose of this study was to determine the predictive performance of this triage and diversion process on hospital discharge.

CONTEXT

One of the key solutions that clinicians and decision-makers implemented during the COVID-19 pandemic was the creation of surge spaces. In this section, we describe the process of our coordinated efforts to develop the surge spaces, from identifying suitable locations, ensuring adequate staffing, equipment, and patient safety. By sharing our experiences, we aim to provide insights into optimal surge space conversion practices and inform future pandemic response planning.

SURGE SPACE PLANNING

Effective pre-planning required early engagement with our organizational leaders and was a key component to our preparation. First, our emergency department leadership communicated with executive leadership about patient volume, bed availability, and staffing levels to determine the need for the surge space. Following initial communication with organizational leadership, we determined that two spaces would be required to accommodate the increasing number of COVID-19 patients. A comprehensive plan was created over the course of one week for where and how each surge space would be utilized. This plan also included determining the layout of the space, changing the electronic health record interface to include the new geographic areas of the emergency department, identifying the necessary equipment, and establishing safe staffing requirements.

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SURGE SPACE LAYOUT AND STAFFING

West Surge Space (WSS)

We transformed our waiting room to a patient care area as our first surge space. Here, we formed six additional treatment spaces using chairs and portable barriers between each chair creating cubicles for patients to sit in. This space was approximately 20 feet away from the main emergency department and staffed by one registered nurse and one nurse practitioner or physician assistant. This surge space was open from 10 AM to 12 AM seven days a week with an option to stay open 24 hours a day if staffing was available. After one week of pre-planning with executive leadership, this surge space became fully operational within 24 hours on March 12, 2020, until its closure on April 24, 2020.

Ambulatory Clinic Surge Space (ACSS)

The second surge space was an ambulatory clinic located 600 feet away from the main emergency department. This space provided an additional 14 treatment areas, which were either private rooms or chairs separated by portable barriers. This surge space was staffed by one physician, one physician assistant, and two registered nurses, and open seven days a week from 10 AM to 10 PM. This surge space was fully operational within 48 hours of pre-planning with executive leadership on March 17, 2020, until its closure on April 14, 2020.

SURGE SPACE EQUIPMENT

The ACSS required a code cart, but the WSS, which was closer to the main emergency department and had access to its equipment, did not. Both surge spaces were designed for the treatment of low-acuity COVID-19 patients and therefore resources essential for providing basic care to patients who were experiencing mild symptoms of COVID-19 were made available. This included personal protective equipment, disinfectant wipes, and basic medical equipment, such as pulse oximeters, blood pressure cuffs, thermometers, oxygen tanks, and locked medication bins to store common medications such as fever reducers and albuterol metered-dose inhalers. Nebulizer treatments were not permitted due to the risk of COVID-19 transmission (Benge & Barwise, 2020), and a Cochrane review found that metered-dose inhalers with spacers are at least as effective as nebulized medications (Raissy & Kelly, 2004).

NURSING STAFF COMMUNICATION

Training staff and establishing clear communication channels were critical steps in launching the surge spaces. Nursing leadership was responsible for mobilizing staff and ensuring that necessary resources and support to work in the surge spaces were available. This involved identifying and allocating necessary equipment and supplies and establishing clear guidelines for patient care in the surge spaces. Daily huddles and just-in-time face-to-face communications were the primary modes of relaying information and ensuring collaboration to provide optimal care for patients. Daily huddles are brief team meetings that take place at the beginning of each shift or at a specific time each day, led by a team leader with the sole purpose of sharing important information about patients and discussing issues or concerns that may impact the delivery of care. Daily huddles promote communication, collaboration, and teamwork among nursing staff (Di Vincenzo, 2017). Just-in-time face to face communications are a type of communication that occurs in real-time, in-person, and on an as needed basis to convey critical information for care delivery and to update staff on any changes, which helps reduce errors, improve patient outcomes, and promote collaboration among nursing staff (Chueh & Barnett, 1997).

TRIAGE SCREENING PROTOCOL

Standard of Care Prior to Surge Space Launch

Emergency Severity Index

The Emergency Severity Index (ESI) triage protocol is a widely accepted system for prioritizing patients in the emergency department based on the severity of their medical condition (Gilboy et al., 2005). The ESI triage protocol is standard of care in our emergency department and helps ensure that patients

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receive appropriate and timely medical attention based on the urgency of their medical needs. The ESI triage protocol involves a standardized process for assessing patients based on their chief complaint, vital signs, and other clinical information. Patients are then assigned a triage level from one to five, with level one being the most urgent and level five being the least urgent (Table 1) (Gilboy et al., 2005).

ESI CATEGORY	DESCRIPTION
ESI Level 1 – Resuscitation	Patients who have conditions that are immediately lifethreatening and require immediate medical attention, such as cardiac arrest or respiratory failure
ESI Level 2 – Emergency	Patients who have potentially lifethreatening conditions that require rapid medical intervention, such as severe chest pain or stroke
ESI Level 3 – Urgent	Patients who have serious conditions that require timely medical attention, such as a deep laceration or a high fever
ESI Level 4 – Semi-Urgent	Patients who have serious conditions that require timely medical attention but are not immediately life threatening, such as a sprained ankle or a minor burn
ESI Level 5 – Non-Urgent	Patients who have conditions that are not immediately serious or life-threatening, such as a sore throat or a rash. These patients may require medical attention, but their conditions are not time sensitive and can be treated in a non-emergency setting

Table 1 Emergency Severity Index (ESI) Category and Description.
Source. From "Emergency Severity Index (ESI): A Triage Tool for Emergency Department Care" (Version 4), by N. Gilboy, P. Tanabe, D. Travers, and A. M. Rosenau.

The workflow for triaging a patient involves a systematic approach to evaluate the patient's medical needs and prioritize care accordingly, with the goal of providing the best possible outcomes for the patient quickly and efficiently. The standard workflow includes: 1) arrival and registration - when a patient arrives to the emergency department, they are greeted by a staff member (i.e., clerk) who obtains basic information such as reason for visit, name, and date of birth; 2) an initial assessment by the triage nurse who obtains vital signs (blood pressure, heart rate, respiratory rate, temperature, and oxygen saturation), chief complaint, and relevant medical history; 3) assignment of ESI triage category based on the initial assessment (Table 1); 4) treatment initiation by a physician, physician assistant, or nurse practitioner; and 5) nurse reassessment to monitor patient conditions and ensure safe nursing care.

Novel Triage Screening Protocol Following Surge Space Launch

Our study implemented a novel triage screening protocol in the emergency department to identify low-acuity patients and divert them to a designated surge space, with the aim of optimizing resource allocation and reducing wait times for higher acuity patients. The protocol involved an adapted workflow, wherein the triage nurse performed an initial assessment that did not include vital signs. Patients meeting all of the following criteria for low acuity were immediately escorted by a security officer to one of two designated surge spaces, bypassing the standard workflow: ESI category 4 or 5, ≤70 years old, mild COVID-19 symptoms (e.g., low grade fever, cough, sore throat, fatigue, body aches, loss of smell or taste), and not requiring use of a stretcher. Once the patient reached the surge space, a complete set of vital signs, formal triage, and medical exam was completed by a medical provider.

Whenever a patient showed signs of distress or decompensation, we adhered to the standard protocol of immediately transferring them to the main emergency department for acute care. Although patients in ESI categories 4 and 5 typically have less severe conditions than those in categories 1 to 3, the frequency of their reassessment varied depending on individual factors. At our emergency department, the policy mandates a vital sign reassessment every four hours for ESI category 4 and 5 patients.

METHODS

STUDY DESIGN

Following an exempt determination by the Institutional Review Board, an electronic retrospective chart review for all emergency department encounters was performed over a 44-day period

(March 12, 2020 to April 20, 2020). This period includes the weeks before, during, and after the first wave of COVID-19 infection in New York City (New York City Department of Health and Mental Hygiene. (2020)., n.d.).

SETTING

This study took place at one emergency department within an eight-hospital healthcare organization in the New York metropolitan area. The annual census of patients at this single site emergency department is approximately 70,000, reflecting a diverse patient population in terms of race, ethnicity, age, and income.

SAMPLE

All patients who were diverted to a surge space and had a disposition status of admitted, discharged, left against medical advice, transferred, or expired were included in the sampling frame. Patients who left without being seen (either before triage, before registration, or before a medical provider evaluation) were excluded from the sample.

DATA COLLECTION PROCEDURE

Data were extracted from the electronic health record using a query tool that provided de-identified data in a password protected spreadsheet. The data were transferred to IBM SPSS Statistics for Windows Version 22.0 (IBM Corp., Armonk, NY) for analysis.

MEASURES

We collected the daily census in the main emergency department and in each of the surge spaces. Patient-level measures included assigned surge space location and disposition status (admitted, discharged, left against medical advice, transferred to the main emergency department, or expired). The main outcome was whether or not a patient triaged to the surge space was discharged without entering the main emergency department.

DATA ANALYSIS

We produced a receiver operator curve (ROC) to examine the discrimination power of our surge space triage process to predict discharge disposition. An area under the curve (AUC) greater than 0.90 was operationalized as excellent performance of the triage screening process. An AUC less than 0.90 was operationalized as triage failure.

RESULTS

There were 6,241 patients who were triaged during the 44-day study period, in which one-quarter [n = 1,753 (26%)] were diverted to a surge space. The average number of patients per day over the 44-day period was 141.8 (standard deviation [SD] 54.5) in the main emergency department and 39.8 (SD 29.9) in the surge spaces. Of the patients triaged and diverted to a surge space, a large proportion were successfully discharged from those areas without entering the main emergency department (84%, n = 866 in WSS and 94%, n = 745 in ACSS). Very few signed out against medical advice (3%, n = 26 in WSS and 2%, n = 12 in ACSS), transferred to the main emergency department (1%, n = 8 in WSS and 0.4%, n = 3 in ACSS), or admitted (13%, n = 130 in WSS and 4%, n = 30 in ACSS]. No patients expired in either surge space.

RECEIVER OPERATOR CURVE RESULTS

We analyzed records from the 1,753 patients triaged to a surge space to evaluate the performance of our triage screening process on a successful discharge. As shown in Table 2, the sensitivity, or true positive rate of successful discharge from the surge space following diversion was 98% for the WSS and 94% for the ACSS. The false positive rate, or failure to be discharged from the surge

STATISTIC	AMBULATORY SURGE SPACE	WEST SURGE SPACE
	[% (Confidence Interval (CI)]	
Area Under the Curve	0.964	0.976
Sensitivity	94.3% (92.6 – 96.0)	97.9% (97 – 98.8)
Specificity	98.5% (97.6 – 99.4)	97.4% (96.4 – 98.4)
+ Likelihood Ratio	62.87 (38.5 – 160.7)	37.65 (27.16 – 60.67)
–Likelihood Ratio	0.06 (0.04 – 0.08)	0.02 (0.013 – 0.031)
+Predictive Value	76.7% (73.6 – 79.8)	85.7% (83.6 – 87.8)
–Predictive Value	99.7% (99.3 – 100.0)	99.7% (99.4 – 100)

Table 2 Summary of Results.

space following diversion, was 2.6% for the WSS and 1.5% for the ACSS. The ROC analysis showed that the model had excellent discrimination power, with an AUC of 0.97 for WSS and 0.96 for ACSS. Figure 1 shows the ROC plot and AUC for the WSS and ACSS.

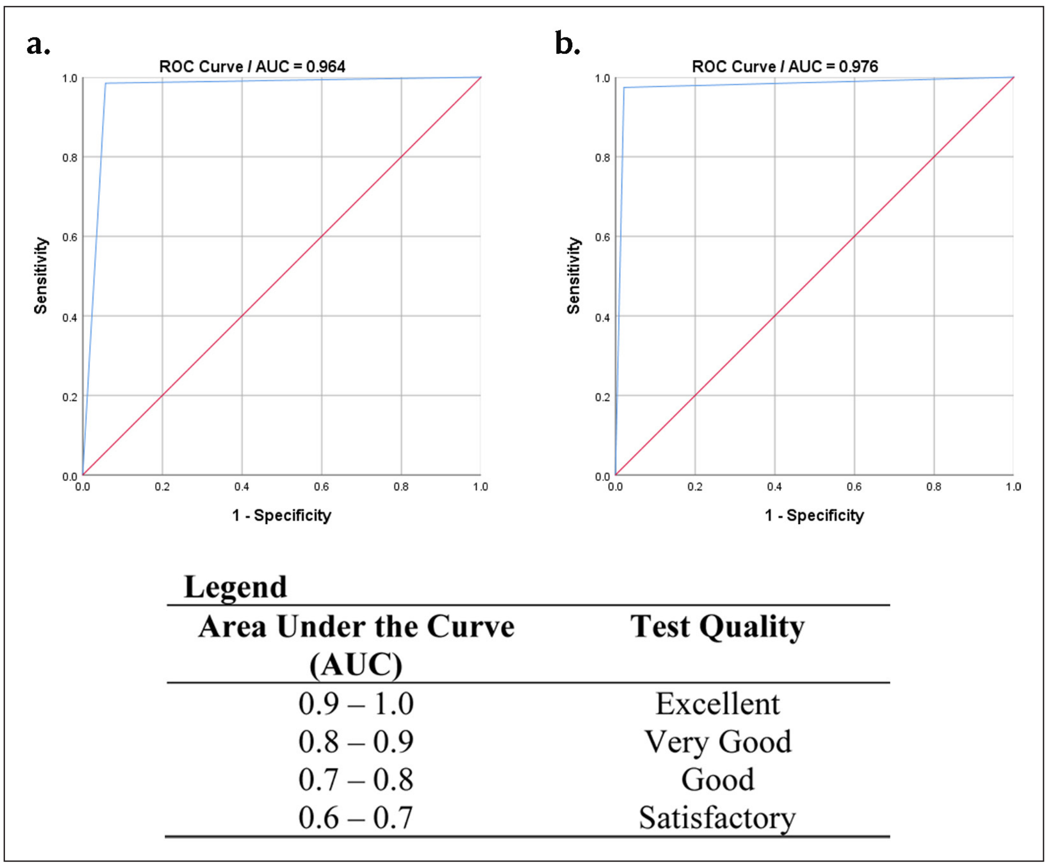

Figure 1 (a) Ambulatory Care Surge Space Receiver Operator Curve and Area Under the Curve. **(b)** West Surge Space Receiver Operator Curve and Area Under the Curve.

DISCUSSION

We implemented a novel triage screening process to divert low acuity patients to a surge space to effectively reduce overcrowding and facilitate their discharge without entering the main emergency department. Reduction in emergency department crowding is an important goal, as overcrowding is associated with adverse patient outcomes such as delays in care, increased length of stay, and increased mortality (Savioli et al., 2022). By diverting low acuity patients to a surge space, higher-acuity resources were made available for patients requiring this level of care (Cohen et al., 2021; O'Donoghue et al., 2021).

Surge spaces have been shown to improve patient outcomes and alleviate burden on healthcare systems both regionally (Keene et al., 2021) and globally (Carenzo et al., 2020; Grave et al., 2021). Successful surge spaces range from convention centers and railway coaches converted to isolation wards equipped with medical facilities to provide basic care for COVID-19 patients (Brown et al., 2020; Kelen & McCarthy, 2006) to hotels that provide isolation and quarantine for patients who did not require hospitalization (Ghinai et al., 2020). Several studies have also demonstrated the effectiveness of surge spaces within the emergency department on improving patient flow, reducing crowding, and improving patient care and outcomes (Bradt et al., 2009; Park et al., 2021; Thomasian et al., 2021; Uppal et al., 2020).

This study should be interpreted in light of several limitations. First, the results may not be generalizable to other emergency departments, as the resources, patient populations, and protocols may differ between sites. Second, the accuracy and completeness of data may be a limitation, as the data queried from the electronic health record were not validated manually. Third, our study lacked a control group, making it difficult to compare outcomes between the surge space program and standard practice. Fourth, this study is limited by the short time frame in which data were collected, as performance of the triage model may change over time. Our study did not collect patient-level demographics, such as age, gender, race or ethnicity, insurance status, or past medical history. Furthermore, patient satisfaction or acceptability of the diversion was not obtained. No clinical demographics of staff were obtained such as years of practice or type of clinician (e.g., float, travel, staff), and acceptability by staff was not measured. Furthermore, a number of operational demographics were not collected such as readmission rates, wait time, time to discharge, number of clinicians working per day or shift across the emergency department, or costs.

While our study was not designed to examine these outcomes, we did observe anecdotal reductions in crowding and wait times, which can have a positive impact on patient satisfaction and outcomes. The use of surge spaces may also have resulted in cost savings for our hospital because resources were conserved for our more critically ill patients in the main emergency department. Additionally, our surge space may have improved patient safety by reducing the risk of COVID-19 transmission to other patients in the main emergency department.

CONCLUSION

In the setting of a New York City emergency department, increasing surge capacity and creating a novel triage screening process to identify low acuity patients with COVID-19 resulted in 26% of patients being diverted from the main footprint. Nearly 92% of patients were successfully discharged from the surge spaces.

COMPETING INTERESTS

The authors have no competing interests to declare.

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