SVOA Medical Research
ISSN:2977-3644

ScienceVolks Open Access

Research

Survival in Newly Created Hospital Units in Response to COVID 19 Pandemic Crisis

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DOI: https://doi.org/10.58624/SVOAMR.2023.01.006

***Received:** June 21, 2023* ***Published:** August 08, 2023*

Abstract

Importance: New York City (NYC) was the first major US city struck by the novel Coronavirus (COVID-19) with significant infection rates, mechanical intubations, and subsequent mortality. New hospital units were created to accommodate the surge of pandemic patients.

Objective: The objective of this study is to examine the outcomes of COVID-19 patients admitted to a community teaching NYC hospital with newly created units and compare them to outcomes of patients admitted to established hospital units to determine if there is a mortality difference.

Design: We retrospectively collected data on patients hospitalized with laboratory-confirmed COVID-19 infection between March 8, 2020 and April 7, 2020. Included were patient demographics, comorbidities, risk factors, clinical factors, laboratory data, imaging studies, hospital course, and outcomes obtained from our electronic medical records. Data were analyzed between two cohorts: new hospital units (NHU) and established hospital units (EHU) to determine if a mortality difference existed.

Setting: The study is based on a 454-bed community teaching hospital in NYC at a location that serves an ethnically diverse population using population-based data.

Participants: All patients included in our study were 17 years or greater in age. The study endpoint was defined as either patient discharge or death, and pregnant women and patients who died in the Emergency Department before admission were excluded from the analysis.

Results: Of the 1288 screened patients, 351 confirmed COVID-19 hospitalized patients were included in our analysis. Specifically, the racial demographics for African Americans were similar between both units (p=0.139). Factors such as elevated BUN, ferritin, lactate dehydrogenase, and troponin were found to be similar in both cohorts. Overall survival was higher for patients in EHU compared to NHU (p=.012). The mortality rate was most striking in the NHU ICU where the mortality, especially in patients on mechanical ventilation (MV), was higher than in EHU ICU units (p = <.004).

Conclusion: Our analysis revealed that patients admitted to newly created hospital units had a significantly lower overall survival rate compared to those admitted to established units, particularly in the NHU ICUs, especially for MV patients. These findings highlight the need for better planning, including the development of protocols that encompass trained providers' assignment, competency, proper orientation to the new unit, team cohesion, familiarity with the equipment, and critically ill patients' allocation. Such measures can help mitigate the survivorship disadvantage observed during surges in hospitalizations, particularly when NHU, especially new ICUs, need to be created.

Keywords: *Covid 19 pandemic, pneumonia, hospital units created during crisis situations, covid 19 survival strategies*

Key Points

Question: When new hospital units are rapidly opened to address a pandemic crisis, is patient survival as good in these new units as compared to more established units?

Findings: Mortality was higher for patients in new hospital units (NHU) compared to established hospital units (EHU) (p=.012). This was most striking in the new ICU units where the mortality was higher than in established ICU units (p = <.004).

Recommendation: Better anticipation and planning including an established protocol is needed when opening new hospital units especially an ICU. This may help improve patient survival during surges inpatient hospitalizations due to pandemic crises.

Introduction

In January 2020 after several pneumonia cases of unknown origin were reported in Wuhan, China, medical authorities isolated a novel coronavirus[1]. The World Health Organization (WHO) designated this virus as the coronavirus disease 2019 (COVID-19).[3]

By March 2020, the global impact of COVID-19 had become evident, following its initial outbreak in Wuhan, China[3,4]. On March 1", NYC had the first confirmed case of COVID 19 followed by a very rapid increase in coronavirus cases[5]. New York State went on "PAUSE" (a 10-point policy to assure uniform safety for everyone)[6] on March 22. In anticipation of a surge in coronavirus cases, the city immediately acted to secure resources such as testing capability, ventilators, reserve medical personnel, and increased hospital bed capacity[7].

In response to the anticipated surge of COVID-19 patients, the New York State Department of Health mandated that hospitals increase their bed capacity by 50%[8]. The objective of our study was to analyze the outcomes of admitted COVID-19 patients after the state mandate to open new beds, specifically, whether patient outcomes differed in new hospital units (NHU) versus established hospitals unit (EHU).

Methods

Study Design and Participants

This is a retrospective study that examined patients hospitalized with laboratory-confirmed COVID-19 infection at our 484-bed institution between March 8, 2020, and April 7, 2020. The study included patients who were ≥17 years old, and pregnant women and patients who expired in the Emergency Department (ED) prior to admission were excluded. Patients were diagnosed using viral detection tests from a nasopharyngeal swab or a sputum sample, depending on the availability of testing supplies. Institutional Review Board approval was obtained.

Patient Assignment to Hospital Location

Patients were assigned to beds based on their acuity, and triage to new hospital units (NHU) or established hospital units (EHU) was done according to the first available bed. The assignment was random and done to quickly decompress the emergency department.

Data Collection

The WHO International Severe Acute Respiratory and Emerging Infections Consortium (ISARIC) case record form was used for data collection.[9] Patient data were obtained from our electronic medical records (EPIC and Allscripts). Two physicians (MC and VP) collected and checked the data.

Statistical Analysis

All statistical tests were run using SPSS v26. Continuous variables were analyzed with a two-tailed independent T-test, and categorical variables were analyzed with a Pearson Chi-Square or a two-sided Fisher's Exact Test. In Table 2, the means and standard deviation were derived from non-adjusted data, and the significance levels were generated after normalization. The statistical tests used assumed that the categories were independent and, as such, without any repeated measures, the missing variables should not have influenced the results.

Results

For the study period March 8, 2020 - April 7, 2020, there were a total of 1,288 symptomatic patients screened for COVID-19 in our ED. Of those, 842 (65%) tested positive, and 362 (28%) were severely symptomatic requiring admission. We included 351 patients in our analysis. EHU had 254 while NHU had 97 patients admitted to the units respectively.

The analysis showed that hospital units were matched for age: mean 64.70 (NHU) and 64.27 (EHU). Both cohorts saw equal gender and racial distributions (p=>.05). (Table 1). Comorbidities associated with poor COVID-19 outcomes were similar between the cohorts: Smoking, HTN, DM, chronic cardiac disease, chronic pulmonary disease, obesity, and even radiologic findings of infiltrates (Table 1). Laboratory elevations consistent with the COVID-19 showed no difference between cohorts, except for the elevation of lactic acid levels (Table 2). In short, patients in NHU versus EHU locations were matched for gender, race, comorbidities, and labs on admission. Mechanical ventilation (MV) requirement was higher in NHU patients (26.80%) compared to EHU patients (16.90%) (p=.037), as shown in Table 3

The overall survival rate of COVID-19 patients was higher for EHU when compared to NHU (p=.012, Table 3). The mortality disadvantage was primarily in the NHU ICU (92.30%) compared to the EHU ICU (60%) (p=<.004), as shown in Table 4, especially in mechanically ventilated patients. Mortality for patients admitted to the floor remained similar (p=0.783, Table 4).

Table 1. Demographic information, comorbidities, signs and symptoms and radiological findings of COVID positive patients hospitalized in Established Hospital Unit (EHU) vs New Hospital Unit (NHU).

Mean is shown for continuous variables; Number of patients (percentage of patients in each group) are shown for categorical data. Differences in each group in NHU vs EHU were tested for all variables with more than 5 cases in each group using the multinomial logistic regression adjusted for age and sex.

	EHU N=254%	NHU N=97%	P-Value
Demographics			
Age (years)	64.27 (16.74)	64.70 (15.29)	.826
Sex	F=124(49)	F = 41(42)	.271
	M = 130(51)	M = 56(58)	
AA	170 (73)	68 (65)	.139
Comorbidities			
Smoker	56 (22)	16(16.5)	.249
HTN	185(72.8)	63(65)	.147
DM	115(45.3)	43(44.3)	.873
CCD	57(22.4)	20(20.6)	.712
CPD	30 (11.8)	15(15.5)	.360
Obesity	98(38.6)	44(45.4)	.247
Infiltrates	215(84.6)	80(82.4)	.564

*Statistically significant p-values are highlighted in bold

AA-African American, HTN- hypertension, DM-diabetes mellitus, CCD- chronic cardiovascular disease, CPD-chronic pulmonary disease

Table 2. Pertinent labs of hospitalized COVID positive patients in EHU vs NHU.

	EHU N=254	NHU N=97	P-Value
	Mean (SD)	Mean (SD)	
CBC	7.24 (3.79) K/cmm	7.68 (4.42) K/cmm	.354
Abs. Lymp	1(0.71) K /cmm	1.07 (1.79) K/cmm	.599
ALT	43.12 (59.24) U/L	41.87 (45.70) U/L	.851
Creatinine	2.7 (7.23) mg/dL.	2.09 (2.47) mg/dL.	.417
BUN	32.83 (35.37) mg/dL.	29.09 (28.83) mg/ dL	.353
Ferritin	1632.69 (3403.82) mg/ dL.	2236.54 (4541.60) mg/dL	.178
Troponin	0.09 (0.35) ng/mL.	0.21 (0.96) ng/ml.	.086

*Statistically significant p-values are highlighted in bold

Table 3. Complete hospital course of COVID positive patients in EHU vs NHU including mechanical ventilation, the associated mortality and survival rate.

	EHU N=254 (%)	NHU N=97 (%)	p-value
NIV	57 (22.40)	20 (20.60)	.715
MV	45 (16.90)	26 (26.80)	**.037**
MV Mortality	35 (77.78)	25 (96.15)	**.040**
Survival Overall	187 (73.60)	58 (59.80)	**.012**

* Statistically significant p-values are highlighted in bold

NIV – noninvasive ventilation, MV – mechanical ventilation

Table 4: Hospital course of COVID positive patients in EHU vs NHU for floor vs ICU and the associated mortality.

	EHU N (%)	NHU N (%)	p-value
Floor	**209 (82.28)**	**71 (73.20)**	.058
Floor Mortality	41 (19.61)	15 (21.12)	.783
ICU	**45 (17.72)**	**26 (26.80)**	.058
ICU Mortality	27 (60.00)	24 (92.30)	**.004**

* Statistically significant p-values are highlighted in bold

Discussion and Conclusion

Our study looks retrospectively at the clinical course and outcomes of COVID-19 patients in a community teaching hospital. As NYC became overwhelmed by a surge of COVID-19 patients, hospitals were asked to increase their bed capacity by the Department of Health (DOH) to accommodate patients.[8,10] In response, hospitals created new units to board patients requiring hospitalization and ventilators. To staff new pandemic in-patient needs, our institution declared an ACGME pandemic crisis, allowing the shift of residents to areas of patient need.[11] Redeployed house staff from various disciplines alongside advanced practice providers staffed the screening tents, EDS, ICUs, and in-hospital floors. New teams were created. EHU ICUs continued with their current staff of attending intensivists, internal medicine residents, and fellows. NHU ICUs were staffed with experienced nurses from the other hospital units including the OR, intensivists, advanced practice providers from inpatient and outpatient clinics, attendings and residents from non-internal medicine specialties, and respiratory therapists. New floor units were staffed with a mix of internal medicine and family medicine attendings and residents.

Although healthcare workers and hospital staff performed heroically, hospitals faced significant challenges, including the goal of increasing bed capacity by 50%, increased patient acuity, staff competency, and limited staffing resources. Patient assignment to NHU or EHU was done randomly to the first available bed matched to patient acuity to allow for the rapid decompression of the ED. Despite similarities in patient populations, overall survival was better in EHU compared to NHU. The incidence of mechanical ventilation (MV) was significantly higher in NHU, and among the critically ill patients requiring MV, survivorship was significantly lower in the NHU (Table 3). Although it is difficult to pinpoint the exact cause for the reduced survivorship, it is worth noting that the ventilators in the NHU were new to the hospital, and the respiratory therapists had been in-service and did not report any difficulty with these machines. In addition, team members in the NHU ICU did not have prior experience working together, and due to staff illnesses, team members often had different shifts, resulting in a different mix of staff members. Despite similar supplies and equipment availability in both units, EHU may have had quicker access due to pre-existing knowledge of supply locations.

As we look ahead to potential disease resurgence, better anticipation and planning are needed when opening new hospital units. Hospital and ICU bed availability, along with ventilators, should be considered in public health governmental planning, and emphasis should be placed on the availability of skilled providers, their competency, and proper orientation to new facilities. Facilitating team cohesion and assigning groups that are familiar with one another, particularly in the ICU, may help improve patient survival. Finally, contingency plans should prioritize admitting the sickest patients to existing cohesive teams.

Conflict of Interest

The authors declare no conflict of interest.

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Citation: M. Cao, Bridges K, Vemulapalli P, Sexton J, Gilchrist B. Case Report: Survival in Newly Created Hospital Units in Response to COVID 19 Pandemic Crisis. *SVOA Medical Research* 2023, 1:1, 24-29.