KANSAS JOURNAL of MEDICINE

Hospital Collaboration in Response to the COVID-19 Pandemic in Kansas City Metropolitan Region

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Received Dec. 2, 2020; Accepted for publication Feb. 15, 2021; Published online April 19, 2021
https://doi.org/10.17161/kjm.vol1414774

ABSTRACT

Introduction. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2, aka COVID-19) virus has evolved into a World Health Organization-declared pandemic which has strained our regional critical care and hospital resources.

Methods. A Critical Care Task Force was established between Kansas City area intensive care units to allow for preparedness for potential surges by sharing of bed capacity both in the ICU and hospital, and ventilator capacity as well as weekly web-based meetings to share resource concerns and best practice. This Task Force also collected patient information to understand the dynamics of community impact and resource needs better. This effort allowed for compilation and dissemination of information regarding data that describe characteristics of patients with COVID-19 compared to a random sample of medical ICU patients with conditions other than COVID-19.

Demographic and therapeutic factors affecting patients admitted to medical intensive care units in the Kansas City metro area are reported from May 5, 2020 until June 2, 2020 using a retrospective case-control study examining gender, race, and therapeutic options including modes of ventilation, vasopressor requirements, renal-replacement therapy, and disposition.

Results. During data collection, patients being treated for COVID-19 in intensive care units in the Kansas City metropolitan area were more likely to be older, less likely to be white, and less likely to be immunosuppressed as compared to those being treated for non-COVID illnesses. They were more likely to require non-invasive ventilation and undergo prone positioning but were equally likely to require invasive ventilation and other organ supportive therapy.

Conclusions. Hospitalized patients being treated for COVID-19 in the Kansas City metropolitan area have similar demographics to those being reported in the U.S. including age and race. Additionally, establishing a Critical Care Task Force in response to the pandemic allowed for preparation for a potential surge, establishing capacity, and disseminating timely information to policy makers and critical care workers on the front line. ***Kans J Med 2021;14:108-110***

INTRODUCTION

The severe acute respiratory syndrome coronavirus 2 virus (SARS-CoV-2, aka COVID-19) evolved into a World Health Organization (WHO)-declared worldwide pandemic with high incidence of respiratory disease, including acute respiratory distress syndrome (ARDS) and critical illness requiring intensive care. To date, it is not clear how many patients needed hospitalization due to lack of clarity in total numbers of cases, however, it is thought to be approximately 4.6 per 100,000 population with significant variation with age.[1] Reports suggested that intensive care unit care (ICU) admission is required in 10 - 20% of hospitalized patients, although estimates range as high as 35%, with 75% of hospitalized patients requiring supplemental oxygen and 3 - 10% requiring intubation.[2,3] Of those that were admitted to the ICU, 19 - 91% required invasive mechanical ventilation.

Initial reports from China revealed a case fatality rate of 5%.[4] However, other research has suggested critical disease involving respiratory failure, pneumonia, shock, and multiorgan failure in 5% of cases, with mortality in the 2% to 5% range. Also, there have been numerous reports regarding risk factors which predispose patients to infection and morbidity with COVID-19 in the scientific literature and popular press. The most noted were race and age, with non-white race and increasing age being risk factors for both infection risk and mortality.[5-7] Additionally, there has been reporting on age, hypertension, diabetes mellitus, and chronic lung disease as risk factors for higher severity of disease and mortality.[8-10]

The pandemic has caused changes to healthcare administration due to multiple challenges, including but not limited to testing, patient isolation, personal protective equipment, medication shortages, supply chain disruptions, and prolonged ventilation requirements. Early reports from China reported on shortages of oxygen, personal protective equipment, and ventilators.[11] To inform changes to the system, there has been a need for hospital systems to examine resource allocation, both within the individual institution and across multiple systems. This examination included closer contact between systems to act as a method for distributing needed materials and to act as a buffer for patients in the case a single or several individual locations reached capacity. To this end, an ad-hoc group of regional ICU leaders was assembled to facilitate discussions regarding immediate needs and best practices for this unique and evolving patient population. The group had a mandate to identify current and emerging needs across health care delivery, as well as to form (and share) mitigation strategies when shortages or potential shortages were identified.

This study reported on the creation of a collaboration network of critical care divisions from hospitals within the Kansas City metropolitan area and surrounding areas. Additionally, it reported on preliminary data, including demographics, about the patients who have been impacted by the COVID-19 virus in the Kansas City metropolitan area.

METHODS

The consortium of fifteen Kansas City COVID-19 medical intensive care units (MICUs) was established in March 2020 to communicate between the Kansas City metropolitan area hospitals and share information on COVID-19 preparedness. This information emphasized, but was not limited to, bed and ventilator availability at both current and surge capacity. Information regarding number of critical care trained providers, including attending-level, fellow, and advanced-practice providers (APP) also was obtained and distributed to the group.

Additionally, a retrospective case-control analysis was conducted using patients older than 18 admitted to a hospital within the newly formed Kansas City COVID-19 Critical Care Consortium. Patients with both SARS-CoV-19 polymerase chain reaction positive and negative results were selected from across all 15 sites. Data including demographics, level of service required, ventilator requirement, treatment strategy, and disposition were obtained from chart review and stored and analyzed as aggregate, de-identified data.

Study data were collected and managed using REDCap® (Vanderbilt University, Nashville, TN, USA) hosted at the University of Kansas Medical Center. Resources of the Critical Care Task Force were summarized descriptively. The t-test was used to compare patients' ages between the COVID-19 positive and negative groups. Chi-square tests or Fisher's exact tests were used to compare categorical variables (demographic information other than ages, patients receiving therapies, and outcomes), as appropriate. A significance level of 0.05 was used for all tests. All statistical analyses were conducted using SAS software version 9.4 (SAS Institute Inc., Cary, NC, USA).

RESULTS

The consortium of Kansas City COVID-19 medical intensive care units (MICU) included 15 sites in the Kansas City metropolitan area and surrounding regions including Kansas City, Kansas and Kansas City, Missouri. Within those 15 sites, as of June 5, 2020, there were a total of 222 critical care trained providers (mean 14.8 per site, SD 22.9, median 6) with a minimum of 2 and a maximum of 87. There were 542 ICU beds available (mean 36.1 per site, SD 34.1) with a surge bed capacity to an additional 540 beds (mean 36 per site, SD 37.1). There were 487 available ventilators across all 15 ICUs (mean 32.5 per site, SD 34.1), with an additional 597 available as surge capacity (mean 39.8 per site, SD 39.4).

As of June 2, 2020, there were 10,320 total COVID-19 cases reported across Kansas, with 2,350 reported in the Johnson and Wyandotte counties.[12] Across the study sites, 160 COVID-19 confirmed patients (84.7%) were compared against 29 (15.3%) COVID-19 negative patients. Patients who were COVID-19 positive were more likely to be older (61.7 years old versus 50 years old, $p = 0.001$) and were less likely to be white (46.9% non-white race versus 10.3% white, $p < 0.001$) as compared to non-white (Table 1). Patients with COVID-19 were less likely to be immunosuppressed (28.1% versus 48.3%, $p = 0.031$) compared to COVID-19 negative patients (Table 2).

From a treatment perspective, COVID-19 patients were more likely to require non-invasive ventilation (45.6% versus 24.1%, $p = 0.031$) and were more likely to undergo prone positioning (25% versus 3.4%, $p = 0.007$), but were equally likely to require invasive ventilation (33.1% versus 34.5%, $p = 0.887$). Vasopressor requirement (23.1% versus 24.1%, $p = 0.906$), renal replacement therapy usage (13.8% versus 10.3%, $p = 0.772$), and rate of tracheostomy placement (5.6% versus 10.3%, $p = 0.400$) were equal in the two populations (Figure 1).

Table 1. Demographic information of patients selected for evaluation based on SARS-CoV-2 (COVID-19) testing.

	COVID positive (n = 160)	COVID negative (n = 29)	p value
Age (mean, SD)	61.7 (16.3)	50.0 (19.2)	0.001
Female gender (n, %)	69 (43.1%)	10 (34.5%)	0.385
Race (n, %)			< 0.001
White	42 (26.3%)	21 (72.4%)	
Other	75 (46.9%)	3 (10.3%)	
Unknown	43 (26.9%)	5 (17.2%)	
Ethnicity (n, %)			0.111
Hispanic/Latino	34 (21.3%)	2 (6.9%)	
Not Hispanic/Latino	111 (69.4%)	23 (79.3%)	
Unknown	15 (9.4%)	4 (13.8%)	
Immunosuppressed (n, %)	45 (28.1%)	14 (48.3%)	0.031

Table 2. Number (%) of patients receiving therapies at any time during index hospitalization.

	COVID positive (n = 160)	COVID negative (n = 29)	p value
Non-invasive ventilation	73 (45.6%)	7 (24.1%)	0.031
Invasive ventilation	53 (33.1%)	10 (34.5%)	0.887
Prone positioning	40 (25.0%)	1 (3.4%)	0.007
Vasopressor use	37 (23.1%)	7 (24.1%)	0.906
Renal replacement therapy	22 (13.8%)	3 (10.3%)	0.772
Tracheostomy	9 (5.6%)	3 (10.3%)	0.400

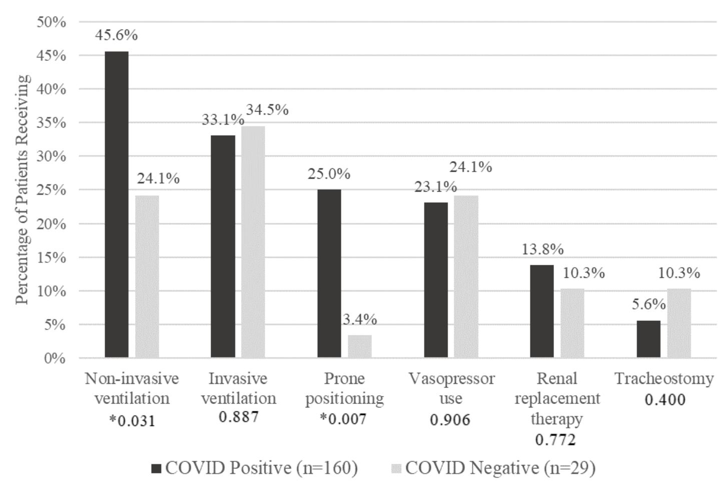

Figure 1. Comparison of therapy use as a percentage of patients receiving the indicated therapy at any point during the reference hospital stay. p value of difference is indicated below each therapy and significant differences are indicated with a *.

Table 3. Outcome of patients during index hospitalization (n, %).

	COVID positive (n = 160)	COVID negative (n = 29)
Death	22 (13.8%)	1 (3.4%)
ICU discharge	40 (25.0%)	7 (24.1%)
In ICU care	13 (8.1%)	2 (6.9%)
Non-ICU hospital care	7 (4.4%)	10 (34.5%)
Hospital discharge	78 (48.8%)	5 (17.2%)
Other	0 (0%)	4 (13.8%)

DISCUSSION

In terms of the patient population, patients who were admitted to the hospital or ICU in Kansas City followed similar patterns as those that have been reported across the country. Namely, patients were more likely to be older and non-white. Previous reports demonstrated that the majority of patients that required hospitalization were older than 50 years old and that the highest rates were seen in patients who were older than 65 years old.[2] This closely followed our findings with an average age of COVID admissions of 62 years old compared to 50 years old for non-COVID admissions.

Similarly, studies across the U.S. demonstrated disproportionately high rates of COVID-19 infections ranging from 18% to 70% of positive tests despite being approximately 13% of the U.S. population.[2,13] The preponderance of non-white patients and their elevated risk of hospitalization has been discussed elsewhere.[6,14-15] Proposals for the etiology include a combination of health care factors including elevated rates of comorbidities which have demonstrated elevated rates of disease, severity of disease, and exposure risk including higher rates of essential work that combine to result in higher infection rates and more severe morbidity.

Additionally, rates of invasive and non-invasive mechanical ventilation were comparable with rates that have been found elsewhere.[2] However, immunosuppressed patients comprised a smaller fraction of ICU patients in the COVID-19 positive group when compared to the COVID negative group. This could be explained by more stringent physical distancing and reduced exposure behavior in this group identified as being at higher risk for morbidity and/or mortality with exposure.

The start of the COVID-19 pandemic resulted in significant changes to the healthcare landscape. There has been great concern regarding capacity of hospitals, intensive care units, and ventilators, as well as access to new medications, established medications, and supply chain components. To address these concerns, a collaboration among critical care divisions in the Kansas City metropolitan area was created. The collaboration arose as a means for the various ICUs to share critically important information during the pandemic, including resource capabilities and COVID-19 infection rates. The hope was that this would allow for more effective sharing of resources in case a single ICU or group of ICUs were short of supplies or reached capacity to facilitate rapid transfer of patients and materials between hospitals.

Limitations. This study was small in scale and restricted to patients within the ICU setting in the Kansas City metropolitan area. We sought to explore if the COVID-19 patient population from this area was similar to those that have been reported in other regions globally and in disparate parts of the United States. However, our respective population was small and extrapolation must be made carefully. Notably, patients were not matched for degree of illness (other than requiring ICU level of care at some point in their stay) or based on demographics.

CONCLUSIONS

Networking between hospitals and hospital systems is an integral strategy to reduce the risk of shortages of supplies or bed availability and to improve the likelihood of rapid and efficient sharing of resources if they are distributed differently than current needs within a local area. This need had come to the forefront during the SARS-CoV-2 (COVID-19) pandemic as hospitals around the U.S. and around the world have faced shortages in needed supplies. Although the Kansas City metropolitan area consortium has not been required to facilitate transfers of patients or equipment to date, reporting of its existence and initiation can assist with its functioning. Additionally, the patient population that has been the most effected by the COVID-19 population in Kansas City has mirrored the national trend of older non-white people with an increased need for respiratory support.

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Keywords: SARS-CoV-2, intensive care units, critical care