RESPIRATORY CARE

Research Article | Original Research

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https://doi.org/10.4187/respcare.10401

Cite as: RESPCARE 2022; 10.4187/respcare.10401

Received: 2 August 2022
Accepted: 6 October 2022

Title:

Daily oxygenation support for patients hospitalized with SARS-CoV-2 in an integrated health system

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Name and location of the institution where the study was performed: Baylor Scott & White Health, Texas, United States

Name, date and location of any meeting or forum where research data were previously presented, and who presented: None.

Sources of financial support:

This work was partially funded by the Cardiovascular Research Review Committee of the Baylor Healthcare System Foundation, Society of Critical Care Medicine, and the Gordon and Betty Moore Foundation.

Conflict of interest statement for all authors:

There are no conflicts or potential conflicts of interest reported by authors.

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Word Count:

2,771

Abstract

Background: Many studies of novel coronavirus 2019 (COVID-19) are constructed to report hospitalization outcomes, with few large multi-center population-based reports on the time course of intra-hospitalization characteristics, including daily oxygenation support requirements. Comprehensive epidemiologic profiles of oxygenation methods used by day and by week during hospitalization across all severities are important to illustrate the clinical and economic burden of COVID-19 hospitalizations.

Methods: This is a retrospective, multicenter observational cohort study of 15,361 consecutive hospitalizations of patients with COVID-19 at 25 adult acute care hospitals in Texas participating in the Society of Critical Care Medicine Discovery Viral Respiratory Illness Universal Study (VIRUS) COVID-19 registry

Results: At initial hospitalization, the majority required nasal cannula (44.0%) with increasing proportion of invasive mechanical ventilation in the first week and particularly the weeks to follow. After four weeks of acute illness, 69.9% of adults hospitalized with COVID-19 required intermediate (e.g., high-flow nasal cannula, non-invasive ventilation) or advanced respiratory support (e.g., invasive mechanical ventilation), with similar proportions extending to hospitalizations lasting 6 weeks or longer.

Conclusions: Data representation of intra-hospital processes of care drawn from hospitals with varied size, teaching and trauma designations is important to presenting a balanced perspective of care delivery mechanisms employed, such as daily oxygen method utilization.

Keywords

SARS-CoV-2; hospitalization; high-flow nasal cannula; oxygen support; chronic critical illness;

Introduction

Throughout the pandemic, observational studies evaluating data across integrated health systems[1-3] in patients with coronavirus disease 2019 (COVID-19) have reported hospital mortality and hospitalization characteristics, including length of stay, intensive care unit (ICU) admission rates, and the varying levels of oxygen support required for treating respiratory failure[2, 4]. These epidemiologic insights into broad processes of care during hospitalization have generated consensus around risk factors associated with ICU admission, in-hospital mortality and post-hospitalization debility attributed to COVID-19[5, 6]. Many studies, however, are constructed to report hospitalization outcomes, with few large multi-center population-based reports on the time course of intra-hospitalization characteristics, including daily oxygenation support requirements. Further, the incidence and prevalence and characteristics of patients with chronic critical illness, broadly defined as organ failure requiring prolonged ICU stays of >6 days[7, 8], are difficult to discern from existing aggregate reports of COVID-19 hospitalizations.

Hence, high-quality integrated health system data offer insights into community-level contributions that may otherwise be hidden in prominent datasets reporting largely on academic medical centers[9]. Thus, we describe catchment-area factors (i.e., facility volumes, location, trauma center status) and patient characteristics, including daily oxygenation support, and outcomes associated with critical illness and mortality for adults hospitalized with COVID-19.

Methods

We conducted a retrospective, multicenter cohort study of adult patients admitted to 25 hospitals within an integrated health system over 12 months (March 13, 2020 – February 28, 2021). This research was approved by the Baylor Scott & White Research Institute's Institutional

Review Board (#020-119) with a waiver for informed consent. The ClinicalTrials.gov identifier is NCT04323787 and the reporting of this study conforms to the STROBE statement[10].

Study Population, Setting and Data Collection

Baylor Scott & White Health hospitals participating in the Society of Critical Care Medicine Discovery Viral Respiratory Illness Universal Study (VIRUS) COVID-19 registry for patients hospitalized with SARS-CoV-2 were included in this study[11]. Inclusion criteria were hospitalized, adult (age ≥18 years) patients with either a positive polymerase chain reaction (PCR) test result for SARS-CoV-2 during their admission or within the preceding 14 days or diagnosed with COVID-19. Our patient selection criteria were consistent with approaches applied by large United States networks to extract COVID-19 illness diagnoses (e.g., COVID-19, respiratory failure, or pneumonia) or related signs or symptoms (e.g., cough, fever, dyspnea, vomiting, diarrhea) using diagnosis codes from ICD-10 in combination with COVID-19 test results and identifiers[12]. The exclusion criteria were hospitalizations missing discharge status or missing patient age.

Twenty-five hospitals serving rural, suburban, and urban settings within an integrated health system contributed data to this analysis. As an integrated health system, participating hospitals were directly linked to resource- and knowledge-sharing via institutionally-embedded logistic distribution center and system acute care council networks which were matured prior to the pandemic. For example, regional forecasting of hospitalization demand paired with just-in-time institutional oxygen delivery equipment (e.g., high flow nasal cannula (HFNC), invasive mechanical ventilation (IMV)) between hospitals occurred at least daily to enable anticipatory oxygen device inventory readiness for all sites throughout the pandemic. This approach enabled clinicians to select from the full array of oxygen methods to match patient acuity at their discretion, so oxygen method selections were neither affected by equipment scarcity nor tethered to medication delivery methods.

Variables were defined by the international multicenter Society of Critical Care Medicine COVID-19 VIRUS registry[11], with core elements drawn from the World Health Organization templates[13]. Comorbidities were classified using validated ICD-10 algorithms[14] for the Charlson Comorbidity Index[15]. We accessed the Epic electronic health record using structured query language to obtain all variables. Query development was an iterative process between the principal investigator and the programming team, which focused on continuous quality improvement[16]. To validate the integrity of data, consecutive subsets of cases were verified using manual data abstraction procedures. Study data were collected and managed using REDCap electronic data capture tools hosted at Baylor Scott & White Health[17]. Consecutive cases are reported at the hospitalization-level. Data elements in the VIRUS registry have been reported previously[11]. For this report, data elements include demographics, comorbidities, and hospitalization characteristics with daily oxygenation support methods. Oxygenation support methods are classified as low (e.g., conventional nasal cannula), intermediate (e.g., HFNC, non-invasive ventilation (NIV)) and advanced respiratory support (e.g., IMV).

Statistical Analysis

Descriptive results are reported using medians [quartile 1, quartile 3] for continuous variables, frequencies and percentages for categorical variables, and data visualizations via box plots and histograms. Proportions are computed on known values; thus, missing data are removed from denominators. We tested for differences between groups using the Cochran-Armitage test for trend, Chi-Square, Fisher's Exact, Wilcoxon Rank Sum, and Kruskal-Wallis tests, as appropriate. Statistical analyses were conducted using SAS Enterprise Guide Version

9.4 (SAS Institute Inc., Cary, NC) software. All statistical tests were two-sided with a statistical significance level set at p-value < .05.

Results

There are 26 adult acute care hospitals within the Baylor Scott & White Health system in Texas with a shared Electronic Health Record. One of the facilities was excluded due to incomplete data reporting. The 25 participating hospitals represent diversity in trauma level designation (16% Level 1-2; 16% Level 3; 68% Level 4), teaching hospitals (4), and hospital size (11 hospitals <100 beds; 8 hospitals 101-200 beds; 3 hospitals 201-399 beds; and 3 hospitals >400 beds) spanning a 36,000 square mile service area (**Figure 1**). Bed counts range from 15 to 914 beds per hospital (mean=150, standard deviation=188). Of a total of 4,457 licensed beds, almost half (46%) represent non-teaching hospitals.

Among 18,267 hospitalization records of patients with COVID-19 at 25 hospitals during the study period, 2,759 hospitalizations with unknown discharge status and 147 patients under 18 years old were excluded, thus 15,361 hospitalizations met eligibility criteria and were included in analyses. Patient characteristics stratified by the highest level of oxygenation support requiring during hospitalization are presented in **Table 1**. The overall sample was predominantly male (53.0%, n= 8,145) and White (74.1%, n=11,383). Significant differences were observed across age groups in every characteristic examined, including lower Body Mass Index (BMI) in older adults and fewer comorbidities in younger adults. The proportion of hospitalizations for respiratory failure increased from younger (18-49 years) to older age groups (5.7% to 12.7%, p<0.0001) (Supplemental **Table 1**). Similarly, the proportion of ICU admissions was lowest for younger adults, and their ICU and hospital survival rates were higher than for adults aged 65 years and above (**Supplemental Table 2**, **Supplemental Table 3**).

Methods of oxygenation support required by adults hospitalized with COVID-19 are stratified by day (**Figure 2**) and by waves of hospital admissions (**Supplemental Figure 1)** to present distributions over time. On the first day of hospitalization, 44.0% required basic oxygen support (e.g., nasal cannula), 12.9% required intermediate respiratory support (e.g., HFNC, NIV) and 2.8% requiring advanced oxygen delivery methods (e.g., IMV). By Day 4 of hospitalization, oxygen support methods reflect higher proportions of intermediate and advanced respiratory support, from a combined 15.7% at hospital admission to 34% of patients still admitted. Overall, the proportion of high-acuity oxygenation support demand increases over time, reflecting a decreasing denominator of patients with longer hospitalization durations (**Figure 3**). After four weeks of acute illness, 69.9% of adults hospitalized with COVID-19 required intermediate or advanced respiratory support, with similar proportions extending to hospitalizations lasting 6 weeks or longer.

Discussion

In this diverse 25-hospital consecutive case series describing all COVID-19 hospitalizations irrespective of oxygenation requirements and acuity, we observed that oxygen support was required in 60% of adults on the day of hospital admission, reflecting varied initial presentations of hypoxemia. At one week, >70% of patients hospitalized with COVID-19 required oxygen support (**Figure 2**). Intermediate respiratory support (i.e., high-flow nasal cannula [HFNC], non-invasive ventilation [NIV]) represents an increasing proportion of oxygenation method utilization across the time-course of COVID-19 hospitalizations, increasing from 13% of hospitalized adults at admission to 32% at one week, and to 70% of adults hospitalized at one month. Similarly, in prolonged hospitalizations lasting five, six or seven weeks, IMV utilization represents the oxygenation method in >50% of patients (**Figure 3**). We illustrate that while the number of patients decreases over time due to hospital discharge or death, the prevalence of daily oxygenation support remains high (78-88%) when hospitalizations are >6 days. The utilization of oxygenation methods influence patient outcomes, clinician workload, and health system resourcing. To the best of our knowledge, this is the first multi-site study conveying basic, intermediate and advanced oxygenation support requirements as a time-course and inclusive of hospitalization stays longer than two weeks.

Despite the intuitive nature of day-by-day oxygenation support methods required throughout hospitalizations across all severities of COVID-19 illness, few cohort analyses have demonstrated the persistence of high oxygen demands extending into chronic critical illness (>6 days) with oxygen methods needed during very long hospitalizations (e.g., >2 weeks). Thus far, oxygen support requirements of hospitalized adults with COVID-19 represent a patchwork of populations, geographies and exposures, with most reports aggregating oxygenation methods used at the hospitalization level, which mask the system-level epidemiology of demand. For example, in the few very large cohort studies describing >10,000 hospitalizations, the methods of oxygen support during hospitalization include reports of 17.0-55.0% requiring IMV, as few as 2.8% requiring HFNC, 56.0% requiring nasal cannula and reports of 13.1% of the hospitalized patient population not requiring any oxygen support[5, 18]. In contrast to these reports, we present comprehensive epidemiologic profiles of oxygenation methods used by day and by week during hospitalization across all severities of COVID-19. We demonstrate that a clinically significant proportion of 44% of hospitalized adults across 25 hospitals relied on low levels of oxygenation support (conventional nasal cannula) at admission. In general, the diversity of oxygenation support methods needed by patients hospitalized with COVID-19 were relatively similar during the first three days of hospitalization, with fewer than 1 in 4 requiring intermediate or advanced oxygen support (HFNC, NIV, IMV) each day. In contrast, 1 in 2 adults hospitalized with COVID-19 required intermediate or advanced oxygen support on Day 14. Generally patients with chronic critical illness require longer hospitalizations and thus need more resources allocated for inpatient care[7, 19, 20]. For the subset of hospitalizations persisting to six weeks, more than 70% were relying on intermediate and advanced oxygen support methods.

Trends in oxygenation support method utilization over the daily and weekly time-course of COVID-19 hospitalizations can contribute to high-level resource allocation and health care delivery planning, to help inform long-range equipment and staffing needs. Additionally, all patients with a COVID-19 diagnosis require equipment and clinician time-related resources, including Personal Protective Equipment[21] and visitation restrictions altering the usual frequency and communication patterns with family members[22, 23]. Overall, care processes are affected across the continuum of daily oxygenation method utilization, with time costs and resources tied to COVID-19 hospitalizations. The risk factors associated with ICU admission and in-hospital mortality specific to COVID-19 are aligned with previous reports[5, 18], but the inclusion of oxygen support methods by day and inclusive of prolonged hospitalizations contributes to conveying the prevalence pattern over time.

Daily oxygenation method utilization illustrates the clinical and economic burden of COVID-19 hospitalizations. The high proportion of patients requiring HFNC, NIV, and IMV oxygen support throughout the time-course of COVID-19 hospitalizations corresponds with high-intensity clinician-delivered care by nurses, respiratory therapists and physicians for near-continuous monitoring and frequent assessments of patient condition and equipment (e.g., settings, tubing, documentation)[24]. Unlike previous pandemics, COVID-19 has been associated with resource allocation burdens specific to oxygen scarcity[25]. The oxygen flow rates for HFNC

(10-60 liters/minute) are high compared with conventional nasal cannula (0-6 liters/minute) and compared with advanced oxygen support via IMV (20-30 liters/minute)[26, 27]. At the integrated health system level, the overall consumption of oxygen used for patient care increased substantively, with monthly oxygen volume utilization up to 220% higher during the pandemic (volume purchased and used, January 2020 vs January 2021) (T. Williams-Dennis, personal communication, May 2022). Our analysis of daily oxygenation methods needed by adults hospitalized with COVID-19 contributes to conveying the scope of oxygen consumption specific to COVID-19.

Focused evaluations of hospital-level variation in the context of COVID-19 describe mortality differences despite similar interventions (e.g., renal replacement therapy, IMV)[5, 28, 29]. The data representation of intra-hospital processes of care drawn from small (<100 hospital beds) and medium hospitals (100-399 beds) with varied teaching and trauma designations paired with large and very large academic medical centers, are important to presenting a balanced perspective of care delivery mechanisms employed. In very large cohort studies (>10,000 hospitalizations), hospital characteristics specific to size, case volume, and teaching status are more often reported, but the inclusion of day-by-day intrahospital process of care variables are rare. For example, in 11,721 hospitalizations derived from commercial insurance claims from 245 hospitals, the proportion of patients receiving IMV reported by academic status (16% of patients in academic centers vs 19% in non-academic centers)[18], but is not inspected for variability.

Changes in clinical practice over time may have influenced outcomes of patients hospitalized with COVID-19 across waves. Reports from Spain describe differences in medication management between waves with increased use of HFNC as a first-line therapy in waves 2/3 (July 1, 2020 – February 28, 2021) while describing no significant association found between COVID-19 waves and mortality[30]. Beyond pharmacologic management variations between waves, the consideration of controversial practice pattern differences of earlier intubation during the first wave of COVID-19 hospitalizations reported in critical care settings[31, 32] merits attention in the absence of large-scale empirical evidence. In our sample of 15,361 consecutive hospitalizations within an integrated health system, fewer patients required oxygen support at hospital admission in wave 1 (March 1, 2020 – June 30, 2020) compared with waves 2/3 (July 1, 2020 – February 28, 2021). In the later waves 2/3, overall oxygen method utilization reflects higher proportions of patients managed using HFNC during the first week of hospitalization. These results add a broader perspective of hospitalizations inclusive of all care units[33]. Further analyses describing practice patterns and assessing outcomes associated with delayed intubation specific to COVID-19 are warranted.

Future research can contribute beyond prediction modeling to include subtype discovery and trajectory analyses[34, 35,] around oxygenation methods for respiratory failure (e.g., HFNC) and to advance knowledge around clinically relevant catchment-area factors (i.e., facility volumes, trauma center status) informing non-COVID-19[36] and COVID-19 care delivery[29]. Furthermore, examining longer durations of hospital- and ICU stays contributes to controversial topics of futility, palliative care services, hospital-level capacity, and triaging decisions in the setting of resource constraints inherent to a pandemic of the COVID-19 scale.

Limitations

Our first limitation is due to the study design, because we are unable to make any causal inferences, and there is potential residual confounding by unmeasured variables. Second, while we report that 40% of adults did not require oxygen support on the day of hospital admission, half were hospitalized at 4pm or later, reflecting 8-hour or shorter periods and not reflective of full calendar days. Oxygen support required within the first 24 hours of hospitalization is thus distributed for most patients across the first and second day of hospitalization due to reporting by calendar day increments. Ultimately, 80% of adults received oxygen support during hospitalization (Table 1). Third, the utilization of concomitant practices, such as prone positioning or inhaled vasodilators, likely contributed with the selection of oxygen delivery devices, affecting the interpretation of our results. Fourth, our population-based approach is reflective of a single large integrated health system, with representation specific to the Southwest region of the United States. The reporting of oxygenation methods as a static time-course during hospitalization could be viewed as a weakness in that the dynamic surge capacity demands are not directly reflected, while also serving as a strength, by offering a broad epidemiologic view of these important intra-hospital processes of care. Overall, cohorts from other health systems and regions are needed to confirm findings.

Conclusion

This consecutive case series of more than 15,000 hospitalizations describes daily oxygenation measures as intra-hospital processes of care conveying clinical characteristics and COVID-19 implications, which are traditionally masked in cohort studies. We present epidemiologic profiles of oxygenation methods by day and by week to demonstrate that 44% of hospitalized adults across 25 hospitals relied on basic oxygenation support at admission, with intermediate and advanced oxygen support over the course of hospitalization required by 34% of patients by day 4 of hospitalization. In prolonged hospitalizations, 70% of adults required intermediate or advanced respiratory support at 4 and 6 weeks. This serves as a comprehensive system-level lens into the epidemiology of demand for oxygen specific to adults hospitalized with COVID-19. Knowing about the prevalence of a specific disease can help with understanding the demands on health services, thus these findings underscore the importance of the intra-hospital organization of care in contributing to epidemiologic insights, health system science and healthcare policy and planning.

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Figure Legends

Figure 1. Geographic Distribution of Hospitals (n=25)

Figure 2. Oxygen Support by Day of Hospitalization

Overall < 3% missing daily data: 0% on admission day; 3% (n = 445) on day 1; 3.1% (n = 450) on day 2 ; 2.4% (n = 304) on day 3 ; 2.1% (n = 223) on day 4 ; 2.4% (n = 213) on day 5; 2.4% (n = 178) on day 6; 3.1% (n = 186) on day 7

Figure 3. Oxygen Support by Week of Hospitalization

Overall < 3% missing weekly data: 0% on week 1; 1.2% (n = 74) on week 2; 1.4% (n = 30) on week 3 ; 2.9% (n = 29) on week 4 ; 2.2% (n = 11) on week 5 ; 1.9% (n = 5) on week 6; 2.6% (n = 4) on week 7

Supplemental Digital Content

Supplemental Figure 1. Oxygen Support by Day of Hospitalization by COVID-19 Wave

Wave 1 - March 1, 2020 to June 30, 2020; Waves 2/3 - July 31, 2020 to February 28, 2021

Table 1. Patient Characteristics by Highest Level of Oxygen Support

Supplemental Table 1. Patient Characteristics by Age Group

Supplemental Table 2. Patient Characteristics by Hospital Survival

Supplemental Table 3. Patient Characteristics by Intensive Care Unit Admission

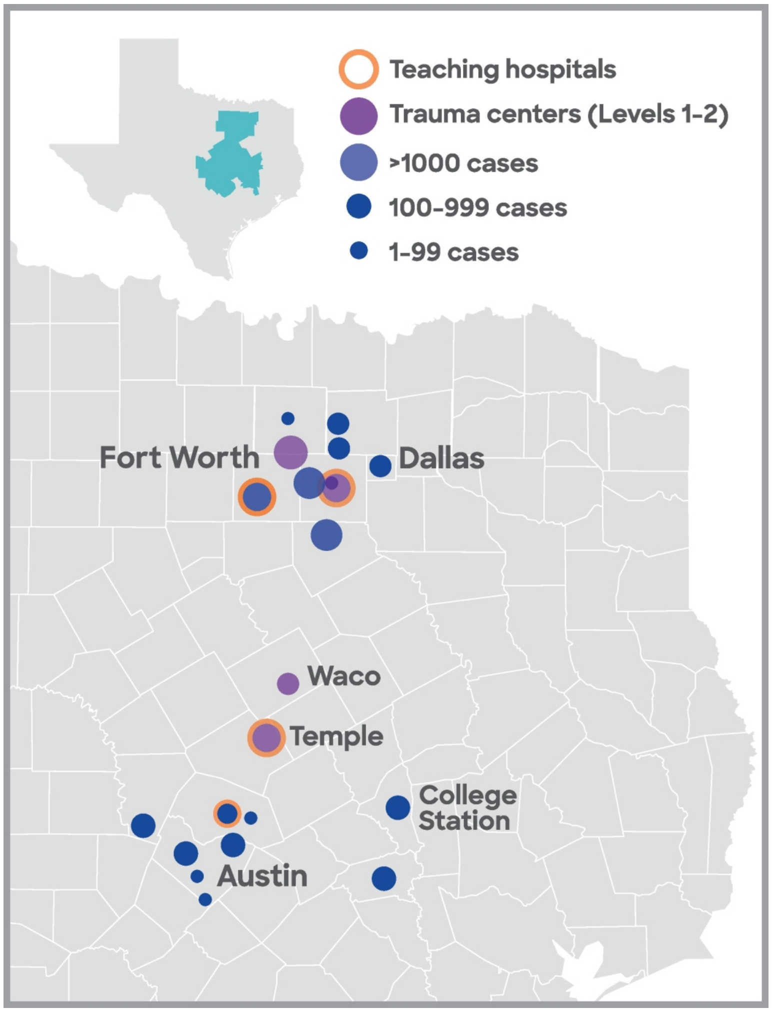
Quick Look

Current Knowledge:

Many observational studies are constructed to report hospitalization outcomes, with few large multi-center population-based reports on the time course of intra-hospitalization characteristics.

What This Paper Contributes To Our Knowledge:

We present epidemiologic profiles of daily oxygenation methods by day and by week to describe these intra-hospital processes of care for a consecutive case series of 15,361 hospitalized adults diagnosed with SARS-CoV-2. Measures of daily oxygen support methods can serve as a comprehensive system-level lens into the epidemiology of demand for oxygen specific to adults hospitalized with COVID-19.



Geographic Distribution of Hospitals (n=25)

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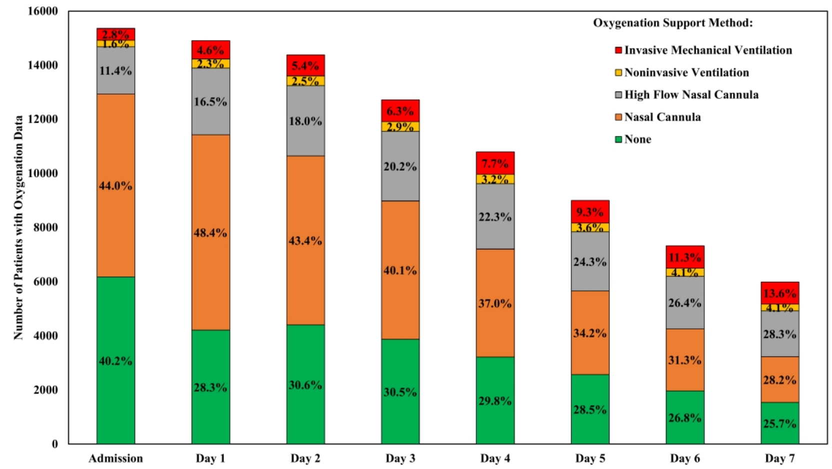

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Overall < 3% missing daily data: 0% on admission day; 3% (n = 445) on day 1; 3.1% (n = 450) on day 2 ; 2.4% (n = 304) on day 3 ; 2.1% (n = 223) on day 4 ; 2.4% (n = 213) on day 5; 2.4% (n = 178) on day 6; 3.1% (n = 186) on day 7

338x190mm (300 x 300 DPI)

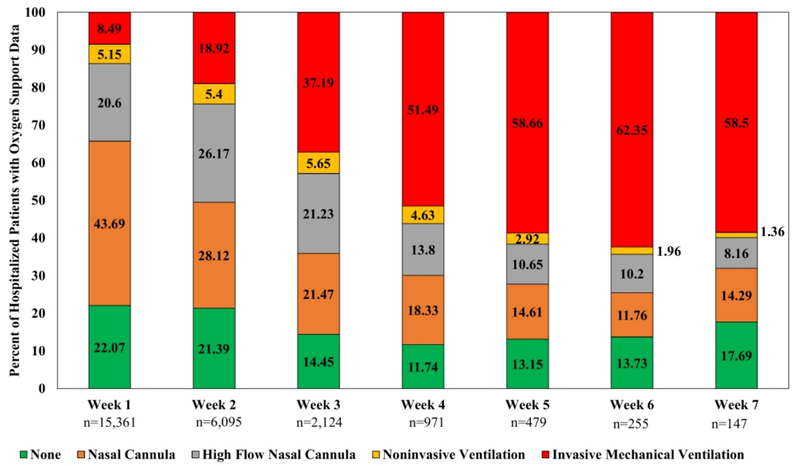

Figure 3. Oxygen Support by Week of Hospitalization
Overall < 3% missing weekly data: 0% on week 1; 1.2% (n = 74) on week 2; 1.4% (n = 30) on week 3 ; 2.9% (n = 29) on week 4 ; 2.2% (n = 11) on week 5 ; 1.9% (n = 5) on week 6; 2.6% (n = 4) on week 7

338x190mm (300 x 300 DPI)

Table 1. Patient Characteristics by Highest Level of Oxygen Support

	Highest Level of Oxygen Support During Hospitalization (n = 15,361)				
	Invasive Mechanical Ventilation (n=1,766)	Noninvasive Ventilation (n=7,74)	High Flow Nasal Cannula (n=2,905)	Nasal Cannula or Facemask (n=6,791)	None (n=3,125)
Gender (male)	1137 (64.4)	467 (60.3)	1714 (59.0)	3556 (52.4)	1271 (40.7)
Age (years)[a]	66 [55, 74]	68 [57, 79]	66 [54, 77]	65 [52, 76]	57 [35, 74]
Body mass index (kg/m^2)[a]	31.1 [26.6, 36.6]	33.6 [27.6, 40.7]	30.4 [26.5, 35.6]	30.2 [26.0, 35.9]	29.1 [24.8, 34.4]
Obese	976 (55.3)	516 (66.7)	1527 (52.6)	3497 (51.5)	1403 (44.9)
Race[b]	48 (2.7)	27 (3.5)	79 (2.7)	173 (2.5)	73 (2.3)
Asian	48 (2.7)	27 (3.5)	79 (2.7)	173 (2.5)	73 (2.3)
Black	262 (14.8)	125 (16.1)	389 (13.4)	1214 (17.9)	636 (20.4)
White	1318 (74.6)	588 (76.0)	2246 (77.3)	4992 (73.5)	2239 (71.6)
Other[b]	138 (7.8)	34 (4.4)	191 (6.6)	412 (6.1)	177 (5.7)
Charlson Comorbidity Index					
0	538 (30.5)	217 (28.0)	1273 (43.8)	2900 (42.7)	1494 (47.8)
1-3	885 (50.1)	399 (51.6)	1290 (44.4)	2971 (43.7)	1259 (40.3)
4+	343 (19.4)	158 (20.4)	342 (11.8)	920 (13.5)	372 (11.9)
Comorbidities					
COPD	291 (16.5)	201 (26.0)	479 (16.5)	840 (12.4)	164 (5.2)
Asthma	159 (9.0)	79 (10.2)	257 (8.8)	621 (9.1)	247 (7.9)
Diabetes mellitus[c]	616 (34.9)	280 (36.2)	803 (27.6)	2049 (30.2)	794 (25.4)
Congestive heart failure	455 (25.8)	261 (33.7)	477 (16.4)	1192 (17.6)	422 (13.5)
Admission diagnosis					
Respiratory failure	787 (44.6)	152 (19.6)	319 (11.0)	347 (5.1)	15 (0.5)
Sepsis	1088 (61.6)	217 (28.0)	765 (26.3)	1195 (17.6)	383 (12.3)
Shock	1084 (61.4)	112 (14.5)	339 (11.7)	456 (6.7)	138 (4.4)
ICU admission	1748 (99.0)	304 (39.3)	999 (34.4)	559 (8.2)	229 (7.3)
ICU length of stay (days, n=3832)	12 [6, 20]	4 [2, 7]	3 [2, 6]	2 [1, 3]	2 [1, 2]
ICU survival	831 (47.6)	220 (72.4)	911 (91.2)	536 (95.9)	223 (97.4)
Hospital length of stay (days)	16 [10, 26]	9 [6, 14]	8 [6, 12]	5 [3, 7]	3 [2, 5]
Hospital survival	795 (45.0)	600 (77.5)	2,612 (89.9)	6,692 (98.5)	3,107 (99.4)
Discharge location					
Home	192 (24.2)	328 (54.7)	1604 (61.4)	4643 (69.4)	2345 (75.5)
Home health	107 (13.5)	85 (14.2)	348 (13.3)	859 (12.8)	300 (9.7)
Subacute rehabilitation	93 (11.7)	18 (3.0)	42 (1.6)	100 (1.5)	34 (1.1)
Long-term care facility	269 (33.9)	117 (19.5)	405 (15.5)	838 (12.5)	306 (9.8)
Hospice	54 (6.8)	38 (6.3)	130 (5.0)	152 (2.3)	47 (1.5)

Other hospital	57 (7.2)	10 (1.7)	41 (1.6)	30 (0.4)	30 (1.0)
Other	22 (2.8)	4 (0.7)	41 (1.6)	70 (1.0)	45 (1.4)

Data are shown as n (%) or median (interquartile range); [a]Body Mass Index (BMI) is weight (kilograms) divided by the square of height (meters); [b] Includes mixed race, other, and unknown; [c] diabetes with complications was combined with diabetes without complications;

Abbreviations: COPD: Chronic Obstructive Pulmonary Disease