Factors contributing to ventilator dependent days in COVID-19

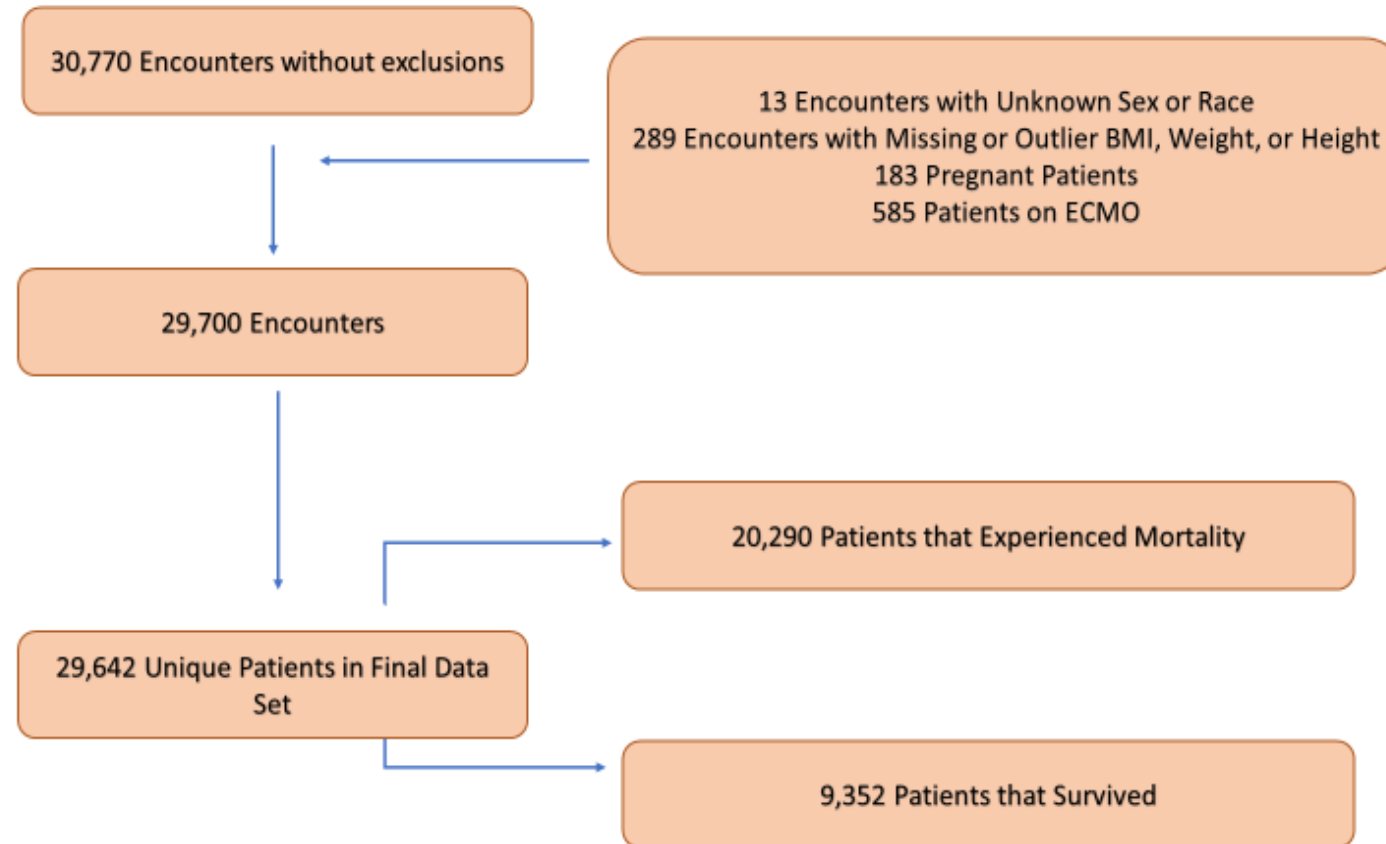Isaac Ginsberg DO, Samantha Eteve DO, Bryan Lunt DO, and Kenneth Krell, MD

Introduction:

There is limited data available regarding the risk factors affecting number of ventilator dependent days for COVID-19 patients. Although there are studies exploring variables affecting length of stay in COVID-19 patients[5], and several others exploring variables that affect mortality or severity[1,2,3,4,6-15], there has not yet been a large study examining factors that may predict the number of ventilator dependent days for intubated COVID-19 patients. We do note with appreciation however, that there have been two small descriptive statistics papers relating the effects of asthma and duration of intubation as well as race and duration of intubation[1,16]. These found a positive correlation between asthma and minority status and duration of intubation. Similarly an exhaustive literature review has been unable to find any papers comparing number of ventilator dependent days between COVID-19 variants.

Methods:

Our analysis was a large-scale, retrospective study examining the contribution of comorbid disease states during admission on length of time of ventilation and morbidity outcomes with COVID-19 patients. Data was used from 145 HCA Healthcare facilities nationwide from March 2020 through May 2022. This ultimately led to 29,642 patients that required intubation and met all inlcusion/exclusion criteria. Exclusion criteria included if there was a missing or outlier BMI, weight or height. Pregnant patients and patients on ECMO were also excluded.
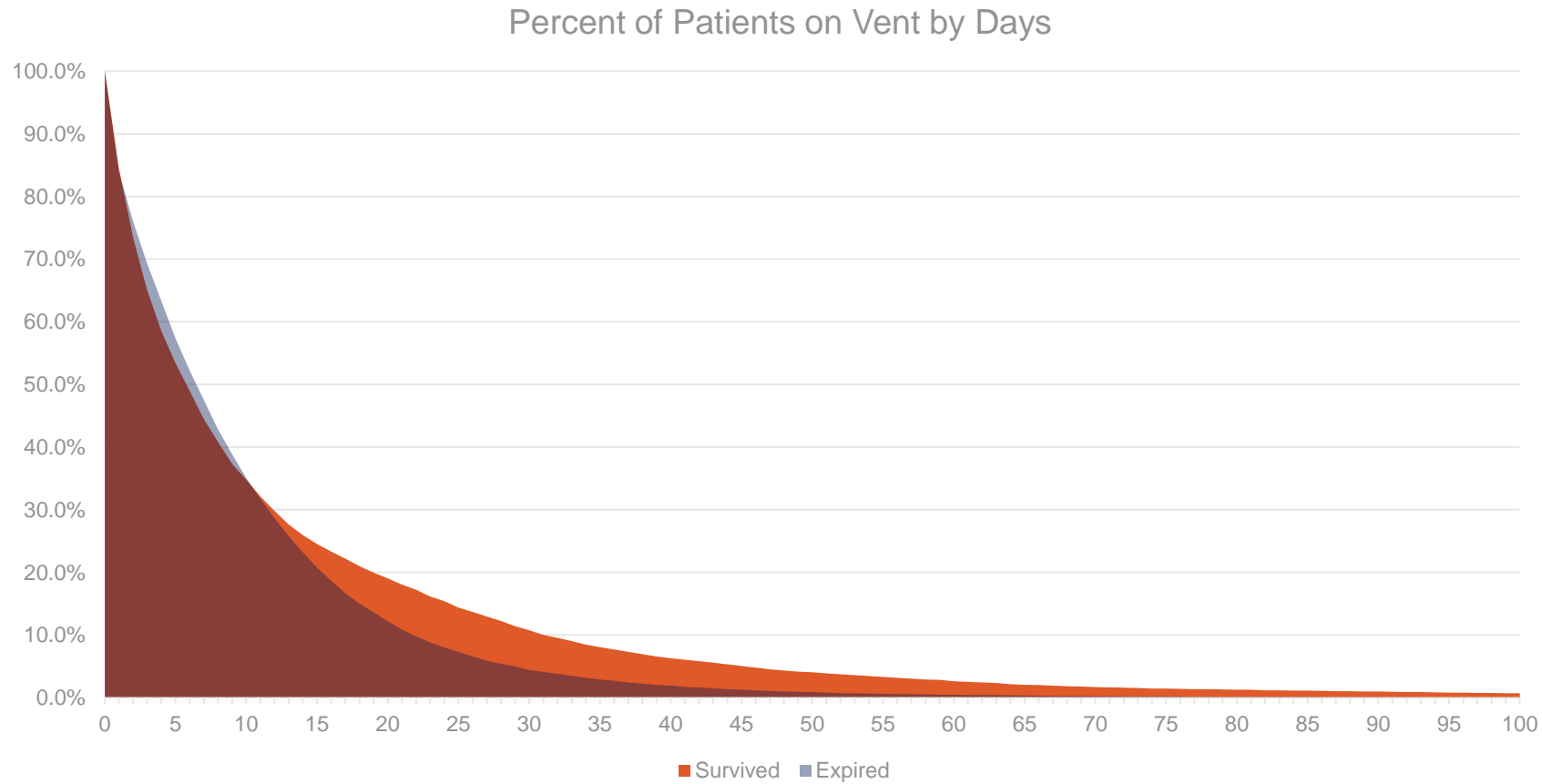
Figure 1

30,770 Encounters without exclusions

13 Encounters with Unknown Sex or Race
289 Encounters with Missing or Outlier BMI, Weight, or Height
183 Pregnant Patients
585 Patients on ECMO

29,700 Encounters

20,290 Patients that Experienced Mortality

29,642 Unique Patients in Final Data Set

9,352 Patients that Survived

Results:

The main contributing factor for mortality was age. Other factors also predictably played a significant role in mortality including renal failure, metastatic cancer, liver disease (severe), pulmonary disease, and diabetes with complications. Other factors seemed to not predict as well like obesity, heart failure, alcohol abuse, or liver disease. These results will be discussed further.

Time on ventilator turned out to be very difficult to track or predict due to patient demise during ventilation skewing the results.

Figure 2

Percent of Patients on Vent by Days

Table 1

| | Mortality | | | | | | | | T-Test | |
| | 0 | | | | 1 | | | | | |
	Mean	Min	Max	Standard Dev	Mean	Min	Max	Standard Dev	p-Value	Mean Difference
Age	57.54	18.00	89.00	15.22	64.99	18.00	89.00	13.25	<0.001	7.451
BMI	32.45	10.26	94.60	9.25	32.04	10.53	98.84	9.10	<0.001	-0.405
Height Cm	170.16	106.68	205.74	10.37	169.67	104.14	231.99	10.41	<0.001	-0.484
Weight Kg	94.34	24.73	259.00	27.69	92.76	23.18	309.09	27.38	<0.001	-1.586
Vent Days	12.25	0.00	279.68	18.72	9.52	0.00	369.34	11.23	<0.001	-2.735
Elixhauser	4.82	0.00	17.00	2.50	4.85	0.00	16.00	2.34	0.472	0.022

Discussion

- Our results are consistent with data nationwide, finding that age was a major contributing factor that predicted time on ventilator and mortality. As discussed earlier, a few comorbidities that were suspected to play a bigger role in fact did not. These included heart failure and alcoholism, which is likely due to patients not growing as old as the rest of the population. Obesity was also a major factor that was believed to have an increased mortality with COVID, but according to our data, it was not a major contributor. These are difficult to truly account for though, due to the fact that patients with obesity often have other comorbities that did indeed have an affect like diabetes with complications, and hypertension. This could show that it wasn't necessarily the obesity that would lead to higher mortality, but rather the comorbidities that often come with obesity.

Discussion continued

- A limitation for this project was the fact that we only gathered information from the HCA Healthcare system. According to the statistics, patients with COVID-19 had higher mortality than the national average. This likely skewed results. The reason for this discrepancy is difficult to know. Further research should be done gathering data from all other hospital systems nationwide to help determine if our results are consistent with the other data from all across the nation.

Conclusions

- The COVID-19 pandemic had a profound impact on the overall wellbeing of our population. Comorbidities play a major role on how patients handle any illness. COVID-19 was no exception with the most obvious and biggest contributor being age. An increase in age increased time on ventilator and mortality. Other comorbidities may not have played as big as a role as previously thought, but according to our data, this is likely due to the fact that these comorbidities lead to a shorter lifespan regardless of COVID or that certain comorbidities played a bigger role than others, therefore, there were less patients reaching old age and therefore were not alive to determine if these comorbidities could play a role in ventilation/mortality.

- There would also need to be further research done to determine if there was predictability in ventilator time as we did not initially take into consideration that time would be skewed by earlier demise/mortality.

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