



# Trends and Variations in Tracheal Intubation for Acute Respiratory Failure in the US

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## Introduction

- Acute Respiratory Failure (ARF) is associated with significant morbidity and mortality, with the mortality rate increasing by roughly 3.4% each year.<sup>1</sup>
- Patients with ARF frequently require invasive mechanical ventilation necessitating tracheal intubation (TI).
- A recent international multicenter study showed that almost 50% of patients undergoing TI experience major adverse events like cardiovascular instability.<sup>2</sup>
- The aim of this study was to evaluate the incidence of TI performed in patients with ARF in hospitals across the United States (US) and to study the trends and variation in practice across institutions.
- We hypothesize that with the advent of non-invasive ventilation (NIV), there has been a decrease in the performance of TI.

## Methods

- Retrospective cohort study using patient-level data from all hospitals participating in the National Inpatient Sample (NIS) database from 2016 to 2020
- IRB exempted
- All critically ill adult patients aged 18 years and older who were diagnosed with ARF, and underwent TI were included.
- Patient and hospital characteristics were extracted using billing codes

Table 1. Demographics of patients with ARF

	Patients non- intubated N= 2008674	Patients intubated N= 522746	P- value
<b>Race</b>			<0.001
White	1440019 (71.7%)	322717 (61.7%)	
Black	254696 (12.7%)	94166 (18.0%)	
Hispanic	161086 (8.0%)	56016 (10.7%)	
Asian/Pacific Islander	41010 (2.0%)	14733 (2.8%)	
Native American	12450 (0.6%)	3135 (0.6%)	
Other/missing	99413 (5.0%)	31979 (6.1%)	
<b>Primary Payer Information Of Patients</b>			<0.001
Medicare	1370854 (68.3%)	297014 (56.7%)	
Medicaid	221639 (11.0%)	90723 (17.4%)	
Private Insurance	306705 (15.3%)	93935 (18.0%)	
OTHER	109476 (5.5%)	41074 (7.9%)	
<b>Median Household Income by Quartile</b>			<0.001
Q1	617971 (30.8%)	176139 (33.7%)	
Q2	547501 (27.3%)	133855 (25.6%)	
Q3	467077 (23.3%)	114562 (21.9%)	
Q4	343217 (17.1%)	87613 (16.8%)	
Missing	32908 (0.02%)	10577 (0.02%)	
<b>Clinical Factors</b>			
<b>Charlson Comorbidity Index</b>			<0.001
0	156735 (7.8%)	68095 (13.0%)	
1-2	728586 (36.3%)	164311 (31.4%)	
3-4	559562 (27.9%)	134009 (25.6%)	
5+	563791 (28.1%)	156331 (29.9%)	
CHF	941566 (46.9%)	202391 (38.7%)	<0.001
COPD	1089723 (54.3%)	181961 (34.8%)	<0.001
Diabetes	751632 (37.4%)	185124 (35.4%)	<0.001
Renal Disease	595594 (29.7%)	141808 (27.1%)	<0.001
<b>Hospital Factors</b>			
<b>Hospital Size</b>			<0.001
Small	441364 (22.0%)	88785 (17.0%)	
Medium	598881 (29.8%)	156112 (29.9%)	
Large	968429 (48.21%)	277849 (53.2%)	
<b>Hospital Region</b>			<0.001
Northeast	325704 (16.2%)	86126 (16.5%)	
Midwest	487898 (24.3%)	106095 (20.3%)	
South	785577 (39.1%)	219262 (41.9%)	
West	409495 (20.4%)	111263 (21.3%)	
<b>Hospital Location and Teaching Status</b>			P<0.001
Rural	209801 (10.4%)	30002 (5.7%)	
Urban Non-teaching	455112 (22.7%)	106218 (20.3%)	
Urban Teaching	1343761 (70.0%)	386526 (73.9%)	

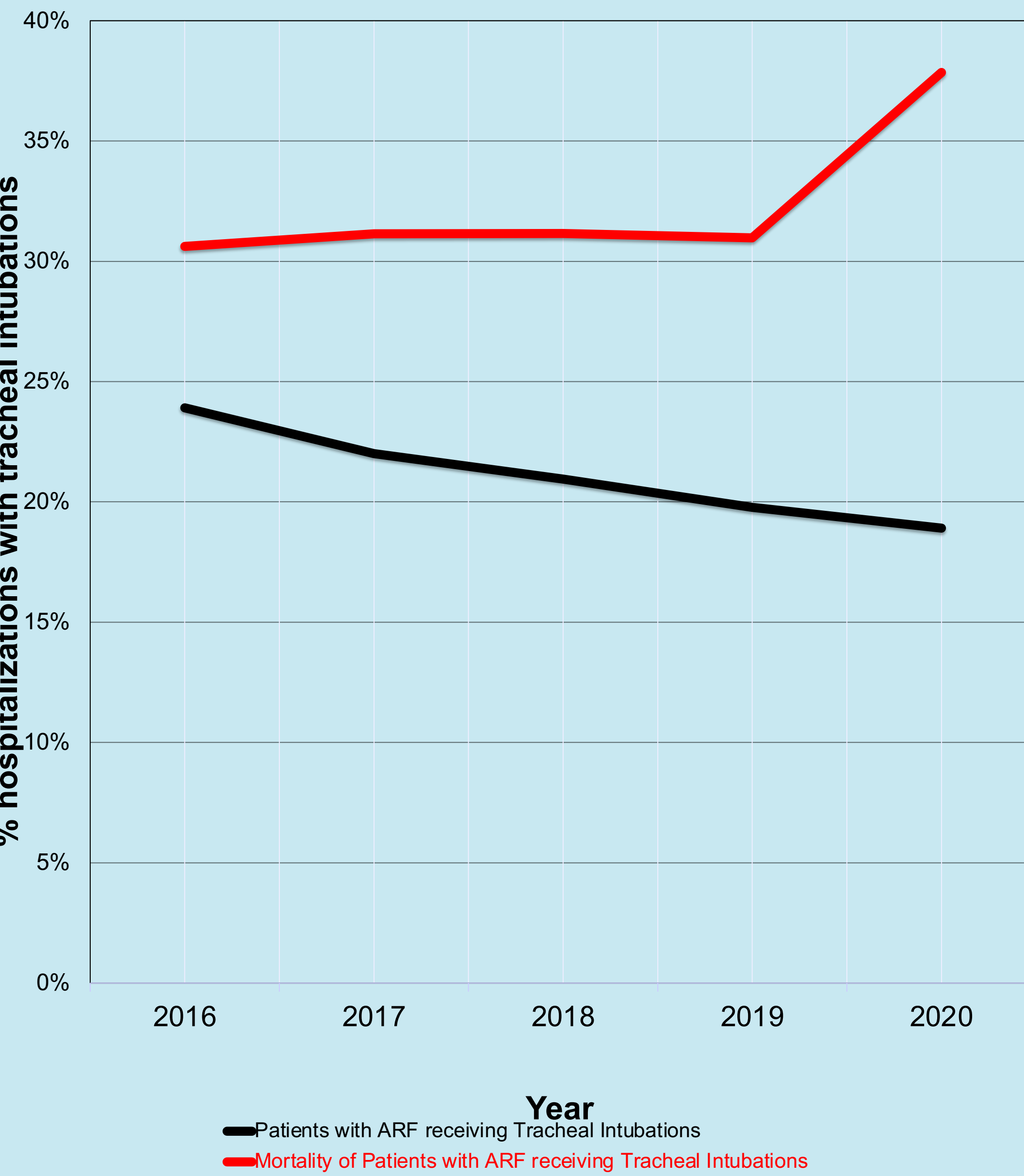
## Results

- A total 2,531,420 patients were identified with ARF during the years 2016-2020, of these, 522746 (26.02%) underwent TI.
- The mean age was 62 years, 44.4% were women, and the in-hospital mortality was 32.8% (95% CI, 32.6%-33.0%).
- The percentage of ARF-related hospitalizations receiving TI decreased from 23.9% (95% CI, 23.4% - 24.4%) in 2016 to 18.9% (95% CI, 18.5% - 19.3%) in 2020 (p<.0001) Figure 1 and Table 2
- Mortality among patients receiving TI increased significantly from 30.6% (95% CI, 30.1%-31.1%) in 2016 to 37.8% (95% CI, 37.3%-38.3%) in 2020 (p<.0001).
- The receipt of TI for ARF varied significantly across hospitals during the study period (median, 19%; IQR, 14%-24%; range, 1%-66%).
- The hospital where the patient received care explained 8.3% of the variability in intubation rates in patients with ARF.

Table 2. Annual Trends in the performance of TI in Patients with ARF

Year	Patients undergoing TI n (%)
2016	79537 (23.9%)
2017	90106 (22.0%)
2018	100981 (21.0%)
2019	112049 (19.8%)
2020	140073 (18.9%)
TOTAL	522746

Figure 1. Trends in Mortality and TI for ARF



## Conclusion

- We found a decline in the receipt of TI for ARF-related hospitalizations across hospitals in the United States.
- This could be due to the increased use of alternative techniques to manage ARF, such as non-invasive ventilation and high-flow nasal cannula.
- The large variation in the performance of TI across hospitals suggests unwarranted practice variation and need for further studies to clarify which patients benefit from TI for ARF.

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