

# Association between race/ethnicity and ventilator associated complications in the pediatric intensive care unit: a retrospective analysis.



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## Introduction

- Ventilator associated pneumonia (VAP) occurs within 48 hours from intubation.<sup>1</sup>
- VAP incidence is 5-20% of intubated patients, associated with worsened outcomes.<sup>2,3</sup>
- Adult literature with higher VAP rate in Hispanic & Asian patients vs white patients.<sup>4</sup>
- Known risk factors for VAP include: genetic syndrome, unintentional extubation, steroid use, bloodstream infection, prior antibiotic therapy, and bronchoscopy.<sup>5</sup>
- Prevention with ICU bundles (i.e. oral care, PPI use, maintaining ETT cuff pressure).<sup>6</sup>
- Racial/ethnic disparities afflict children at multiple levels of healthcare.<sup>7</sup>
- Objective:** Evaluate whether children from diverse racial/ethnic groups are associated with higher rates of VAP compared to their white counterparts.
- Hypothesis:** Children from diverse racial/ethnic groups will have greater rates of VAP.

## Methods

- Retrospective, observational analysis.
- Database:** Healthcare Cost Utilization Project (HCUP) Kids' Inpatient Database (KID); publicly available data on inpatient pediatric care.
- Inclusion Criteria:** Children 18 years and younger; ICD10 diagnosis of endotracheal intubation and VAP; available data on race/ethnicity.
- Exclusion Criteria:** Children with incomplete data.
- Primary outcome:** Diagnosis of VAP.
- Statistical Analysis:** Univariate and multivariate odds ratio (OR) to determine odds of VAP by race/ethnicity with and without adjustment for variables.

Table 1. Demographics of Children Diagnosed with Ventilator Associated Pneumonia

CHARACTERISTIC	WHITE (N=359)	BLACK/AFRICAN-AMERICAN (N=176)	HISPANIC/LATINX (N=168)
AGE(YEARS)	12 (0,18)	0 (0, 14.5)	9 (0, 18)
FEMALE SEX	114 (32%)	64 (36.4%)	30.0%
LOS (DAYS)	30.5 (16, 71.5)	41 (23, 98)	37 (20,93)
TIME TO INTUBATION (DAYS)	1 (0,11)	2 (0,19)	1 (0,9)
PAYER			
MEDICARE/MEDICAID	164 (45.7%)	139 (79.0%)	122 (72.6%)
PRIVATE/SELF	178 (49.6%)	30 (17.1%)	35 (20.8%)
OTHER/NO CHARGE	17 (4.7%)	7 (4.0%)	11 (6.6%)
NEIGHBORHOOD INCOME QUARTILE			
TOP 25%	64 (18.1%)	16 (9.2%)	17 (10.4%)
26-50%	110 (31.2%)	22 (12.6%)	27 (16.5%)
51-75%	99 (28.1%)	46 (26.4%)	42 (25.6%)
76-100%	80 (22.7%)	90 (51.7%)	78 (47.6%)

Table 1. Demographical data of HCUP KID charts meeting inclusion criteria. Age represented as median and 25-75% interquartile range; LOS = length of stay, median and 25-75% interquartile range.

Table 2. Risk Analysis of VAP and Patient Characteristic

CHARACTERISTIC	UNIVARIABLE ODDS RATIO	P VALUE	MULTIVARIABLE ADJUSTED ODDS RATIO	P VALUE
<b>RACE/ETHNICITY</b>				
WHITE	1 [Referent]		1 [Referent]	
BLACK/AFRICAN-AMERICAN	1.39 (1.16-1.66)	0.001	1.28 (1.06-1.56)	0.01
HISPANIC/LATINX	1.09 (0.91-1.31)	0.35	0.97 (0.80-1.18)	0.76
<b>PRIMARY DIAGNOSIS</b>				
ALL OTHER DIAGNOSES	1 [Referent]		1 [Referent]	
ARDS DIAGNOSIS	7.62 (5.57-10.43)	<0.001	7.10 (5.00-10.18)	<0.001
VIRAL RESPIRATORY TRACT INFECTION	4.31 (3.14-5.92)	<0.001	3.10 (2.09-4.59)	<0.001
<b>NEIGHBORHOOD INCOME QUARTILE</b>				
TOP 25%	1 [Referent]		1 [Referent]	
26-50%	1.23 (0.99-1.52)	0.06	1.20 (0.93-1.55)	0.16
51-75%	1.31 (1.06-1.61)	0.01	1.25 (0.97-1.60)	0.09
76-100%	1.31 (1.08-1.60)	0.01	1.16 (0.90-1.48)	0.25
AGE	1.04 (1.03-1.05)	<0.001	1.06 (1.05-1.07)	<0.001
FEMALE SEX	0.44 (0.37-0.51)	<0.001	0.36 (0.30-0.42)	<0.001
PAYER				
MEDICARE/MEDICAID	1 [Referent]		1 [Referent]	
PRIVATE/SELF	0.71 (0.61-0.83)	<0.001	0.71 (0.60-0.85)	<0.001

Table 2. Univariate and Multivariate adjusted odd ratios with 95% confidence intervals.

## Results

- Total of 703 patients: 51% (n = 359) white, 25% (n = 176) Black/AA, and 24% (n = 168) Hispanic/Latinx.
- Black/AA children with VAP were younger (median age = 0) and had longer length of stay (LOS, median days = 41)
- Black/AA and Hispanic/Latinx children resided in lower income neighborhoods and more likely to have Medicaid
- Black/AA children with significant increased univariate OR (1.09, 95%CI 1.16-1.66) and multivariate adjusted OR (1.28, 95%CI 1.06-1.56).
- Hispanic/Latinx children did not demonstrate significant difference in univariate OR (1.09, 95%CI 0.91-1.31) or multivariate adjusted OR (0.97, 95%CI 0.8-1.18).

## Conclusion

- Black/African-American children are at higher risk for VAP compared to White counterparts.
- Possible contributors:
  - Lower overall SES & access to healthcare outpatient
  - Poor adherence to standard bundles designed to decrease VAP
  - Low volume of providers
  - Differences in illness progression
  - implicit bias from healthcare team
- Hispanic/Latinx children did not demonstrate increased risk for VAP.
- Limitations:** Data lacks granular details of patient care; limited data regarding co-morbidities; impossible to account for all co-founding.
- Future studies:** study other ventilator-associated complications; understand overall outcomes & mortality; consider using VPS data to account for co-morbidities, illness severity, and other patient care variables.

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## References

- Edwards JR, Peterson KD, Mu Y, et al: National Healthcare Safety Network (NHSN) report: Data summary for 2006 through 2008. Am J Infect Control 2009; 37:783-805
- Srinivasan, Ramya, et al. "A prospective study of ventilator-associated pneumonia in children." Pediatrics 123.4 (2009): 1108-1115.
- Papazian, Laurent, Michael Klompas, and Charles-Edouard Luyt. "Ventilator-associated pneumonia in adults: a narrative review." Intensive care medicine 46.5 (2020): 888-906.
- Bakullari, Anila, et al. "Racial and ethnic disparities in healthcare-associated infections in the United States, 2009-2011." Infection Control & Hospital Epidemiology 35.53 (2014): S10-S16.
- Liu, Bo, et al. "Risk factors of ventilator-associated pneumonia in pediatric intensive care unit: a systematic review and meta-analysis." Journal of thoracic disease 5.4 (2013): 525.
- Modi AR, Kovacs CS. Hospital-acquired and ventilator-associated pneumonia: Diagnosis, management, and prevention. Cleve Clin J Med. 2020;87(10):633-639. Published 2020 Oct 1.
- Flores G; Committee On Pediatric Research. Technical report--racial and ethnic disparities in the health and health care of children. Pediatrics. 2010;125(4):e979-e1020.

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