

Evaluating the Effects of the COVID-19 Pandemic on ICU Mortality and Sedation Charges in Mechanically Ventilated Patients

Caroline Paley, PharmD¹, Ryan Rivosecchi, PharmD², Kangho Suh, PharmD, PhD¹

¹University of Pittsburgh School of Pharmacy, Pittsburgh, PA, ²UPMC Presbyterian Hospital, Pharmacy, Pittsburgh, PA

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Introduction

- The COVID-19 pandemic strained ICU capacity, staffing, and medication supplies¹
- Most research has focused on COVID-19; with less known about the impacts on non-COVID on patients
- Ventilated non-COVID patients may have experienced altered care during COVID surges^{2,3}
- Understanding these effects is key to improving crisis preparedness

Objectives

- Primary:** Assess the link between ICU COVID-19 burden and mortality in ventilated non-COVID patients
- Secondary:** Compare sedative drug charges in high vs. low COVID burden periods for non-COVID ICU patients

Methods

Design

- University of Pittsburgh Medical Center (UPMC) EHR
- Study Period: March 2020 – December 2022
- Exposure defined at the ICU-month level:
 - High COVID-19 period: ≥50% of ventilated patients had COVID-19
 - Low COVID-19 period: <50% of ventilated patients had COVID-19
- Sedative charges were estimated using 2023 UPMC chargemaster median rates for five agents: dexmedetomidine, ketamine, fentanyl, propofol, and midazolam

Statistical Analyses

- ICU Mortality
 - Model: Mixed-effects logistic regression with random intercepts for hospital and patients
- Sedative Charges
 - Model: Two-part model
 - Logistic regression to model any positive sedative charge
 - Generalized Linear Model (GLM) with gamma distribution and log link to model charges among users

Covariates Included

- ICU type, GOSSIS, sex, age, race, duration of mechanical ventilation (DMV), ICU length of stay (LOS), total number of sedatives used, and high influenza activity

Results

During periods of high COVID-19:

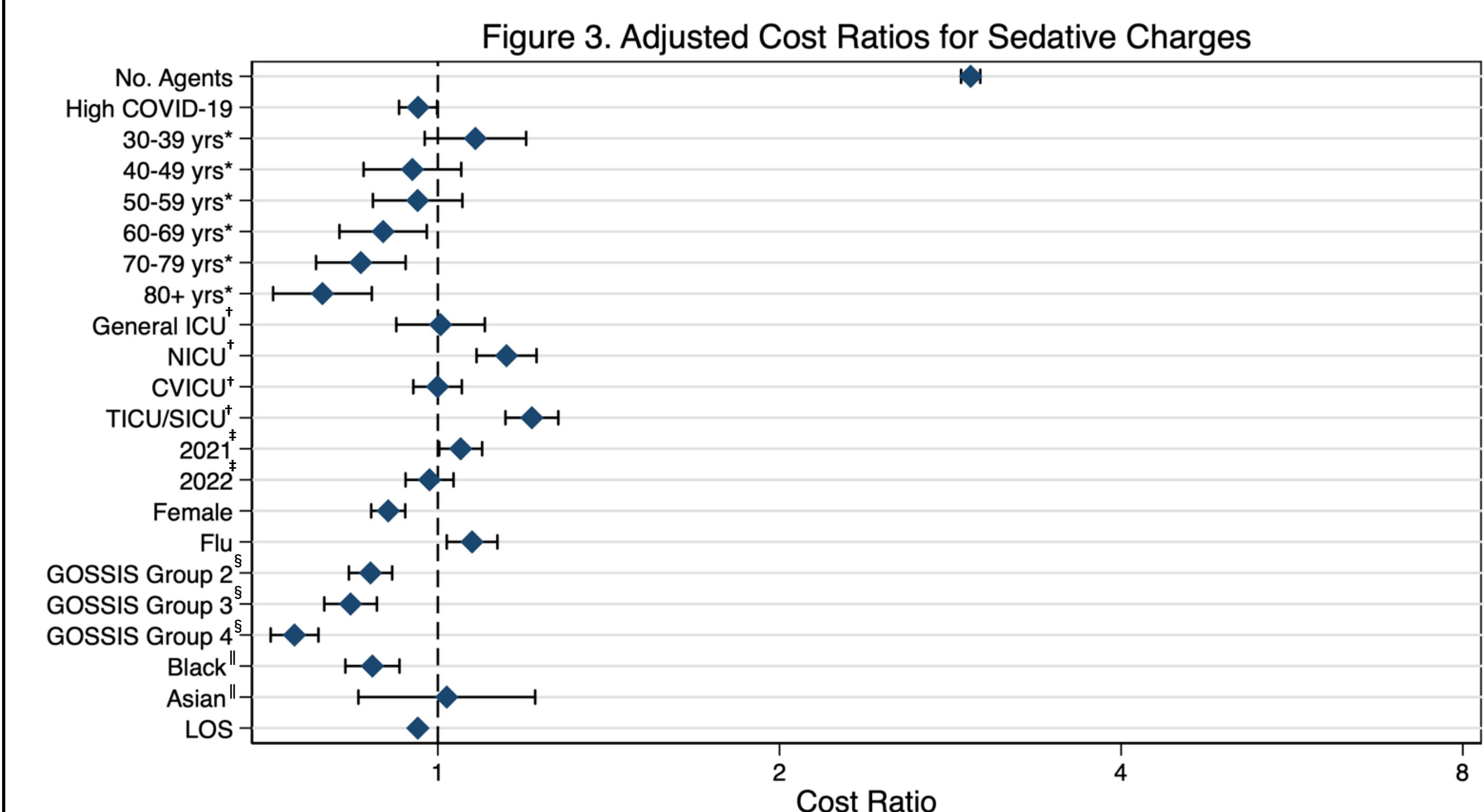
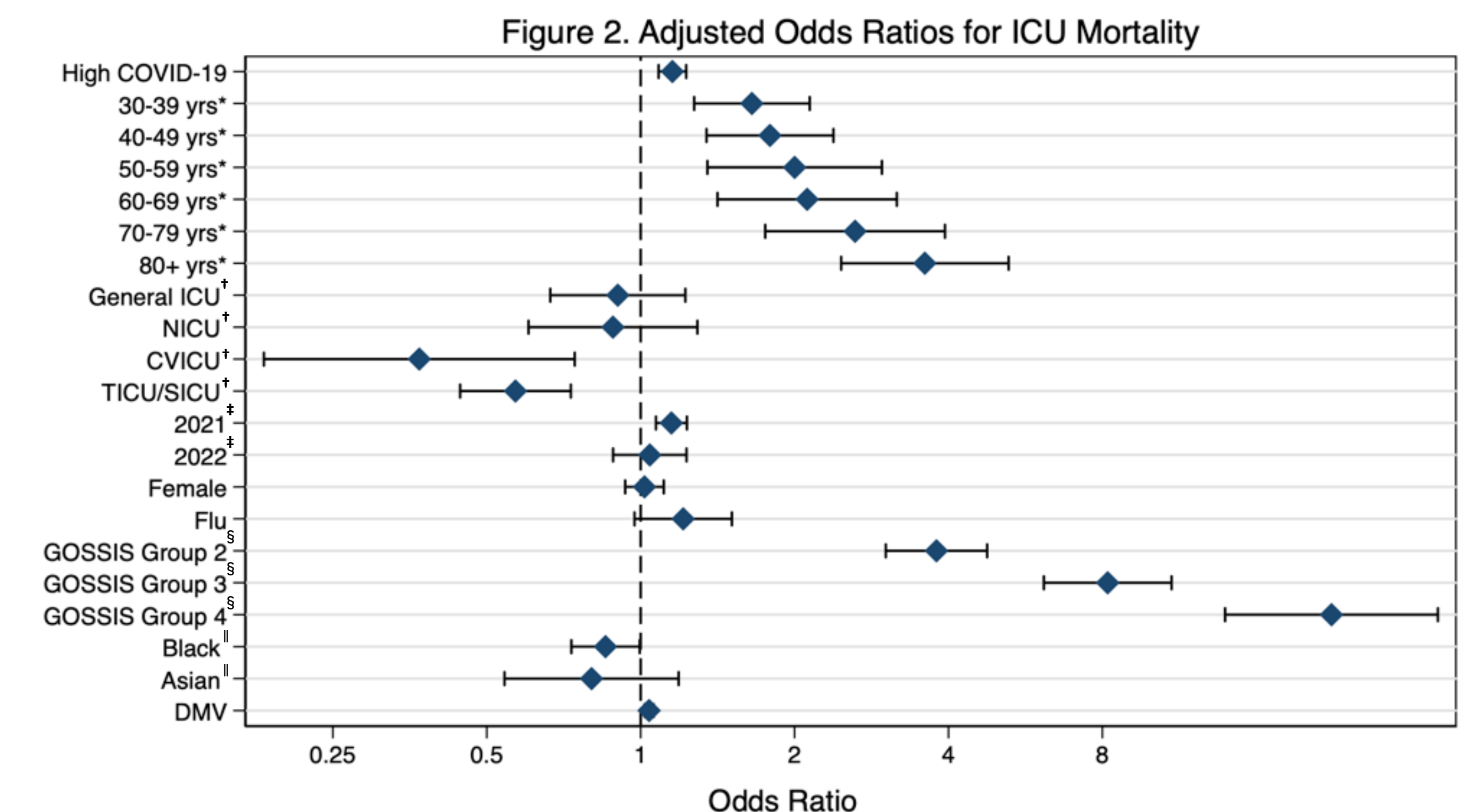
- A **13.7% increase in ICU mortality** was observed ($p=0.001$, 95% CI: 1.06–1.23)
- Sedative agent charges **decreased** by 4.0% ($p=0.031$, 95% CI: 0.93–1.00)

Table 1. Key Baseline Characteristics

| Characteristic | Low COVID-19 n = 9,687 | High COVID-19 n = 10,040 |
|---------------------|---------------------------|-----------------------------|
| Age Category | | |
| 18-29 | 385 (4.0) | 389 (3.87) |
| 30-39 | 608 (6.3) | 607 (6.0) |
| 40-49 | 852 (8.8) | 803 (8.0) |
| 50-59 | 1,738 (17.9) | 1,807 (18.0) |
| 60-69 | 2,775 (28.6) | 2,820 (28.1) |
| 70-79 | 2,318 (23.9) | 2,460 (24.5) |
| 80+ | 1,011 (10.4) | 1,154 (11.5) |
| Sex | | |
| Male | 5,621 (58.0) | 5,838 (58.1) |
| Female | 4,066 (42.0) | 4,202 (42.0) |
| Race | | |
| White | 8,123 (83.9) | 8,361 (83.3) |
| Black | 1,044 (10.8) | 1,146 (11.4) |
| Asian | 88 (0.9) | 77 (0.8) |
| Other | 432 (4.5) | 456 (4.5) |
| Institution | | |
| Community | 607 (6.3) | 662 (6.6) |
| Quaternary | 5,445 (56.2) | 5,943 (59.2) |
| Tertiary | 3,635 (37.5) | 3,435 (34.2) |
| GOSSIS | | |
| Group 1 (<0.2) | 4,540 (46.9) | 4,913 (48.9) |
| Group 2 (0.2–<0.4) | 2,072 (21.4) | 2,213 (22.0) |
| Group 3 (0.4–<0.6) | 1,259 (13.0) | 1,259 (12.5) |
| Group 4 (≥0.6) | 1,816 (18.7) | 1,655 (16.5) |

Note: Data are presented as N (%)

Abbreviations: GOSSIS = Global Open Source Severity of Illness Score



*Reference group: patients aged 18-29
† Reference group: patients admitted to the medical ICU (MICU)
‡ Reference group: patients admitted in 2020
§ Reference group: GOSSIS Group 1
|| Reference group: White race

Conclusions

- Periods of High COVID-19 were associated with increased odds of ICU mortality and a reduction in sedative use**
- This highlights the impact of healthcare strain on non-COVID-19 ICU patients

Limitations

- Single-health system may limit generalizability
- No data on sedation timing or duration
- Inability to capture admitting diagnosis
- Future studies should consider comparing ICU-level outcomes between the pre- and post-pandemic periods and evaluating sedative drug use in the context of national shortages.

References:

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- Bravata DM, et al. JAMA Netw Open. 2021;4(1):e2034266
- Barker AK, et al. Chest. 2024;166(1):118-126