



# Impact of body habitus on the development of fluid overload in critically ill patients

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## BACKGROUND

- Intravenous fluids (IVF) are commonly used in the critical care setting for resuscitation and maintenance therapy.
- There are currently no specific guidelines for dosing IVF in critically ill patients.
- Excessive fluid administration resulting in fluid overload is associated with organ failure, increased mortality, and increased time on mechanical ventilation.
- **Research Question:** Does body habitus influence the risk of fluid overload?

## OUTCOMES

### Primary

- Incidence of fluid overload on day 3 of ICU stay

### Secondary

- Total fluid intake/kg total body weight (TBW)
- Hospital mortality

## STUDY DESIGN

- **Design:** IRB-approved, retrospective cohort
- **Time Frame:** January 2017 through April 2018
- **Setting:** Dual-centered study; 350-bed community teaching hospital and 478-bed academic medical center
- **Inclusion Criteria:** Non-pregnant adults admitted to mixed medical/surgical ICU for  $\geq 72$  hours
- **Exclusion Criteria:**
  - Receiving TPN
  - End stage renal disease
  - Do not intubate/resuscitate status on admission
  - Transferred from an outside institution
  - Specific indication for IVF (e.g. diabetic ketoacidosis)
- **Study Groups:** obese vs. non-obese patients
- **Statistical Plan:**
  - Primary outcome was analyzed using logistic regression
  - Categorical and continuous data were analyzed with the  $\chi^2$  and Mann Whitney U tests, respectively
- **Definitions:**
  - Obesity: BMI  $> 30$  kg/m<sup>2</sup>
  - Fluid overload: positive fluid balance at 72 hours that produces a weight gain  $> 10\%$  from baseline

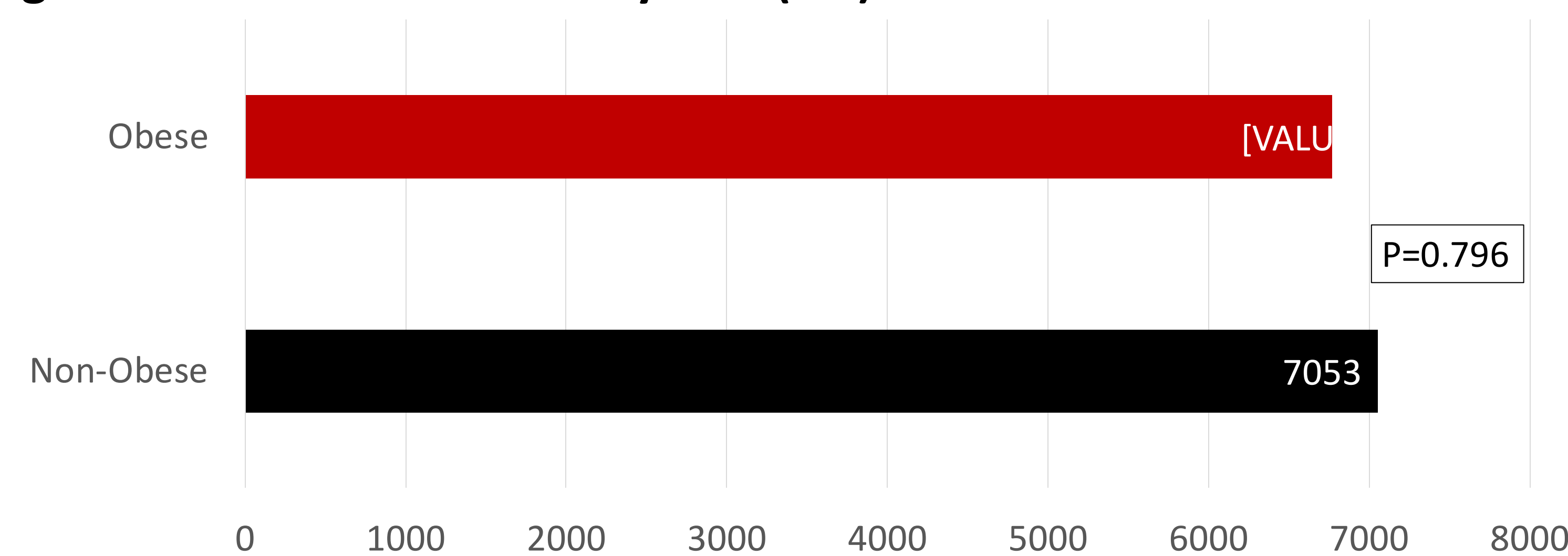
## RESULTS

**Table 1. Baseline Characteristics**

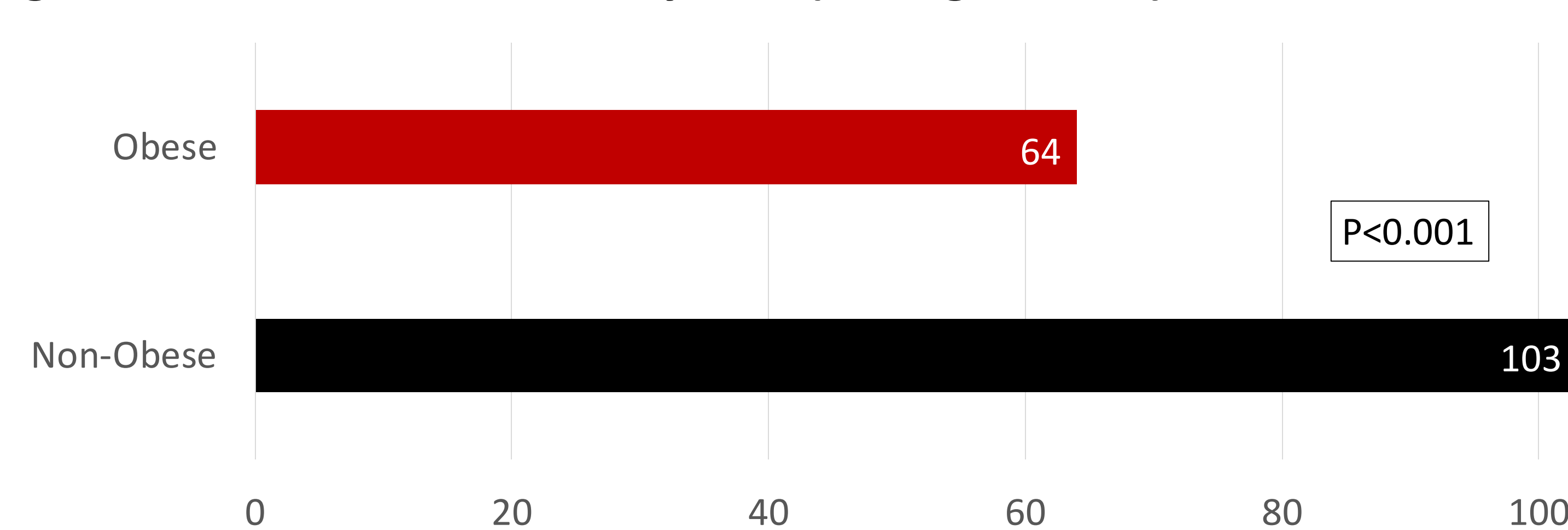
|  | Non-obese<br>n=97 | Obese<br>n=52 | P-value  |
|--|-------------------|---------------|----------|
| <b>Male</b>                              | 56 (58%)          | 19 (37%)      | 0.014    |
| <b>Age, years</b>                        | 64 (52-73)        | 61 (53-70)    | 0.560    |
| <b>Race</b>                              |                   |               | 0.152    |
| Caucasian                                | 62 (64%)          | 26 (50%)      |          |
| African American                         | 30 (31%)          | 24 (46%)      |          |
| <b>Body Mass Index, kg/m<sup>2</sup></b> | 24 (21-27)        | 36 (33-44)    | $<0.001$ |
| <b>Weight, kg</b>                        | 68 (59-80)        | 107 (91-127)  | $<0.001$ |
| <b>Number of Comorbidities</b>           | 1 (0-2)           | 1 (0-2)       | 0.520    |
| <b>SOFA score</b>                        | 6 (4-8)           | 6 (3-8)       | 0.402    |

All values presented as Number (%) or Median (Interquartile Range)

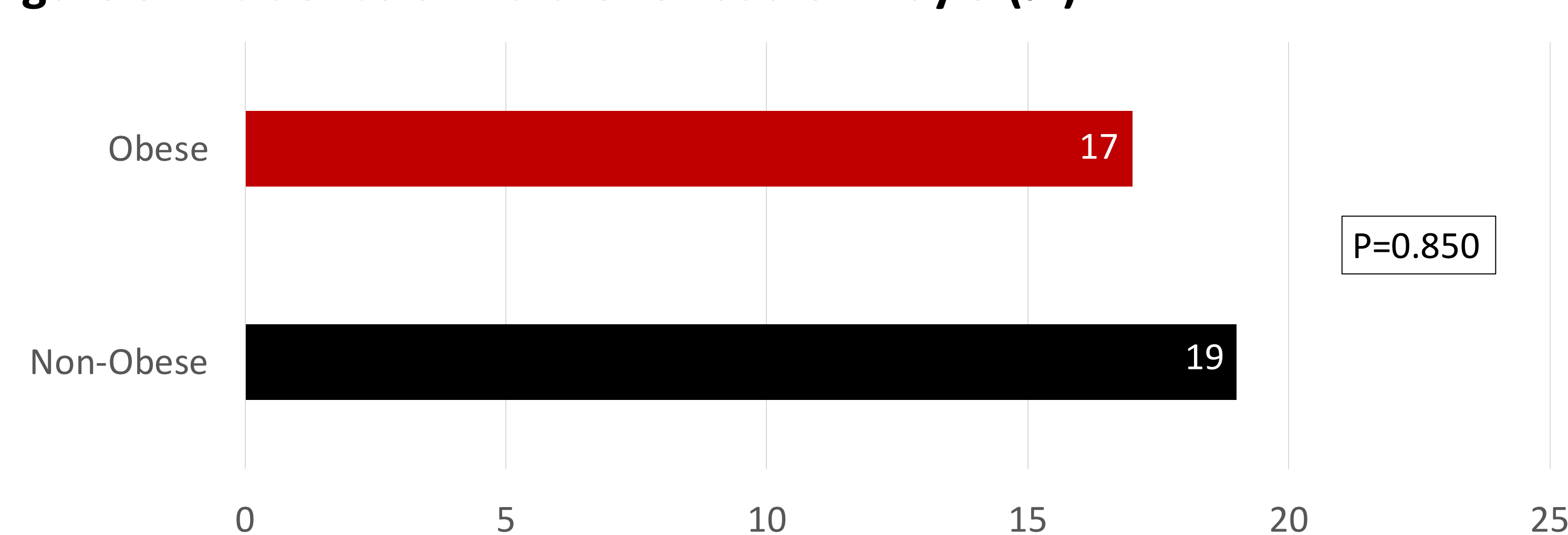
**Figure 1. Total Fluid Intake Days 1-3 (mL)**



**Figure 2. Total Fluid Intake Days 1-3 (mL/kg of TBW)**



**Figure 3. Incidence of Fluid Overload on Day 3 (%)**



## RESULTS CONTINUED

**Table 2. Factors Associated with Fluid Overload in Logistic Regression**

|                                | Odds Ratio | 95% CI         | P-value  |
|--------------------------------|------------|----------------|----------|
| <b>Age</b>                     | 0.001      | -0.002-0.005   | 0.491    |
| <b>Male Gender</b>             | -0.120     | -0.233- -0.008 | 0.037    |
| <b>ICU Length of Stay</b>      | 0.001      | -0.006-0.008   | 0.779    |
| <b>Fluid Intake per kg TBW</b> | 0.003      | 0.002-0.004    | $<0.001$ |
| <b>SOFA Score</b>              | -0.006     | -0.024-0.012   | 0.506    |
| <b>Non-Caucasian race</b>      | -0.018     | -0.134-0.097   | 0.755    |

**Table 3. Clinical Outcomes**

|   | Non-obese<br>n=97 | Obese<br>n=52 | P-value |
|---|-------------------|---------------|---------|
| <b>Mechanical Ventilation</b>                   | 18 (19%)          | 9 (17%)       | 0.850   |
| <b>Duration of Mechanical Ventilation, days</b> | 3 (0-6)           | 4 (0-4)       | 0.540   |
| <b>Hospital Mortality</b>                       | 17 (18%)          | 6 (12%)       | 0.323   |
| <b>Length of Stay, days</b>                     | 12 (7-17)         | 11 (7-22)     | 0.434   |
| <b>New Onset Atrial Fibrillation</b>            | 8 (8%)            | 5 (10%)       | 0.778   |
| <b>New Renal Replacement Therapy</b>            | 6 (6%)            | 1 (2%)        | 0.241   |

All values presented as Number (%) or Median (Interquartile Range)

## CONCLUSIONS

- Although obese and non-obese patients received a similar volume of fluids, obese patients received less fluid per kilogram TBW.
- There was no statistical difference in fluid overload between obese and non-obese patients.
- When a binary logistic regression controlling for demographics, severity of illness, and fluid intake was applied, BMI was not associated with fluid overload.
- Obese patients experienced numerically less hospital mortality, but this was not significant.
- This study was limited by its retrospective design, small sample size, and imprecise definition of fluid overload.
- This study was an expansion of a single-center study that showed obesity was associated with decreased fluid overload. Future research is planned in order to further assess body habitus and fluid overload at additional sites.

## REFERENCES

Fraze E, Kashani K. Fluid Management for Critically Ill Patients: A Review of the Current State of Fluid Therapy in the Intensive Care Unit. *Kidney Dis (Basel)*. 2016;2(2):64-71.  
Hawkins, W. A., Smith, S. E., Newsome, A. S., Carr, J. R., Bland, C. M., & Branan, T. N. (2019). Fluid Stewardship During Critical Illness: A Call to Action. *Journal of Pharmacy Practice*.

