



# Characteristics of Fluid Administration in Critically Ill Patients Experiencing Fluid Overload

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## BACKGROUND

- The use of intravenous fluids (IVF) is ubiquitous in the intensive care unit (ICU)
- Fluid overload (FO) is defined as a body weight increase by  $\geq 10\%$  from baseline secondary to fluid administration and is associated with organ damage, prolonged hospital stay, and mortality
- The volumes of “hidden fluids” (i.e. IV medications, blood products, enteral nutrition) are not specifically prescribed and may contribute to FO
- Purpose:** characterize the sources of IVF administered to critically ill patients who experience FO compared to those who do not
- Hypothesis:** Patients who experience FO will have received higher volumes of hidden fluids

## OUTCOMES

### Primary Outcome

- Contribution of hidden fluids to total fluid intake

### Secondary Outcomes

- Morbidity
  - Ventilation
  - Atrial fibrillation,
  - New dialysis
- Length of stay
- Mortality

## STUDY DESIGN

- Design:** IRB-approved, retrospective cohort
- Time Frame:** January 2017 through April 2018
- Setting:** 350-bed community teaching hospital
- Patient Cohort:**
  - Random sample of 75 adults admitted to mixed ICU for  $\geq 72$  hours during time period of interest
- Statistical Plan:**
  - Categorical data – Chi-squared test
  - Continuous data – Mann Whitney U
  - Contributors to fluid overload – binary logistic regression

## RESULTS

Figure 1. Patient Enrollment

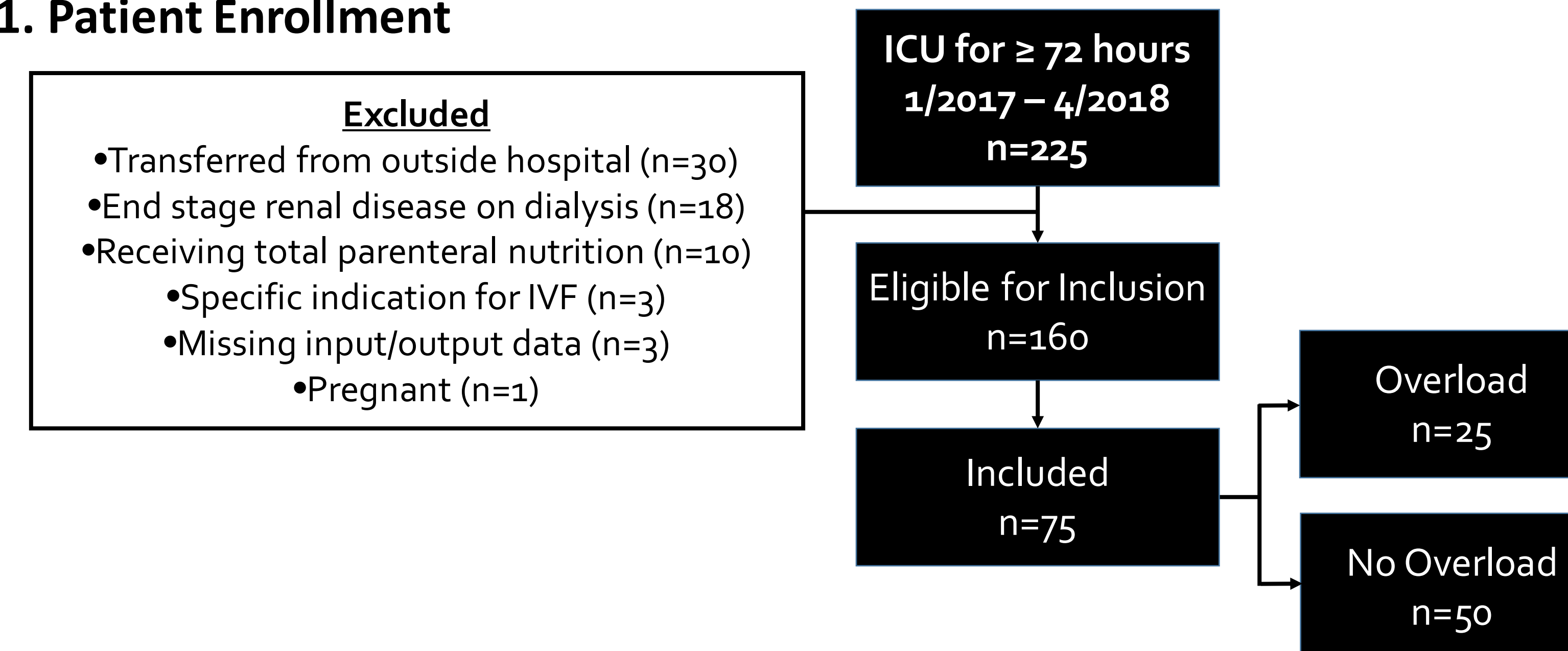


Table 1. Baseline Characteristics

	Overload (n=25)	No Overload (n=50)	p-value
Male	13 (52%)	28 (56%)	0.743
Age, years	64 (52 – 71)	64 (55 – 73)	0.770
Caucasian Race	12 (48%)	35 (70%)	0.136
Body Mass Index, kg/m <sup>2</sup>	25 (21 – 30)	28 (24 – 34)	0.026
Medical ICU	21 (84%)	44 (88%)	0.631
SOFA score	8 (5 – 11)	5 (4 – 8)	0.005

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

Figure 2. Cumulative ICU Fluid Intake

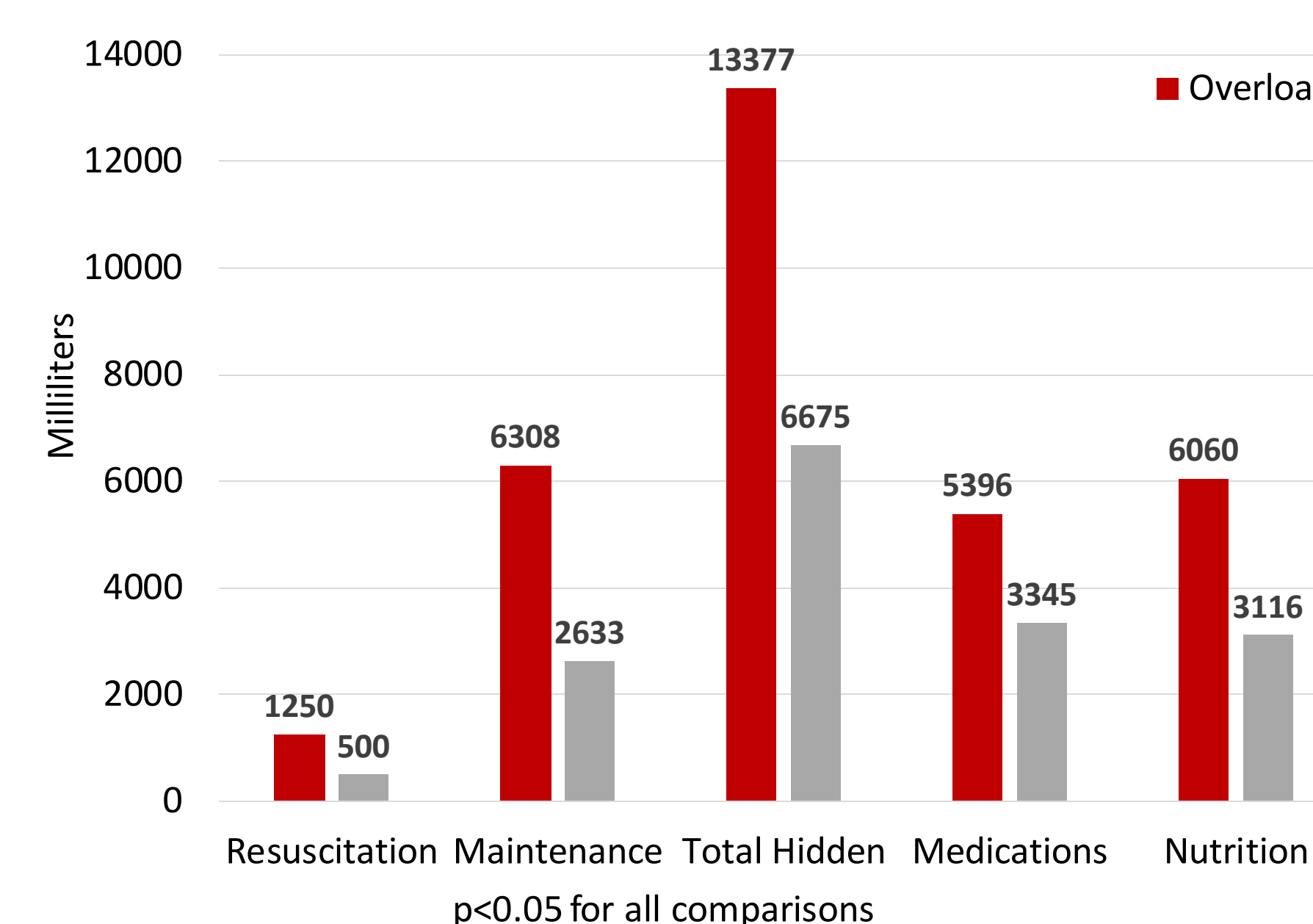


Figure 3. Fluid as Proportion of Total Intake

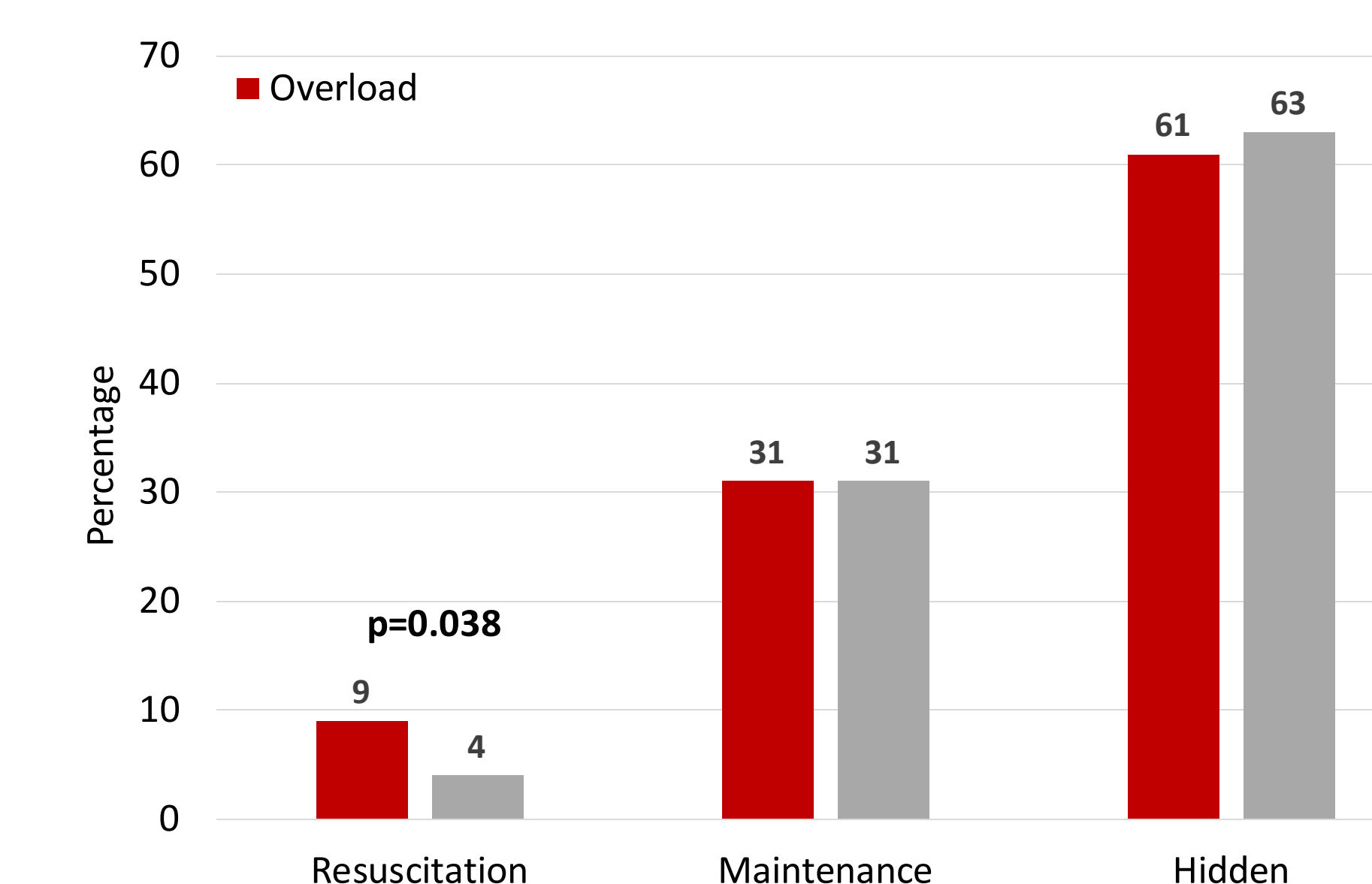


Table 2. Clinical Outcomes

	Overload (n=25)	No Overload (n=50)	p-value
Mechanical Ventilation	17 (68%)	26 (52%)	0.187
Ventilator-Free Days	8 (0 – 20)	22 (18 – 24)	<0.001
ICU Length of Stay	8 (6 – 13)	6 (5 – 10)	0.048
Hospital Length of Stay	15 (7 – 27)	12 (8 – 17)	0.296
New Onset Atrial Fibrillation	1 (4%)	8 (16%)	0.132
New Renal Replacement Therapy	1 (4%)	0 (0%)	0.155
ICU Mortality	6 (24%)	1 (2%)	0.002
Hospital Mortality	7 (28%)	4 (8%)	0.023

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

## RESULTS CONTINUED

Table 3. Factors Associated with Fluid Overload

Variable	Odds Ratio	95% Confidence Interval
Age	1.027	0.975 – 1.081
Male Gender	0.946	0.228 – 3.979
Body Mass Index	0.847	0.747 – 0.961
SOFA Score	1.178	0.956 – 1.453
Resuscitation Volume	1.000	1.000 – 1.001
Maintenance Volume	1.000	1.000 – 1.000
Hidden Volume	1.000	1.000 – 1.001
ICU Length of Stay	0.974	0.864 – 1.099

## CONCLUSIONS

- The incidence of FO (33%) was similar to that reported in previous research
- FO was associated with prolonged mechanical ventilation and length of stay and with increased patient mortality
- Understanding the type of fluid administered to patients developing FO may help identify strategies to mitigate this adverse effect
- Patients experiencing FO received larger volumes of every fluid type than those without FO
- Hidden fluids were the largest contributor to fluid intake in patients with and without FO and comprised over twice the volume in FO patients
- The dose of resuscitation IVF should be closely monitored, as FO patients received a greater proportion of intake from these IVF
- BMI was inversely related to FO. Types and quantities of IVF administered to obese patients is an area of future research that may further elucidate the role of hidden fluids in FO

## ACKNOWLEDGMENTS

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## REFERENCES

- Boyd JH, Forbes J, Nakada TA, et al. Fluid resuscitation in septic shock: a positive fluid balance and elevated central venous pressure are associated with increased mortality. *Critical care medicine*. Feb 2011;39(2):259-265.
- Mitchell KH, Carlhom D, Caldwell E, et al. Volume Overload: Prevalence, Risk Factors, and Functional Outcome in Survivors of Septic Shock. *Ann Am Thorac Soc*. Dec 2015;12(12):1837-1844.