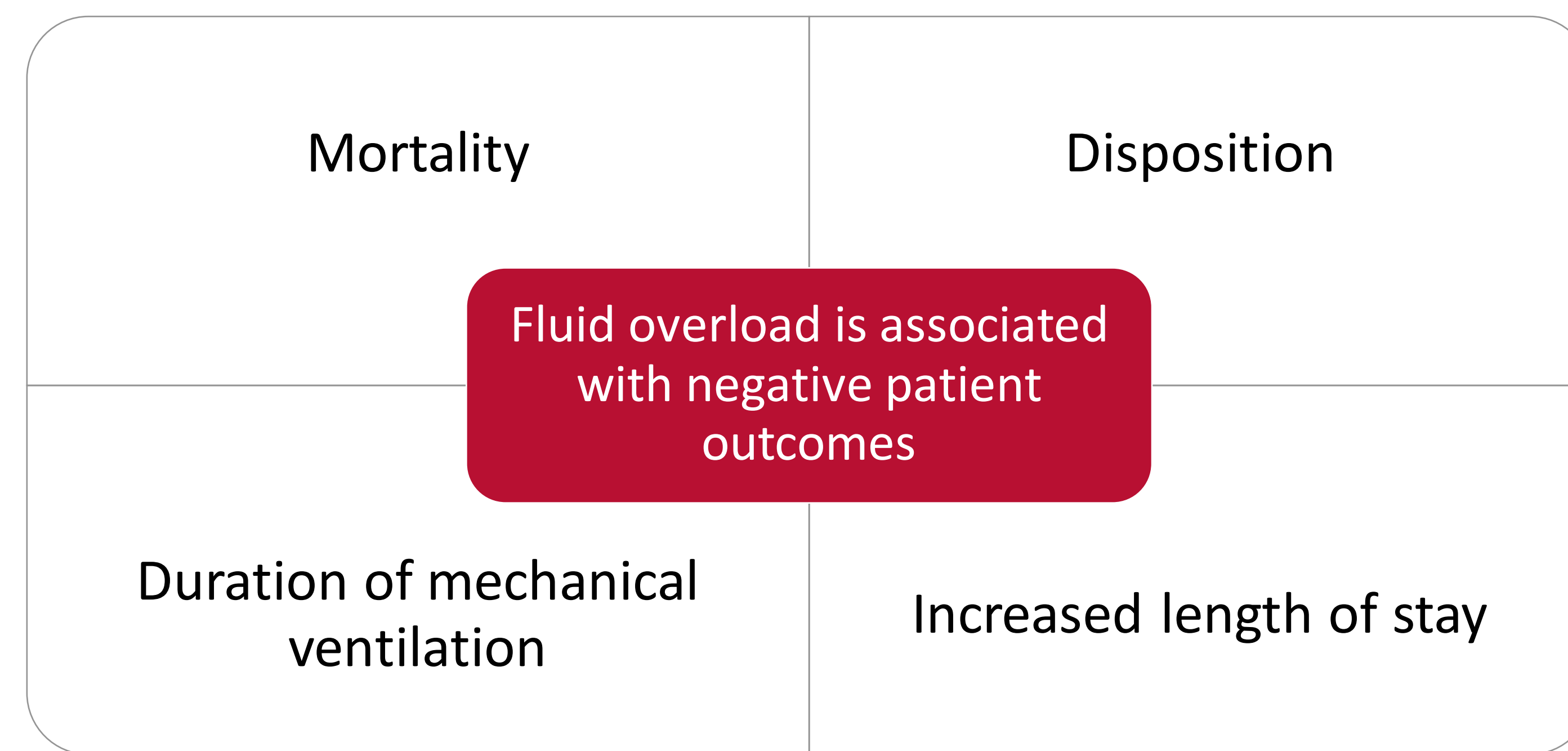


# Association of fluid balance with the medication regimen complexity score in intensive care units

Sarah H. Adams, Pharm.D. Candidate; Andrea Sikora Newsome, PharmD, BCPS, BCCCP;  
Susan E. Smith, PharmD, BCPS, BCCCP;  
on behalf of The University of Georgia Critical Care Collaborative

## BACKGROUND



The medication regimen complexity score for the intensive care unit (MRC-ICU) is shown to correlate with:

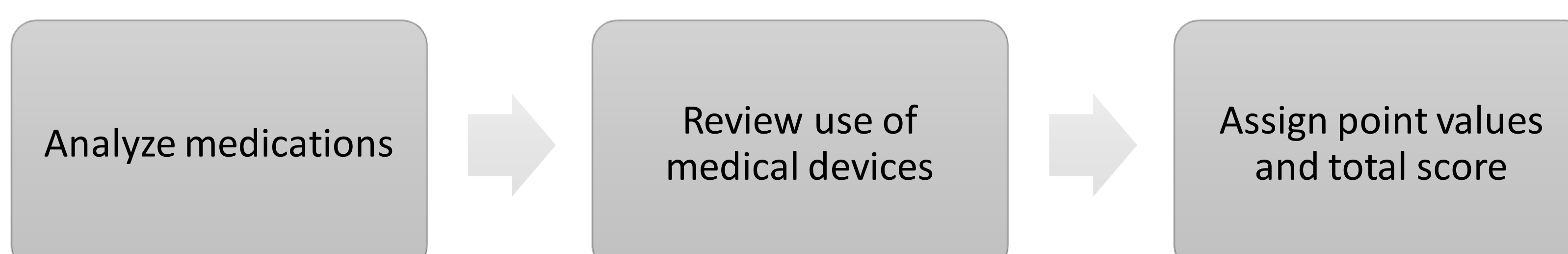
- Pharmacist interventions
- Drug-drug interactions
- Hospital length of stay
- Mortality

## PURPOSE

The purpose of this study was to evaluate the relationship between the MRC-ICU and fluid balance. A positive correlation is expected.

## STUDY DESIGN

- IRB-approved, retrospective analysis of electronic medical records for patients admitted to medical and surgical ICUs at a 350-bed community teaching hospital
- Inclusion criteria: admission to ICU between December 2016 and March 2018 for at least 24 hours, 18 years of age and older
- Exclusion criteria: ICU stay less than 24 hours
- Evaluation of relationship using Pearson's correlation and linear regression analysis
- MRC-ICU scoring:



## RESULTS

**Table 1: Patient Characteristics**

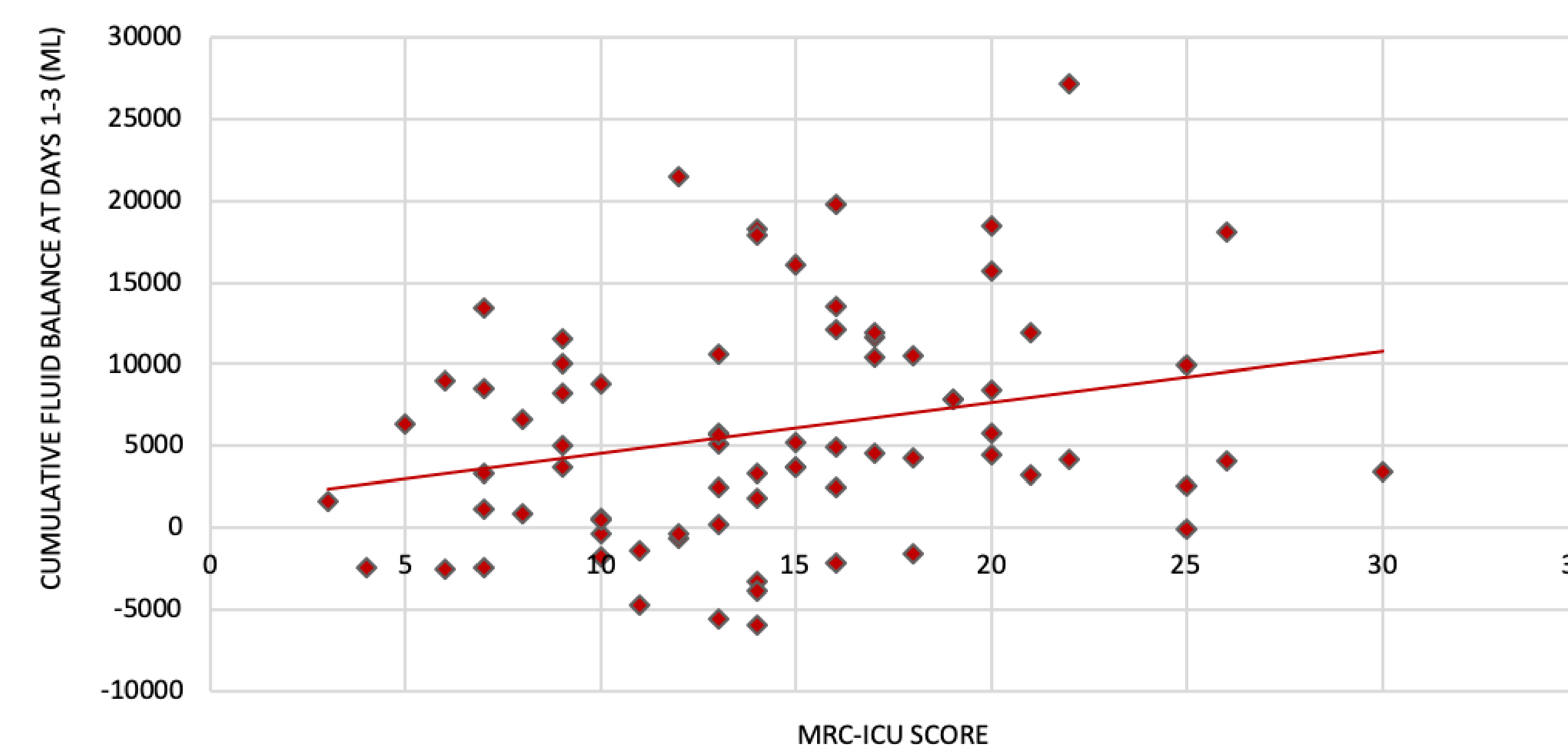
Variable	ICU (N = 75)
<b>ICU Type</b>	
Medical	65 (87%)
Surgical	10 (13%)
<b>Age (years)</b>	64 (54 – 72)
<b>Male Gender</b>	41 (55%)
<b>Caucasian</b>	41 (63%)
<b>MRC-ICU Score at 24 hours</b>	14 (10 – 18)
<b>Height (cm)</b>	169 (162 – 178)
<b>Weight (kg)</b>	77 (63 – 92)
<b>BMI</b>	27 (22 – 33)
<b>SOFA Score</b>	6 (4 – 8)
<b>Fluid Balance, Day 1 (mL)</b>	+1513 (+329 - +3134)
<b>Cumulative Fluid Balance, Day 1-3 (mL)</b>	+4188 (+1902 - +7090)
<b>Fluid Overload</b>	25 (33%)
<b>Ventilator-Free Days</b>	21 (5 – 24)
<b>Mortality</b>	11 (15%)
<b>ICU Length of Stay</b>	6 (5 – 11)
<b>Hospital Length of Stay</b>	13 (8 – 18)

Data reported as median (interquartile range [IQR]) or number (percent).

**Table 2: Factors Associated with Cumulative Fluid Balance at Days 1-3**

Variable	Beta Coefficient	95% Confidence Interval	p-value
MRC-ICU Score	167	8.83 – 325	0.039
Female Gender	338	-1489 – 2164	0.713
Age	5.95	-56.1 – 68.1	0.849
SOFA Score	262	14.9 – 509	0.038
Weight	-13.1	-46.4 – 20.1	0.434

**FIGURE 1: FLUID BALANCE AND MRC-ICU CORRELATION**



## MRC-ICU Scoring Tool

Parameter	Point Value
<b>High Priority Medications</b>	
Aminoglycosides (amikacin, gentamicin, tobramycin)	3x
Amphotericin B and liposomal amphotericin B	1
Antiarrhythmics (amiodarone, dofetilide, sotalol)	1x
Anticoagulants (NOACs/DOACs, fondaparinux)	1x
Anticonvulsants (carbamazepine, phenobarbital, phenytoin, valproic acid)	3x
Argatroban	2
Azole antifungals (posaconazole, voriconazole)	2x
Blood products (factor products, antithrombin III)	2x
Chemotherapy (active inpatient)	3x
Clozapine	3
Digoxin	3
Ganciclovir/valganciclovir	1x
Hyperosmolar fluids (hypertonic saline [1.5%, 3%, 23.4%], mannitol)	1x
Immunosuppressants (cyclosporine, sirolimus, tacrolimus)	3x
Lidocaine (continuous infusion)	2
Lithium	3
Prostacyclins (epoprostenol, iloprost, treprostinil)	2x
Theophylline	3
Therapeutic heparins (enoxaparin, heparin infusion)	2x
Vancocmycin (IV)	3
Warfarin	3
<b>ICU Medications</b>	
Neuromuscular Blockade	2
Continuous infusions (exclude those listed elsewhere)	1x
<b>Total Parenteral Nutrition</b>	
Managed by non-pharmacist service	1
Managed by clinical specialist pharmacist	3
<b>ICU Prophylaxis and FAST HUGS BID</b>	
Thromboembolic prophylaxis (exclude heparin infusion, therapeutic enoxaparin)	1
Stress ulcer prophylaxis (exclude pantoprazole infusion)	1
Glycemic control (subcutaneous insulin; exclude IV insulin)	1
Bowel regimen	1
Chlorhexidine	1
<b>Analgesia and Sedation</b>	
Opioids and sedatives (scheduled and PRN)	1x
Continuous infusion opioids and sedatives (propofol, fentanyl, dexmedetomidine, ketamine, benzodiazepines)	2x
<b>Antimicrobial Agents</b>	
Antimicrobials (include HIV medications, exclude those listed elsewhere)	1x
Restricted antimicrobials	2x
<b>Devices</b>	
Dialysis	2
Extracorporeal membrane oxygenation (ECMO)	2
Intra-aortic balloon pump (IABP)	1
Left ventricular assist device (LVAD)	1
Mechanical ventilation	2

Each medication or class is associated with a numeric score. If a multiplier is listed, every medication that meets the criteria will be multiplied by that multiplier. The MRC-ICU is the sum of all the points.

## CONCLUSIONS

There was a positive, yet weak correlation observed between the MRC-ICU score and cumulative fluid balance over the first three days.

- Combining data from multiple study sites is needed to evaluate the strength of this correlation and the potential use of the MRC-ICU for identifying patients at risk of fluid overload
- Future directions:
  - ❖ A strong correlation will promote early fluid de-resuscitation thus improving patient outcomes
  - ❖ MRC-ICU score will aid in appropriate use of pharmacy resources, including pharmacist-to-patient ratios

## REFERENCES

1. Sikora Newsome A, Smith SE, Olney WJ, Jones TW, Forehand CC, Jun AH, Sellers L. Medication regimen complexity is associated with pharmacist interventions and drug-drug interactions: a use of the novel MRC-ICU scoring tool. *Journal of the American College of Clinical Pharmacy*.
2. Sikora Newsome A, Smith SE, Olney WJ, Jones TW. Multi-center validation of a novel medication regimen complexity scoring tool. *American Journal of Health-System Pharmacists*.
3. Claire-Del Granado R, Mehta RL. Fluid overload in the ICU: evaluation and management. *BMC Nephrology*. 2016; 17(1):109.



www.mrcicu.com

## DISCLOSURES

The authors of this presentation have nothing to disclose.