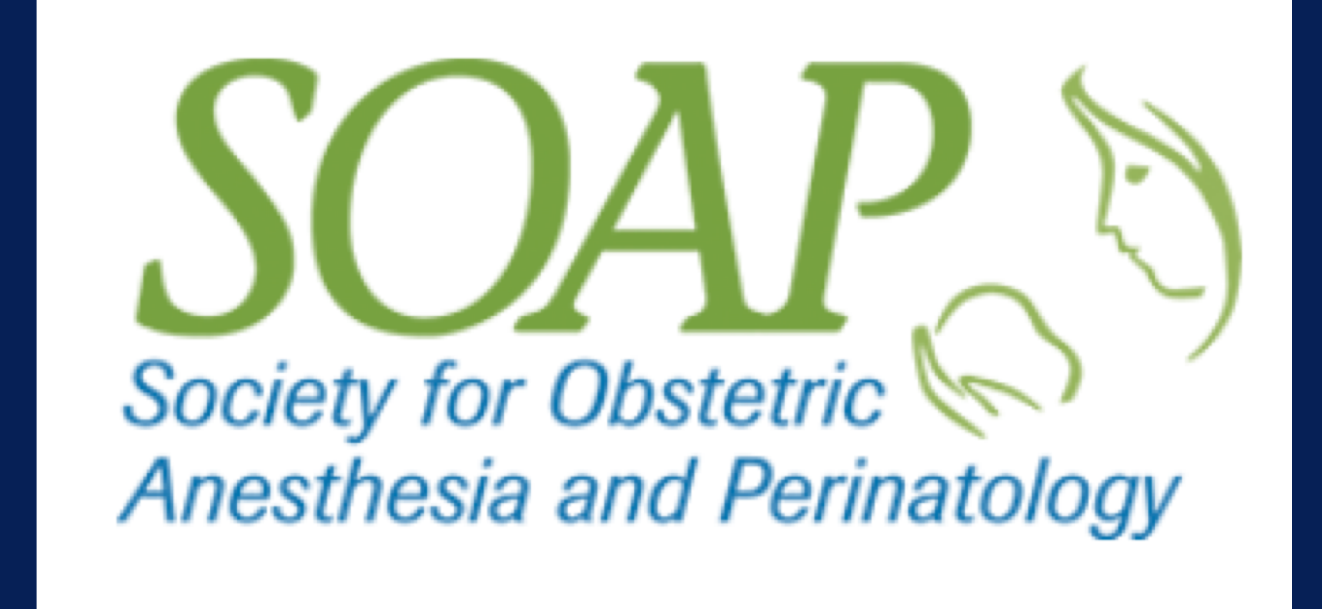


Venovenous Extracorporeal Membrane Oxygenation (ECMO) Treatment Parameter Differences in Obstetric Patients



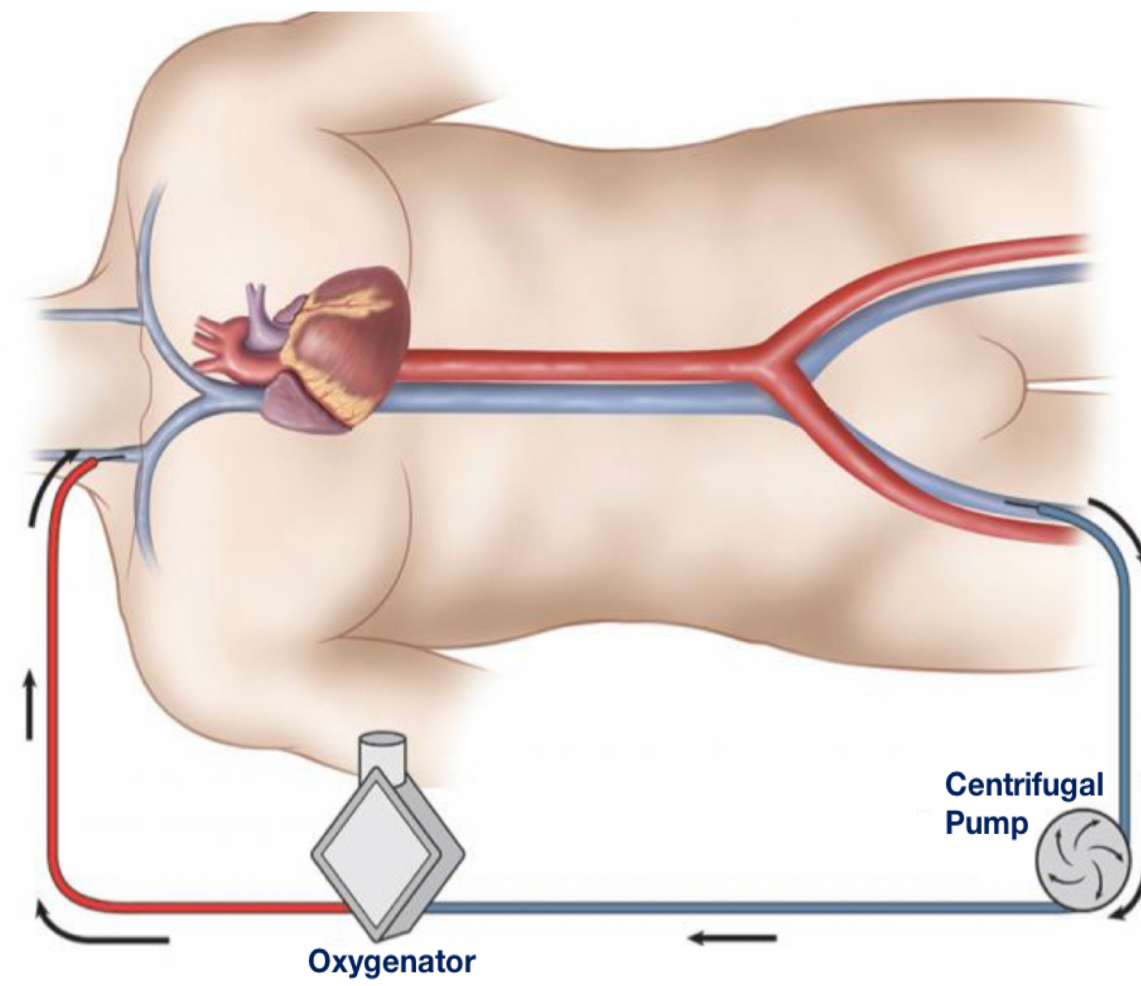
Brianna Hildreth¹, Alexandra Nicholas¹, Kate Petty¹, Philip Grosse², Grace Lim¹

¹ Department of Anesthesiology & Perioperative Medicine, University of Pittsburgh School of Medicine, ² Department of Epidemiology, University of Pittsburgh



Background

- Maternal mortality rates continue to rise due to advanced maternal age and increasing medical complexity
- ECMO is a rescue therapy utilized in patients suffering from complications of pregnancy and delivery
- The incidence of ECMO in the obstetric population has increased in recent decades
- Pregnant and postpartum women experience physiologic changes that lead to expected differences in ECMO treatment parameters
- Few studies have identified key ECMO parameter adjustments for obstetric patients that can guide current and future therapies for pregnant women



Methods

- Pre-pandemic retrospective case control that compared all pregnant and postpartum patients requiring V-V ECMO at UPMC between 2013-2020, with non-pregnant controls matched by age, body surface area (BSA), indication, and sex
- Hourly vital signs, blood gas values, and ECMO parameters for the first 72 hours following ECMO initiation were recorded
- Descriptive statistics described indications for ECMO, survival rates, and timing of initiation
- Means were summarized over 12-hour intervals and plotted for trends while accounting for variability in the form of standard error of the mean
- Plots displayed means and the region within 2 standard errors of the mean for each variable, comparing differences between cases and controls
- Frequency of abnormal events in ECMO parameters were reported for each group
- Analyses were performed with SAS version 9.3 (SAS Institute, Cary, NC)

Results

- 10 records (5 cases and 5 controls) were identified
- All 5 (100%) obstetric patients and 2 (40%) non-obstetric patients survived to hospital discharge
- Indications for V-V ECMO cases were viral pneumonia (4 of 10, 40%), aspiration pneumonia (3, 30%), status asthmaticus (1, 10%), and other acute respiratory illness (2, 20%)
- Obstetric cases had ECMO initiated on postpartum days 2.2 ± 2.7 , with most initiated in the context of cesarean delivery (4 of 5, 80%)
- Pregnant cases had more frequent abnormal instances for low pH (case 64.6% vs. control 38.6%), respiratory rate (9.7% vs. 2.2%), and low PaO₂ (case 63.3% vs. control 33%)
- Control cases had more frequent abnormal instances for heart rate (case 10% vs control 66.7%), SpO₂ (6.7% vs. 25.9%), high mean arterial pressure (MAP) (2.6% vs. 18.4%), and high PaCO₂ (10.1 vs. 95.5%)

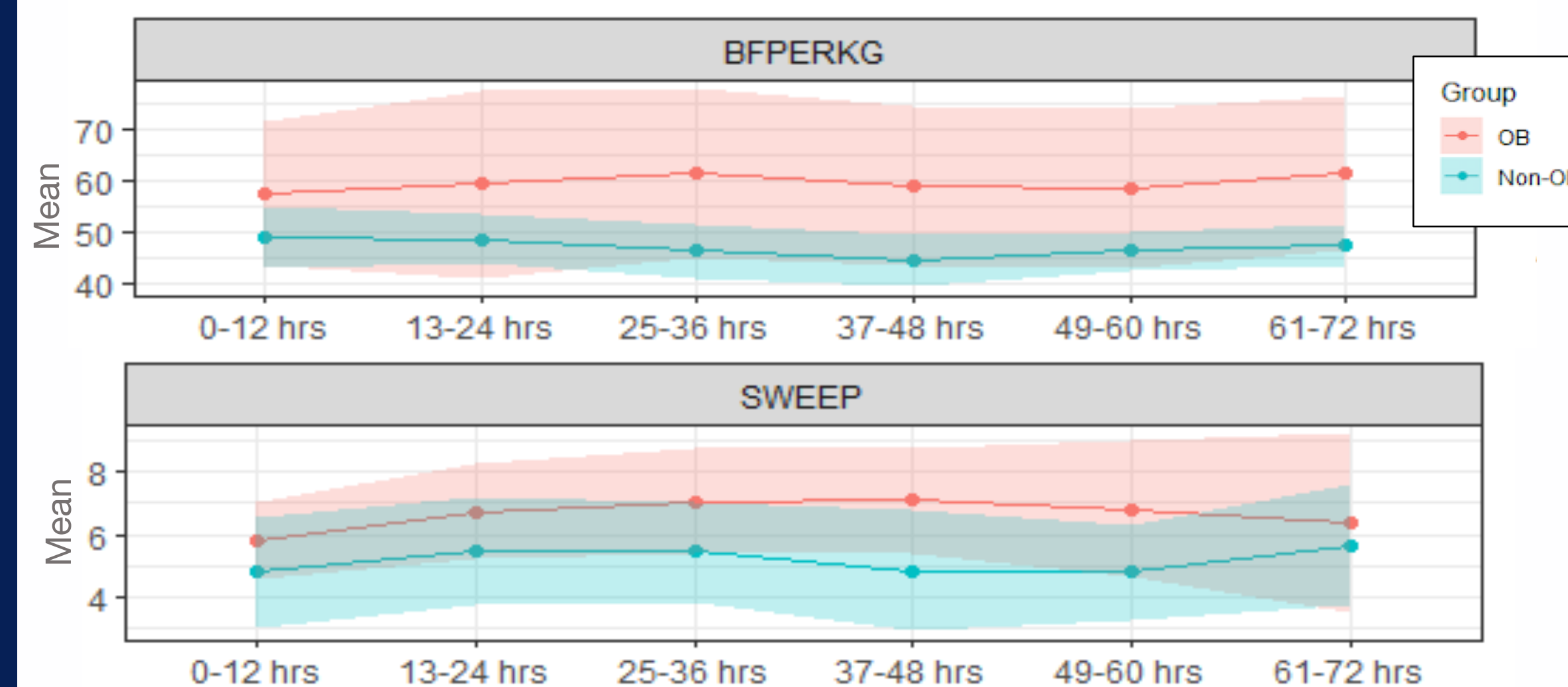


Figure 1. ECMO variables over 12-hour intervals

Figure 1 demonstrates means of ECMO parameters summarized over 12-hour intervals and plotted for trends, comparing cases and controls while accounting for variability in the form of standard error (shaded regions). ECMO variables blood flow per kg per minute (BFPERKG) and carbon dioxide removal (sweep), were most notably different in pregnant vs. nonpregnant controls across the total treatment time.

Figure 2 depicts the number of device changes that were recorded for parameters that impact oxygenation including sweep, speed, and FiO₂. Each dot represents one individual's number of changes. For all measures, the number of changes is less variable for the OB group, with the non-OB group having number of changes more concentrated at the high and low ends of the range of distribution for each variable.

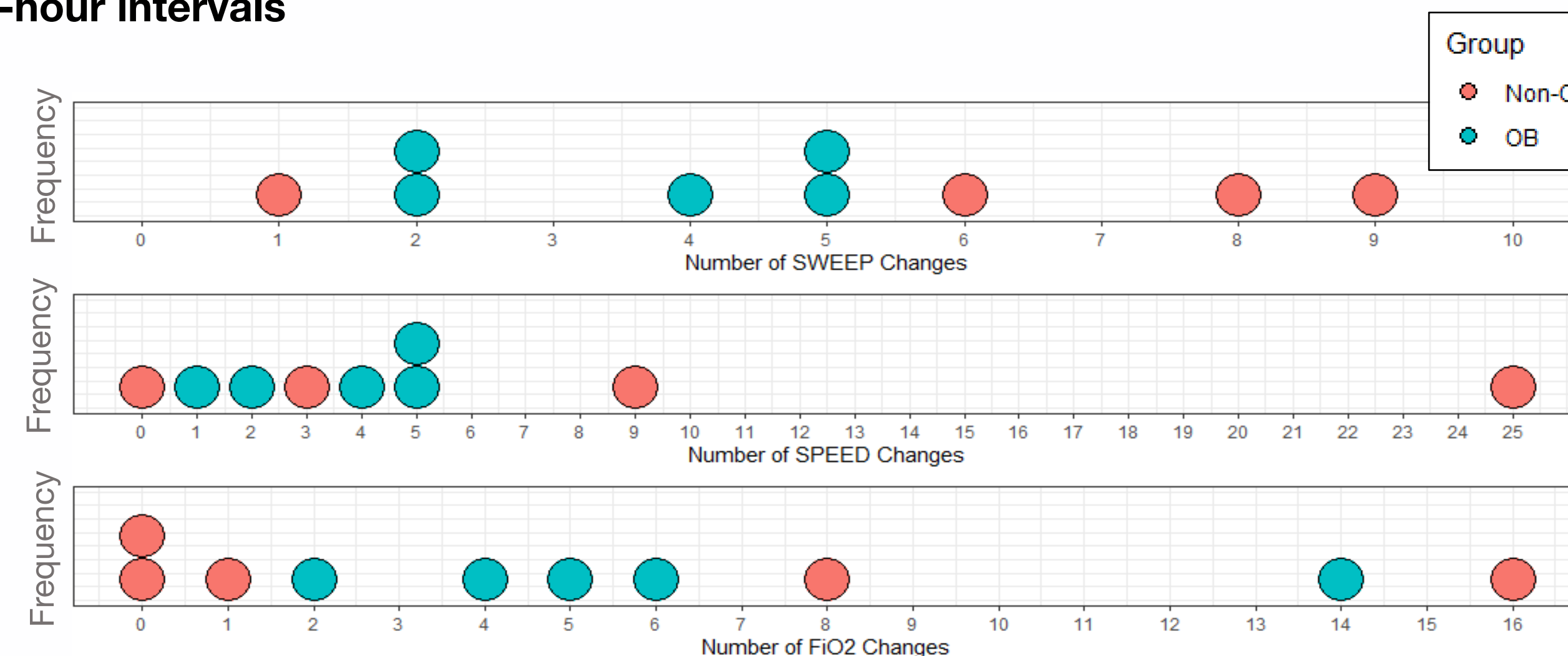


Figure 2. Number of ECMO and Ventilator Device Changes

Discussion

- ECMO sweep and BFPERKG parameters and resultant PaCO₂ changes are notably different in obstetric patients compared to non-obstetric patients
- These findings suggest that obstetric cases maintained more optimal flow rates (target of 60-88 cc/kg/min) and sustained higher rates of CO₂ removal, when compared to the non-obstetric cohort
- Limitations: single center study, rarity of ECMO rescue therapy use, and variation in postpartum date of ECMO initiation

Conclusion

- Obstetric patients requiring V-V ECMO receive treatment initiated in the postpartum period and are likely to survive to hospital discharge
- These results highlight potential improvement opportunities for mechanical hemodynamic support systems for critically ill pregnant women

Acknowledgements

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