STRONG CHILDREN'S RESEARCH CENTER

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ABSTRACT

Title: *Divergence Between Net Fluid and Weight Measures in Calculating Cumulative Fluid Balance*

Background: Fluid management is a critical aspect of care for patients in the pediatric intensive care unit (PICU). Excess cumulative fluid balance (CFB) is associated with morbidity in critically ill children. CFB, expressed as a percentage of body weight, is clinically assessed by serial weight changes (CFBw) or by net fluid intake and output relative to ICU admission weight (CFBf).

Objective: In this multicenter study, we compare CFBw and CFBf and stratify by patient characteristics. We hypothesize there will be a significant difference between CFB methods, and fewer unmeasured output occurrences will improve agreement.

Methods: We extracted electronic health record data from 4 PICUs and 2 CICUs for the first 7 days of admission. We described counts of repeated weight measurements and calculated CFBw as the change in weight divided by admission weight. For each weight measure beyond admission weight, we calculated net fluid intake-output up to that time point and subsequently calculated CFBf as intake minus output divided by admission weight. We assessed mean difference with Bland-Altman analyses and used linear models to evaluate differences in weight and occurrence frequency across units. We used Wilcox tests to assess differences between groups. Additional patient subgroups included patients with weights recorded on ICU day 0 (Early) and patients younger than one month (Neonate).

Results: Among 12,388 ICU encounters, there was a significant difference in the number of repeated weight measurements between sites ($p<0.001$). Ventilator status was not associated with repeated weights, and neonates had the highest rate of repeated weights. All sites and subgroups had positive bias between CFBf and CFBw (mean bias across sites: All patients = 4.7%, Early = 4.7%, Neonates = 5.9%) suggesting CFBf is greater, on average, than CFBw. Excluding values after a patient's first output occurrence slightly decreased bias between CFBf and CFBw (mean decrease: All Patients = -0.6%, Early = -1.2%, Neonates = -0.7%). Additionally, mean bias significantly increased over ICU admission (mean bias: days 0-3= 2.7%, days 4-7= 8.1%, $p=0.002$), and this difference increased for patients with early weights and neonates.

Conclusion: CFB by net fluid calculation is consistently higher than by weight calculation, and this mean difference increases throughout ICU duration. Early weight measures may amplify these differences, and weight-based CFB calculations are recommended later in ICU admission.