Higher CICU mechanical ventilation volumes are associated with lower in-hospital mortality

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Background: The incidence of respiratory failure and the provision of invasive and non-invasive mechanical ventilation (MV) in patients admitted to cardiac intensive care units (CICU) are increasing. While institutional MV volumes are associated with reduced mortality in medical and surgical ICUs, this relationship has not been characterized in the CICU population.

Purpose: By describing the relationship between institutional MV volume and outcomes in the CICUs, we hope to shed light on minimum volume benchmarks for providing MV.

Methods: National Canadian population-based data from 2005 to 2015 was used to identify patients admitted to CICUs requiring MV. CICUs were categorized into low (≤100), intermediate (101-300), and high (>300) volume centers based on spline knots identified in the association between annual MV volume and mortality (Figure). Outcomes of interests included all-cause in-hospital mortality, the proportion of patients requiring prolonged MV (>96 hours) and CICU length of stay (LOS).

Results: Among the 47,173 CICU admissions that required MV, 89.5% (42,200) required invasive mechanical ventilation. The median annual CICU MV volume was 127 (range 1-490). In-hospital mortality was lower in intermediate (29.2%, adjusted odds ratio [aOR] 0.84, 95% CI 0.72-0.97, p = 0.019) and high-volume (18.2%; aOR 0.82, 95% CI 0.66-1.02, p = 0.076) centers, compared to low volume centers (35.9%). The proportion of patients requiring prolonged MV was higher in low-volume (29.2%) compared to high-volume (14.8%, OR 0.70, 95% 0.55-0.89, p = 0.003) centers. Point estimates for mortality and prolonged MV were lower in PCI-capable and academic centers (Table). Significantly (p <0.01) lower CICU LOS was observed only in the subgroup of PCI-capable intermediate- and high-volume hospitals.

Conclusions: In a national dataset, we observed that higher CICU MV hospital volumes were associated with lower in-hospital mortality, CICU LOS, and fewer episodes of prolonged MV. Pending further validation, these data suggest minimum MV volume benchmarks for CICUs caring for patients with respiratory failure. Further research is warranted to explore these associations in more detail.

Unadjusted volume-outcome relationships

Outcomes	Group 1 Annual Volume ≤100	Group 2 Annual Volume 101-300	Group 3 Annual Volume >300	Total	p-value
Total N	17702	24351	5120	47173	
In-hospital mortality	6357 (35.0%)	7122 (29.2%)	933 (18.2%)	14412 (30.6%)	p < 0.0001
Median CICU LOS (hours)	85	79	66	79	p < 0.0001
Episodes of prolonged MV	5161 (29.2%)	5608 (23.0%)	758 (14.8%)	11527 (24.4%)	p < 0.0001

Abbreviations: OR (odds ratio), RD (risk difference), CI (confidence interval), PCI (percutaneous coronary intervention), LOS (length of stay)

Abstract Figure. Annual CICU MV volume and mortality