

Supplement Table 24. Summary of observational studies comparing indirect calorimetry with predictive equations in critically ill adult patients (KQ9)

Study	Design	Participants	Comparison	Summary
Tah et al. 2020 [114]	Prospective observational study	N=305 (mechanically ventilated ICU patients)	IC vs. 15 PEs	- None of the PEs achieved ICC ≥ 0.8 - Most PEs over- or underestimated REE. - Swinamer (1990) may be acceptable when IC is unavailable.
Tah et al. 2022 [115]	Prospective observational study	N=294 (ICU patients with REE measured in acute and late phases)	IC vs. newly developed PE	- New equations had $<20\%$ error - IC showed increasing REE over time - Acute-phase-derived PE may be used across ICU phases, but repeated IC confirms increasing REE
Moonen et al. 2023 [116]	Prospective observational study	N=56 (mechanically ventilated ICU patients)	IC (Q-NRG) vs. HB and 25 kcal/kg	- Measured REE exceeded predicted values by day 4 and beyond - PEs underestimate energy needs in late ICU/post-ICU - Repeated IC recommended
Lee et al. 2024 [117]	Prospective observational study	N=33 (surgical ICU patients with sepsis)	IC vs. PE (HB, IJ, Penn State 2003, 25 kcal/kg)	- Day 1 REE was highest; Penn State 2003 had highest agreement (ICC=0.71) with IC - PEs became less accurate over time - IC preferred, especially for dynamic energy needs
Lee et al. 2021 [118]	Prospective observational study	N=46 (liver transplant ICU patients)	IC vs. 4 PEs	- Penn State 1988 showed the highest agreement (ICC=0.65) - PEs tended to over- or underestimate true EE - IC is preferred for precise energy assessment.
Jeon et al. 2019 [119]	Prospective observational study	N=215 (adult burn ICU patients, TBSA $\geq 20\%$)	IC vs. 9 PEs	- All conventional equations overestimated REE. - Thumb 25 had the highest accuracy (61.5% within $\pm 10\%$) - Hangang equation had the best performance (CCC=0.67, RMSE=311.4).
Ma et al. 2021 [120]	Prospective observational study	N=31 (mechanically ventilated trauma ICU patients)	IC (CCM Express) vs. PEs (HB, Fleisch, Robertson-Reid, IJ, 25 kcal/kg)	- IC measured REE significantly higher than most PEs - Highest agreement: IJ (41.9% within $\pm 10\%$) - IC considered more accurate for trauma ICU patients' caloric assessment
Bae et al. 2020 [121]	Prospective observational study	N=55 (mechanically ventilated ICU patients with brain injury)	IC vs. 5 PEs (ESPEN, Harris-Benedict, Frankenfield, Penn State, Faisy)	- In the acute phase (≤ 3 days), IC-REE was significantly higher than estimates - PE equations tended to underestimate REE early and overestimate in the later phase - IC is recommended especially in the early ICU period
Piccolo et al. 2016 [122]	Prospective observational study	N=205 (mechanically ventilated ICU patients)	IC vs. HB with different body weights	- REEHB had the smallest bias (-18.8 kcal/day) but wide variability (± 580 kcal/day). - PEs tended to overestimate low REE and underestimate high REE.
De Waele et al. 2013 [123]	Prospective observational study	N=266 (adult ICU patients, 46 underwent IC)	IC vs. HB-based estimates	- Very poor correlation between measured and calculated energy expenditure ($r^2 \approx 0.2$). - IC was feasible but limited by patient condition.
Subramaniam et al. 2012 [124]	Prospective observational study	N=60 (mechanically ventilated ICU patients with varying severity of sepsis)	Weir-derived MEE vs. HB and Schofield equations	- Good correlation in less severe patients - PEs tended to overestimate MEE by 5%–8%. - Weir-based MEE may be a more reliable alternative when IC is not available.
De Waele et al. 2012 [125]	Prospective observational quality control study	N=50 (mechanically ventilated ICU patients, 350 nutrition days)	HB vs. prescription/intake	- Only 24.6% of prescriptions matched calculated needs. - Bedside caloric estimation using Pes is frequently inaccurate

ICU, intensive care unit; IC, indirect calorimetry; PE, predictive equation; ICC, intraclass correlation coefficient; REE, resting energy expenditure; Q-NRG, quantitative nutritional respiratory gas exchange; HB, Harris-Benedict equation; IJ, Ireton-Jones equation; EE, energy expenditure; TBSA, total body surface area; CCC, concordance correlation coefficient; RMSE, root mean square error; ESPEN, European Society for Clinical Nutrition and Metabolism; REEHB, resting energy expenditure by Harris-Benedict Equation; MEE, measured energy expenditure.

