Supplementary Table S4. Determination of energy and protein requirements

Study, year (country)	Study design	n	Population	Age (mean/median), years	Group 1 (n)	Group 2 (n)	Machine used	Main Findings (Group 1 versus 2)
Sheridan et al.[26] 1997 (US)	Pros obs	25 (11 men, 14 women)	Age ≥65 years, MV, multiple organ failure	74.0±6.2	-	-	Expired gas indirect calorimetry	• The reverse Fick method, and the Harris-Benedict, Fredrix and Ireton-Jones equations poorly predicted REE measured by IC.
Frankenfield et al.[31] 2000 (US)	Pros obs	52 (35 men, 17 women)	Age ≥20 years; trauma patients in surgical ICU on MV and initiated nutrition support within 72 hours of injury	Older patients: 73±2 Younger patients: 34±2	Older patients >60 years (21)	Younger patients ≤60 years (31)	Deltatrac, SensorMedics, Yorba Linda, US	• Energy metabolism: – Measured RMR and calculated BMR were lower in older patients and women ($P<0.05$). – Controlling for BMR as a covariate: the difference in RMR between age groups was neutralised (2,125±44 vs 2,035±55, $P=0.235$) • Nitrogen metabolism – BUN higher in male (33±3 vs 20±2) and female (32 ± 4 vs 17 ± 4) older than younger patients (all $P<0.05$) – Incidence of azotaemia (BUN >25mg/dL) higher among older patients (62% vs 22%, $P=0.004$) at similar protein intake
Frankenfield et al.[27] 2009 (US)	Pros obs	202 (110 men, 92 women) Only data of subgroup of patients ≥60 years; 103 patients was abstracted	Age ≥18 years, MV and required nutrition support.	Non-obese older patients: 75±9 Obese older patients: 70±8	Non-obese older patients (52)	Obese older patients (51)	Deltatrac MB-101, Sensormedics, CA, US	The PSU (Mifflin) equation was accurate in nonobese older patients but not the obese older patients. • i) Bias: –57 to 43kcal vs –49 to 127kcal • ii) Precision: 6–11% vs 9–15% • iii) Accuracy rate: 77% vs 53% • iv) Incidence of large error: 13% vs 33% • A new equation specific to obese older patients was developed: PSU (modified)
Frankenfield et al.[28] 2011 (US)	Pros obs	50 (23 men, 27 women)	Age ≥60 years, BMI ≥30kg/m², MV	70±7	-	-	Deltatrac MB-101, Sensormedics, CA, US	PSU (modified) predicted REE better than the PSU (Mifflin) equation in older critically ill obese patients. Results below is from the original 50 patients and archived data, giving a total of 74 patients for PSU (modified) and 106 patients for PSU (Mifflin) • i) Bias: –87 to –4 kcal vs –90 to 25 kcal/ • ii) Precision: 6–9% vs 9–12% • iii) Accuracy rate: 74% vs 58%; $P=0.04$ • iv) Incidence of large error: 12% vs 22%; $P=0.084$

Segadilha et al.[29] 2017 (Brazil)	Retro obs	97 (49 men, 48 women)	Age ≥60 years, MV and required nutrition therapy	77.9±8.5	-	-	E-COVX, GE Healthcare/Datex-Ohmeda, Helsinki, Finland	• Average RQ: 0.83±0.1 • Average REE: 1568.1±374.2kcal/day • Men vs women: 1701.9±387.4 vs 1431.5±308.3kcal/day ($P<0.001$) • Men vs women: 22.6±4.7 vs 21.4±5.1kcal/kg ($P=0.253$) • Obese vs non-obese: 1686.6±460.2kcal/day vs 1535.3±343.2kcal/day ($P=0.100$) • Among the 6 predictive equations (not including PSU), Harris-Benedict equation with a correction factor of 1.2 had values closest to IC readings.
Ebihara et al.[30] 2022 (Japan)	Retro obs	102 (62 men, 40 women)	Age ≥18 years, MV and had REE measured by IC ≤5 days of admission	Older patients: 72 (range: 73–85) Younger patients: 45 (range: 35–45)	Older patients (53)	Younger patients (49)	AMIS2000 quadrupole mass spectrometer (INNOVISION, Odense, Denmark)	• Measured REE/IBW: 22.3±9.7kcal/kg vs 25.1±8.3kcal/kg ($P=0.07$) • Absolute deviation of measured REE from predictive equation ($25 \times$ IBW): 9.3 ± 6.9 vs 6.3 ± 6.6kcal/kg ($P<0.01$)

BMR: basal metabolic rate (calculated using the Harris-Benedict equation in Frankenfield 2000); BUN: blood urea nitrogen; IBW: ideal body weight; IC: indirect calorimetry; ICU: intensive care unit; MV: mechanically ventilated; Pros obs: prospective observational study; PSU: Penn State University equation; REE: resting energy expenditure; Retro obs: retrospective observational study, RMR: resting metabolic rate; RQ: respiratory quotient; Tmax: maximum body temperature in the previous 24 hours; Ve: minute ventilation at the time of measurement, read from the ventilator, not the calorimeter

[a] In Ebihara et al.,[30] IBW = $22 \times$ height m^2.

Note:
PSU (Mifflin) = Mifflin (0.96) + Tmax (167) + Ve (31) – 6212
PSU (modified) = Mifflin (0.71) + Tmax (85) +Ve (64) – 3085
Bias: 95% confidence interval (CI) of the difference between estimated and measured metabolic rate. If the CI included zero, the equation was unbiased.
Precision: 95% CI of the absolute difference (%) between estimated and measured values (referred to as the root mean square prediction error (RMSPE). If RMSPE was ≤15%, the equation was considered precise.
Accuracy: percentage of estimates falling within 10% of measured
Large errors: percentage of estimates >15% greater than measured
Superscript numbers: Refer to REFERENCES