VU university medical center

Danish ESPEN Meeting
Kopenhagen, 8 June 2012

Dr.ir. Peter J.M. Weijs, Lector Weight Management
Dept Nutrition & Dietetics; Dept Intensive Care

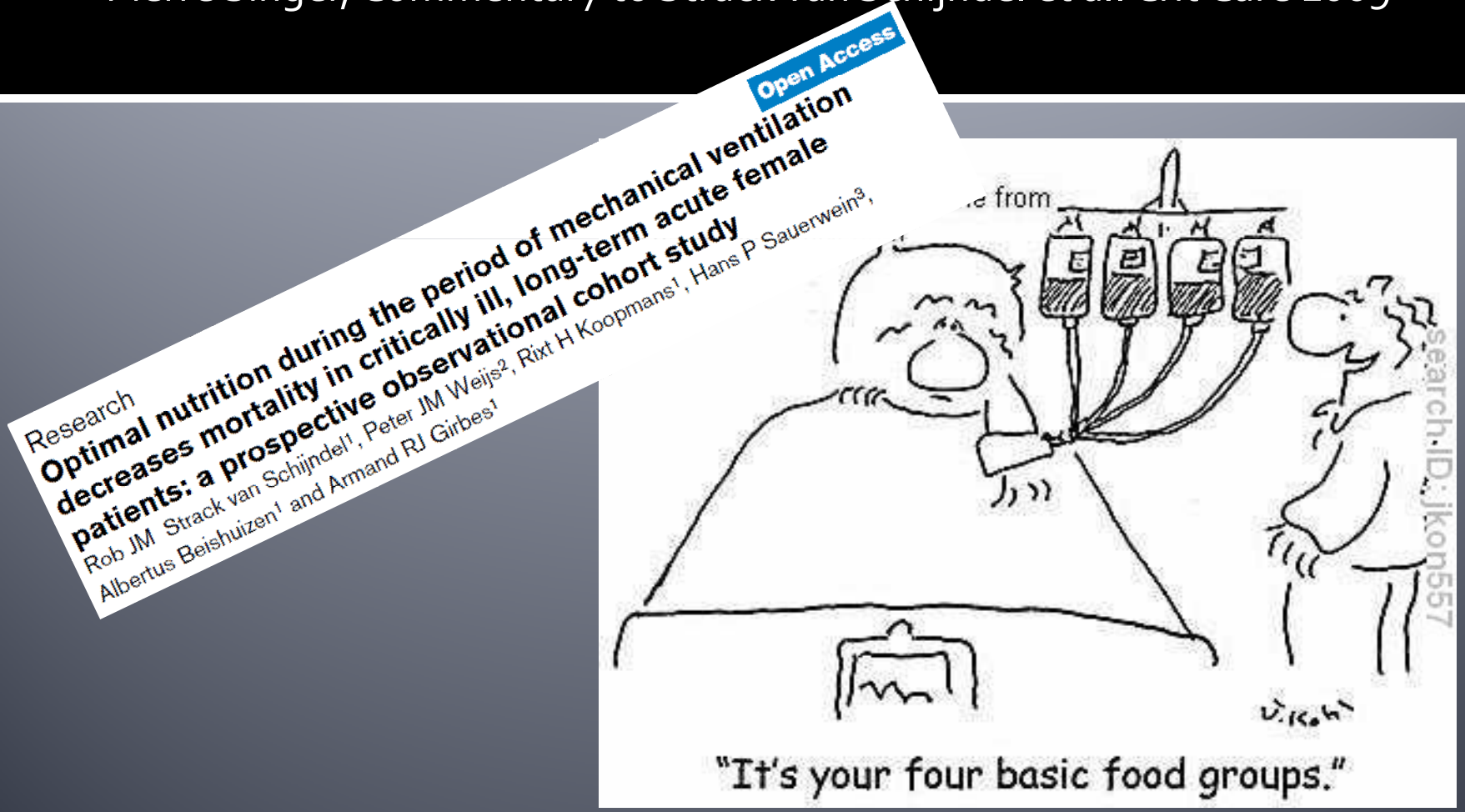
Clinical outcome improves with adequate energy and protein intake. Results from the ICU and ordinary wards.

EMGO+ Institute for Health and Care Research

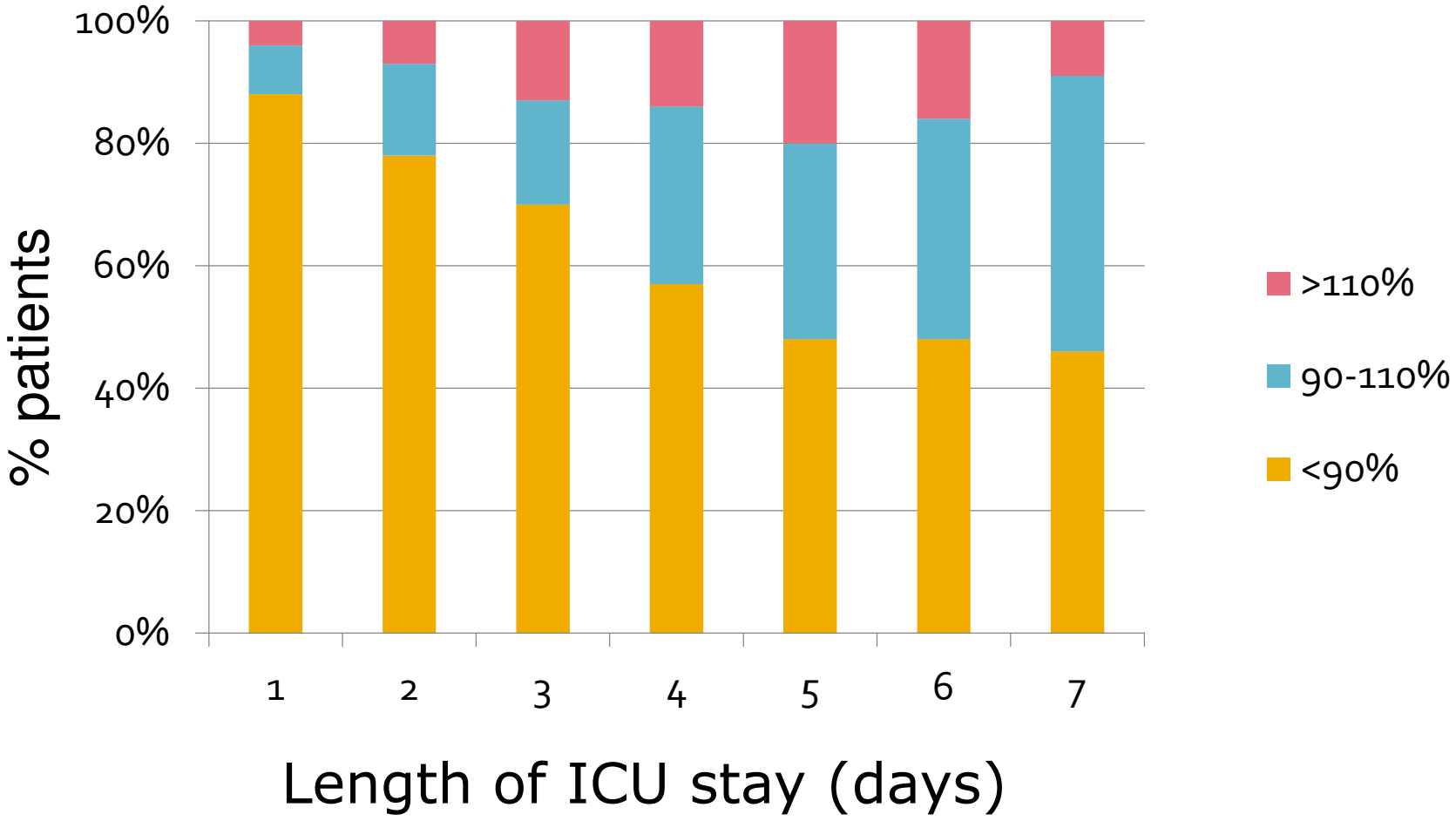
Hogeschool van Amsterdam
Bewegen, Sport en Voeding

"Toward protein-energy goal-oriented nutrition"

Pierre Singer, Commentary to Strack van Schijndel et al. Crit Care 2009

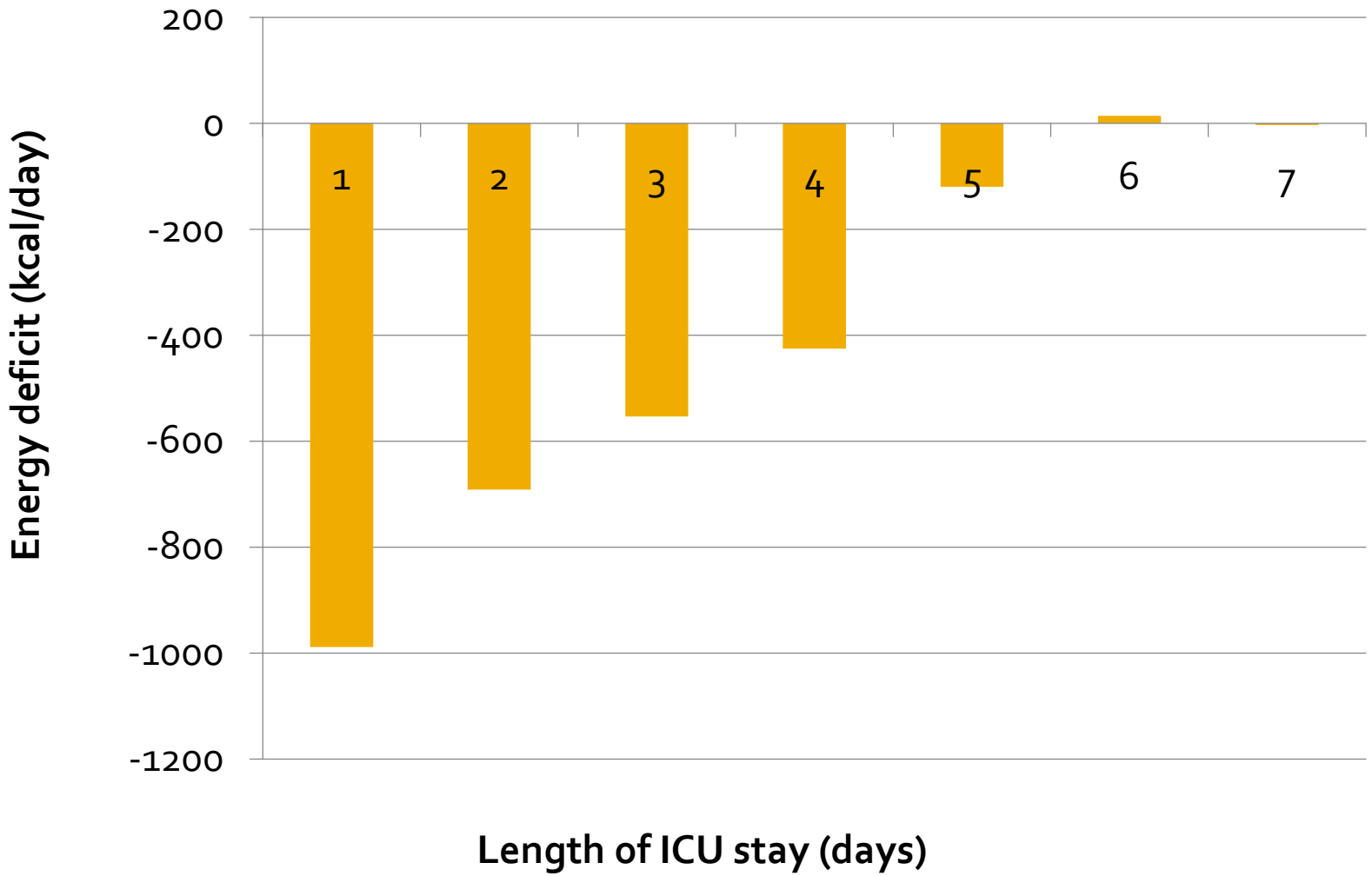


ICU: Over- and undernutrition



Petros et al. Clin Nutr 2006;25,51-59

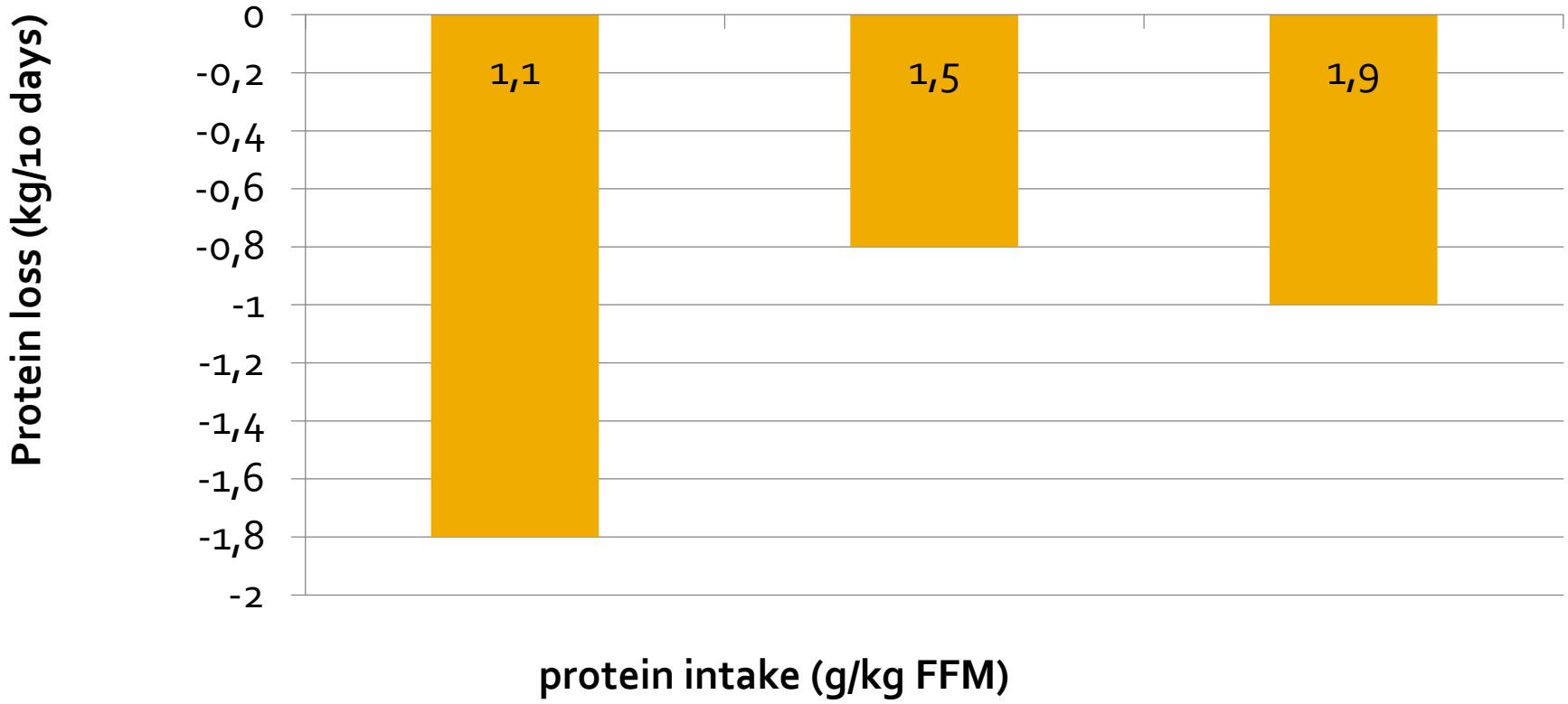
ICU: Energy deficit



Protein loss (kg/10 days)

Ishibashi et al. 1998 (IVNAA)

day 0: 12.8 kg



Sauerwein & Strack van Schijndel 2007

If you do not reach nutrition targets, do not expect effects on outcome.

Clinical Nutrition (2007) 26, 154–158

Available at www.sciencedirect.com

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journal homepage: www.elsevierhealth.com/journals/clnu

SHORT REPORT

Perspective: How to evaluate studies on peri-operative nutrition? Considerations about the definition of optimal nutrition for patients and its key role in the comparison of the results of studies on nutritional intervention

H.P. Sauerwein[a,*], R.J.M. Strack van Schijndel[b]

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[b]*Department of Intensive Care, VU University Medical Center, PO Box 7057, 1007 MB Amsterdam, The Netherlands*

3 challenges of optimal nutrition

1. Definition?
2. How to achieve?
3. Effect on outcome?

1. Definition

- Sauerwein & Strack van Schijndel, 2007:

  Optimal nutrition for intensive care patients:

  - energy as determined by indirect calorimetry plus 10% for activity
  - protein provision of at least 1.2 grams/kg pre-admission weight per day

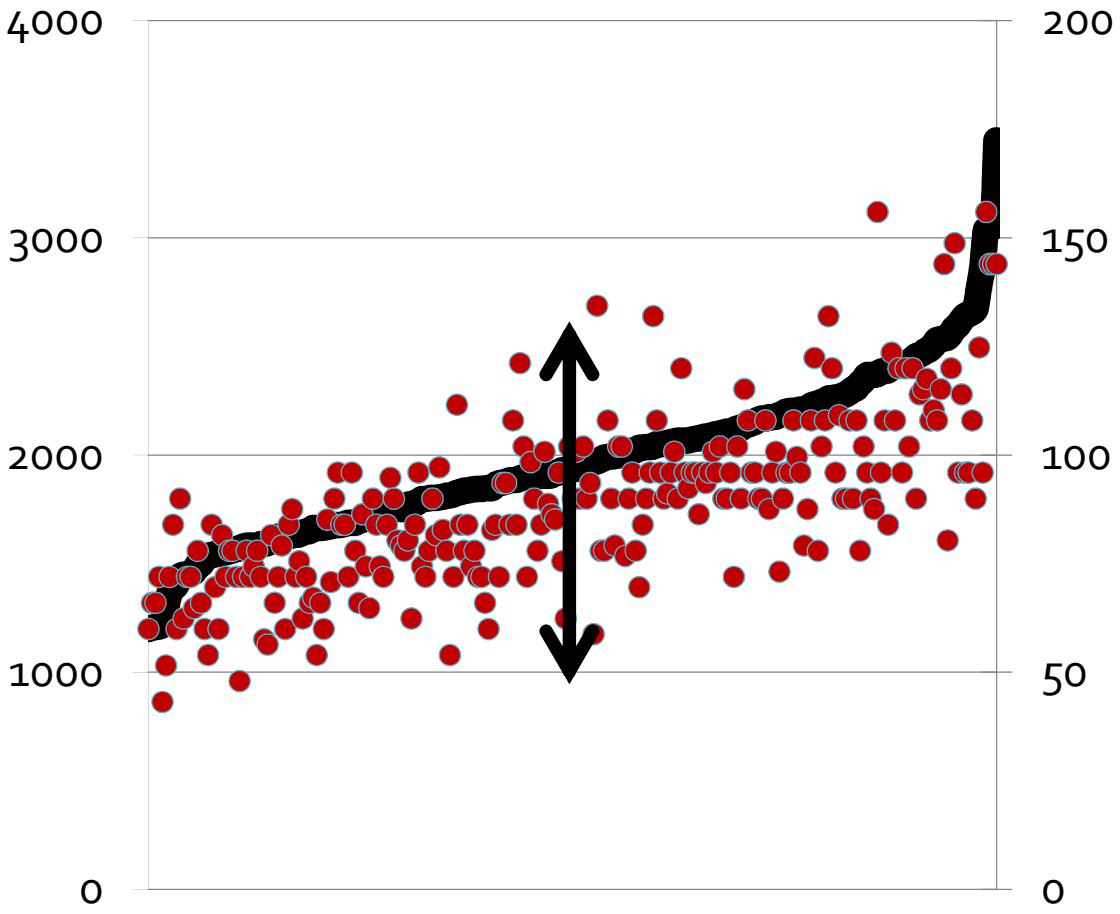
CBO richtlijn perioperatieve voeding, 2007

Sauerwein & Strack van Schijndel. Clin Nutr. 2007;26:154-8.

2. How to achieve?: algorithm

1 EN formula: 14% of patients

Indirect Calorimetry (kcal/d)

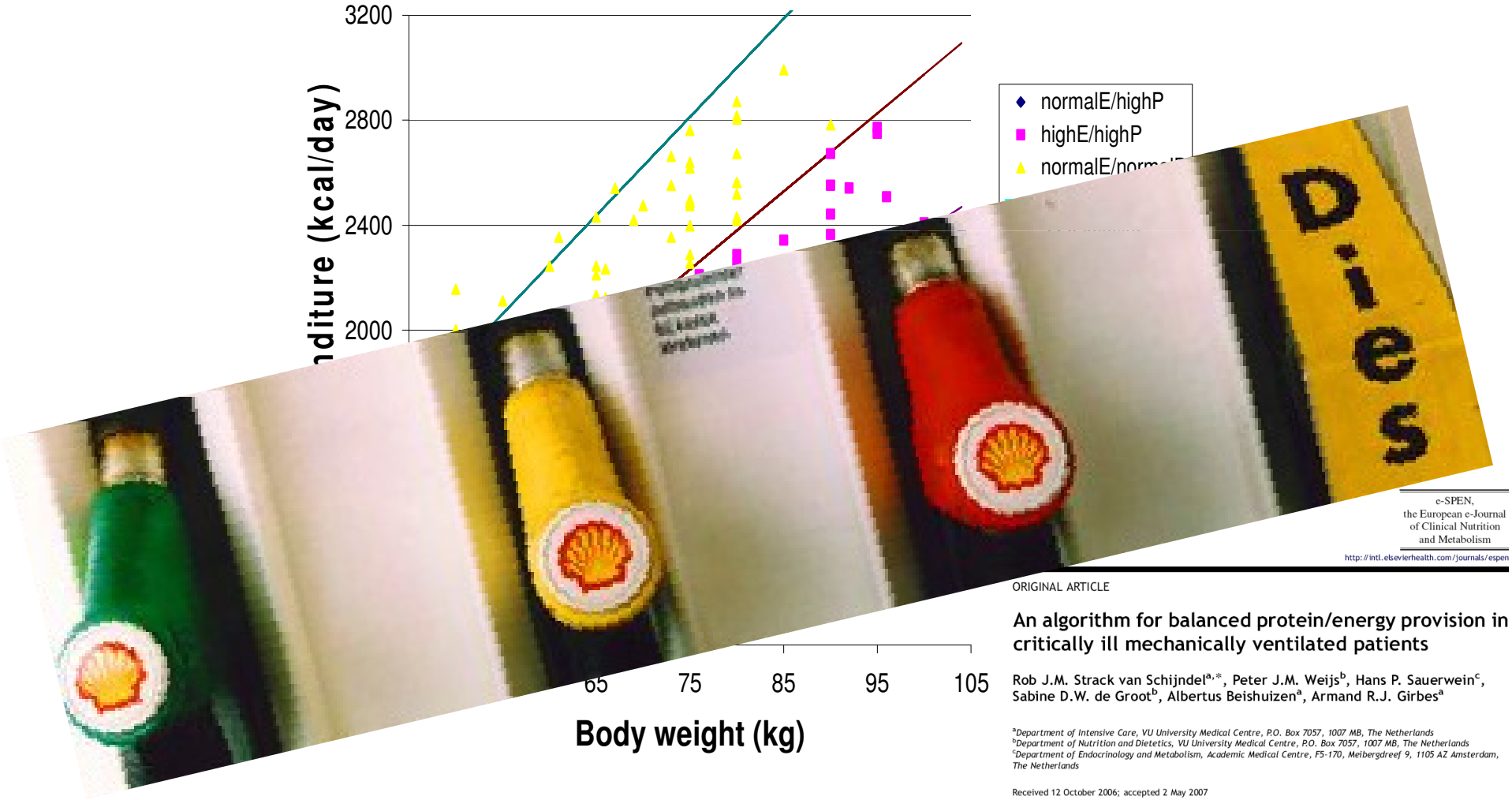


Protein needs (g/d)

Strack van Schijndel RJM, et al. e-SPEN 2007;2:69–74;
de Groot SDW, et al. Clin Nutr Supplements 2010;5:30-31.

Strack van Schijndel et al. 2007

3 EN+algorithm: 89% of patients (in theory)



e-SPEN,
the European e-Journal
of Clinical Nutrition
and Metabolism

http://intl.elsevierhealth.com/journals/espen

ORIGINAL ARTICLE

An algorithm for balanced protein/energy provision in critically ill mechanically ventilated patients

Rob J.M. Strack van Schijndel[a,*], Peter J.M. Weijs[b], Hans P. Sauerwein[c], Sabine D.W. de Groot[b], Albertus Beishuizen[a], Armand R.J. Girbes[a]

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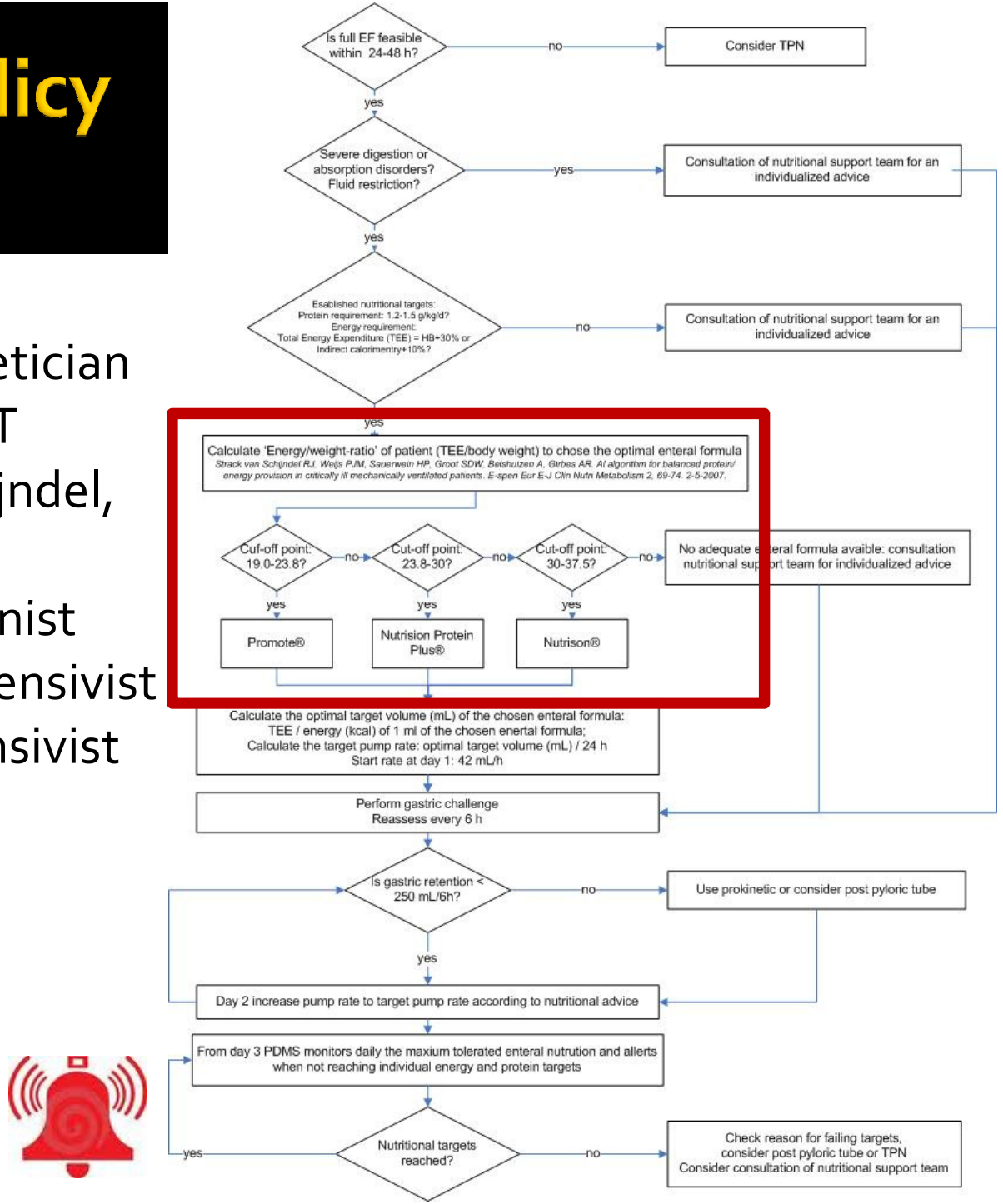
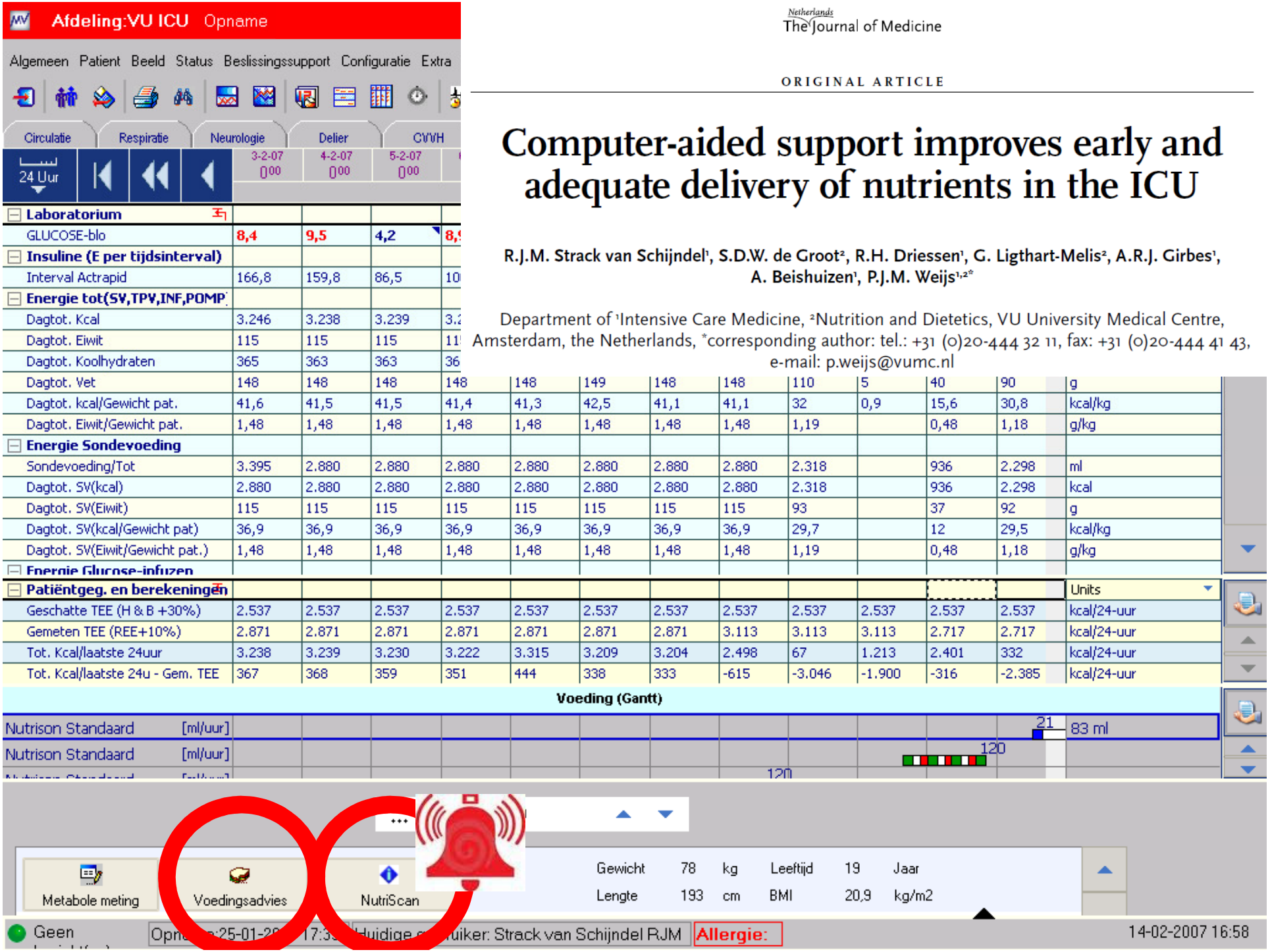
Received 12 October 2006; accepted 2 May 2007

Nutritional policy ICU-VUmc

- Sabine de Groot, dietician
- Ronald Driessen, ICT
- Rob Strack van Schijndel, Intensivist (†)
- Peter Weijs, nutritionist
- Bert Beishuizen, intensivist
- Sandra Stapel, intensivist





Netherlands
The Journal of Medicine

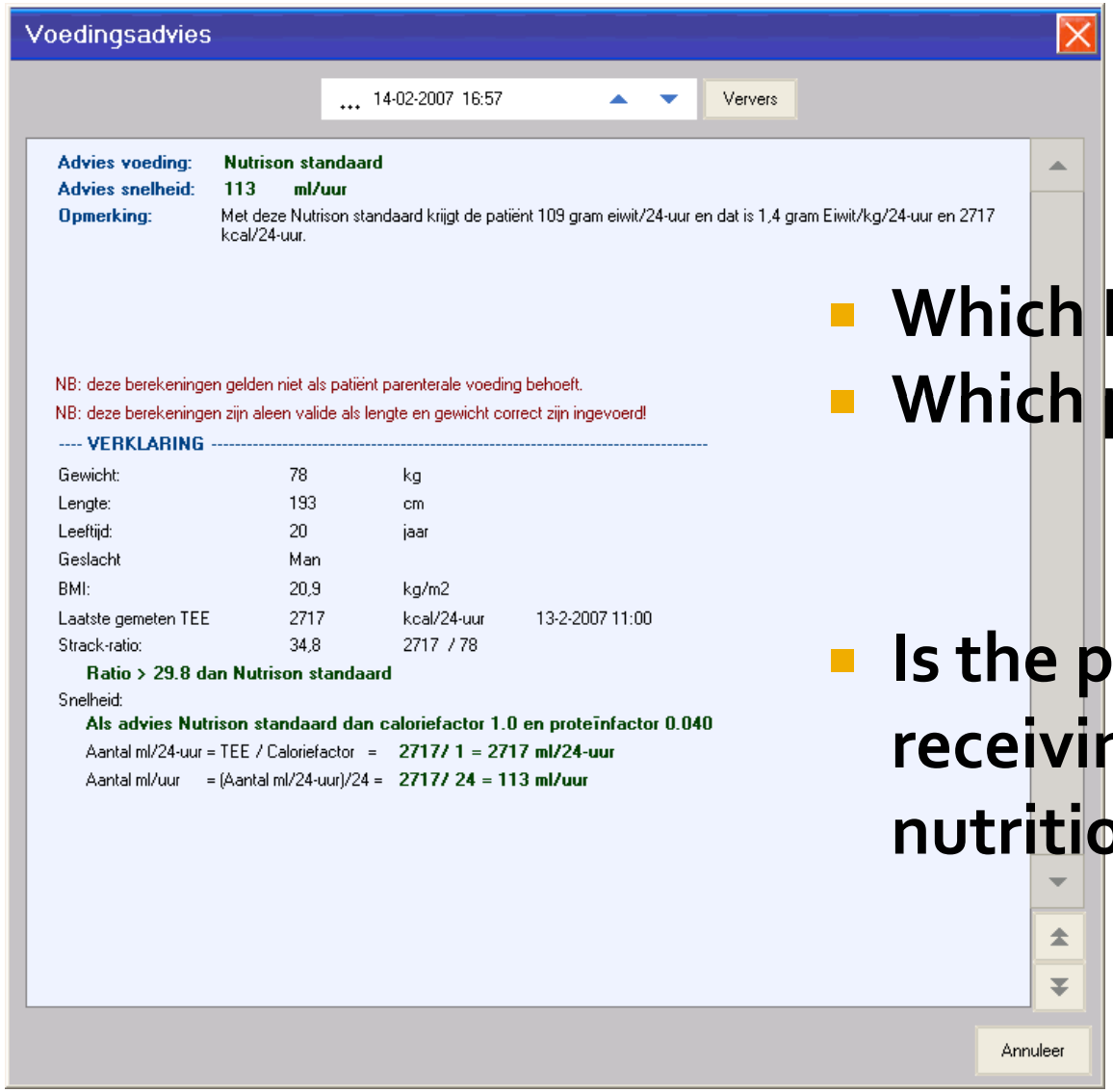
ORIGINAL ARTICLE

Computer-aided support improves early and adequate delivery of nutrients in the ICU

R.J.M. Strack van Schijndel[1], S.D.W. de Groot[2], R.H. Driessen[1], G. Ligthart-Melis[2], A.R.J. Girbes[1], A. Beishuizen[1], P.J.M. Weijs[1,2*]

Department of [1]Intensive Care Medicine, [2]Nutrition and Dietetics, VU University Medical Centre, Amsterdam, the Netherlands, *corresponding author: tel.: +31 (0)20-444 32 11, fax: +31 (0)20-444 41 43, e-mail: p.weijs@vumc.nl

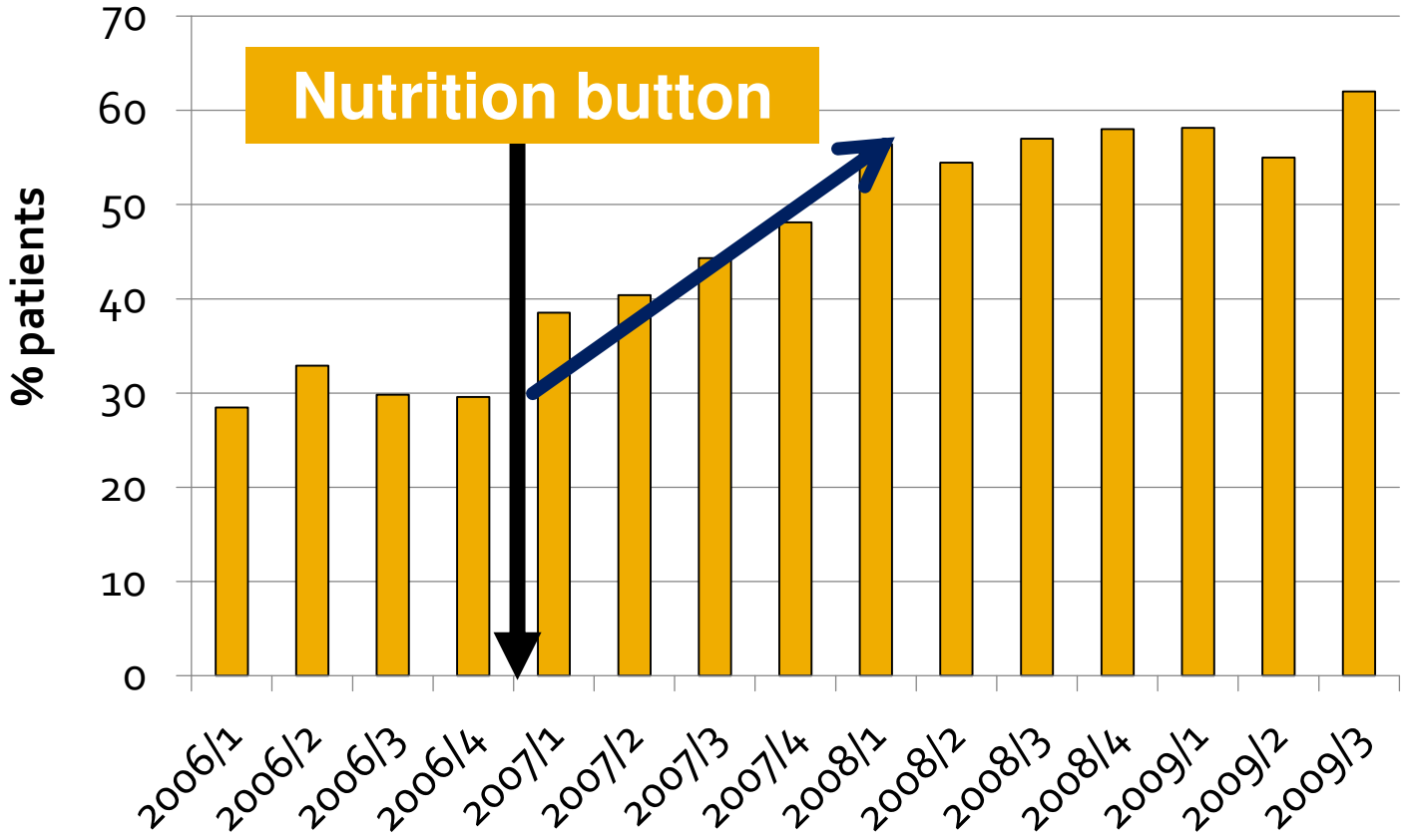
Computerized advice and NutriScan



- Which EN formula
- Which pump speed

- Is the patient receiving targeted nutrition?

2. How to achieve?: computer-aided support

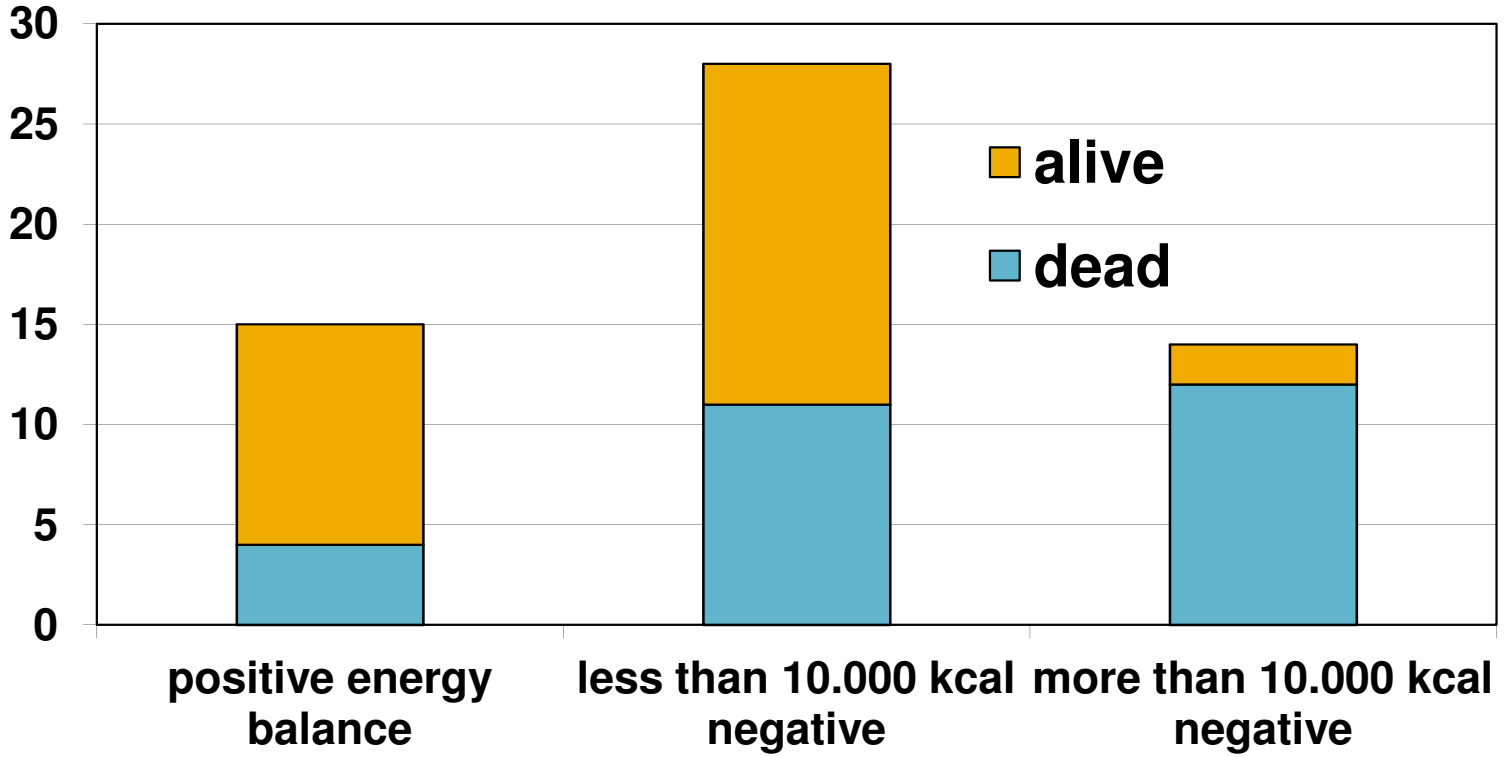


3 monthly National Health Care Inspectorate indicator: protein intake on day 4 after admission

Strack van Schijndel et al. Neth J Med 2009; 67:388-393.

3. Effect on outcome?

- Bartlett et al. 1982: energy deficit and mortality



Bartlett et al. Surgery 1982;92:771-9.

Intake and outcome (1)

Cumulative negative energy balance and outcome

Retrospective studies:

- Bartlett et al. 1982: N=57; **mortality ↑**
- Villet et al. 2005: N=48; **complications/los ↑**, not mortality
- Dvir et al. 2006: N=50; **complications ↑**, not los/mortality
- Faisy et al. 2009: N=38; **mortality ↑**

Evidence-based feeding guidelines and outcome

Prospective studies:

- Doig et al. 2008; Barr et al. 2004; Martin et al. 2004: **mortality =**

Intake and outcome (2)

Energy or protein intake and outcome

- Alberda et al. 2009: N=2772; energy **mortality ↓,** protein **mort.↓**

Energy and protein targets and outcome (MEE)

- Strack van Schijndel et al. 2009: N=243; **mortality ↓** (F)
- Weijs et al. JPEN 2012: N=886; **mortality ↓** (upcoming slides!)
- Allingstrup et al. Clin Nutr 2012: N=113; **mortality ↓** (dose dep.)

Energy & supplemental PN, **RCT**

- Arabi et al. 2011: N=240; permissive underfeeding: **mortality =/↓**
- EDEN trial 2012: N=1000; trophic feeding: **mortality** =
- EPaNIC trial,2011: N~5000; early vs late SPN; **mortality** = complic↑
- Singer et al. 2011: N=112; MEE/SPN; **mortality ↓** complications ↑
- Swiss trial, 2012: N=275; MEE/SPN day 4-8; mortality? complic↓

Alberda et al. 2009

- **Retrospective observational study;** n=2772
- Effect of energy and protein intake during 12 days on 60 day mortality
- 1034 kcal/d (**59%**);
  - +1000 kcal/d: **OR 0.76** (p=.014)
- 0.6 g eiwit/kg.d (**56%**);
  - +30 g protein/d: **OR 0.84** (p=.008)

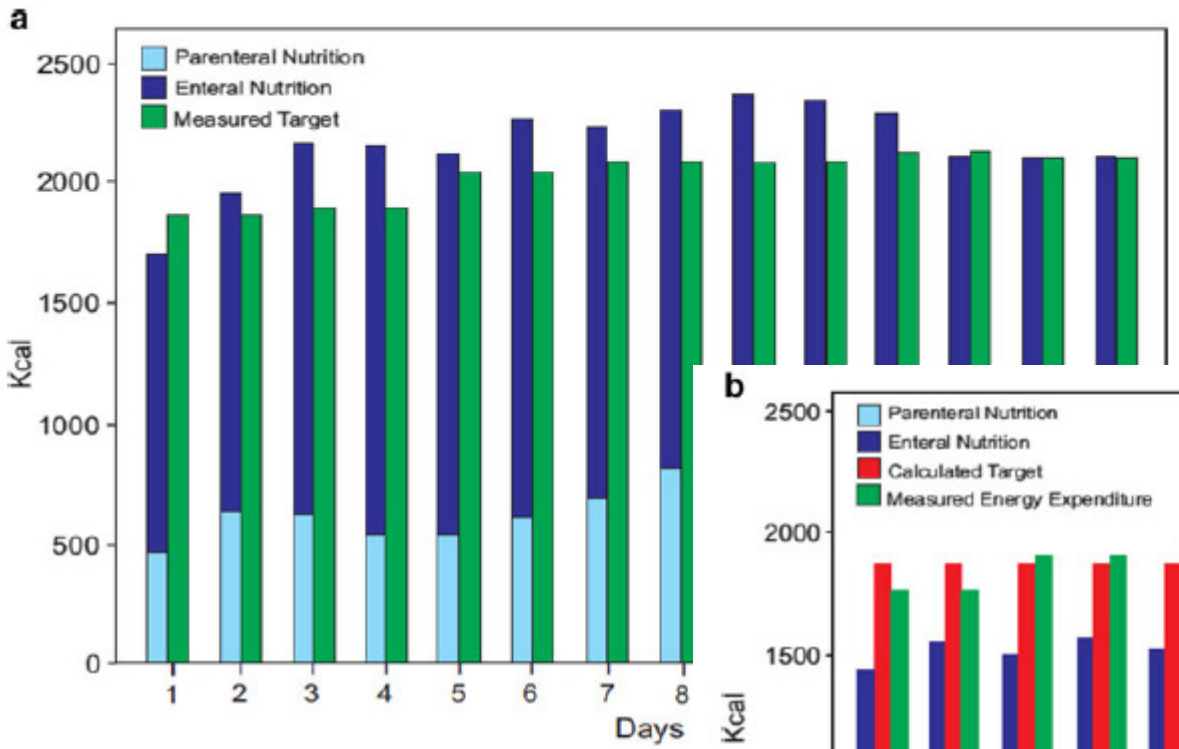
Alberda et al. Intensive Care Med. 2009;35(10):1728-37.

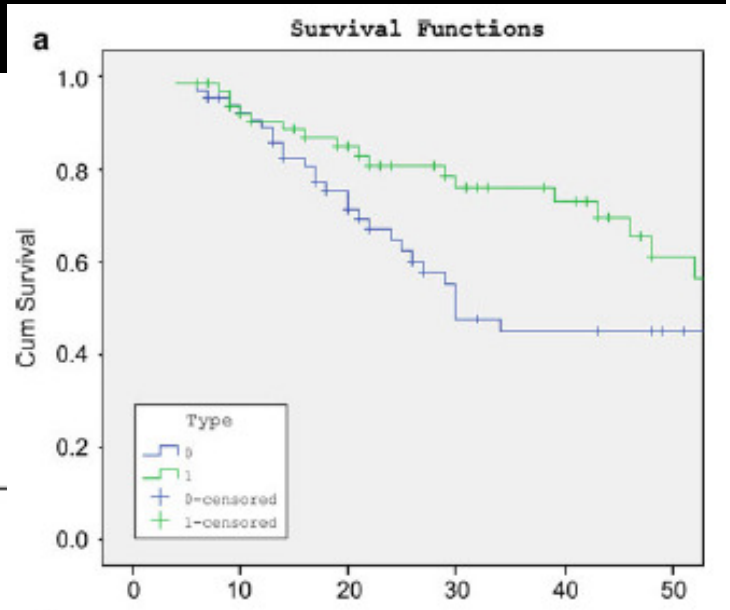
TICACOS study 2011

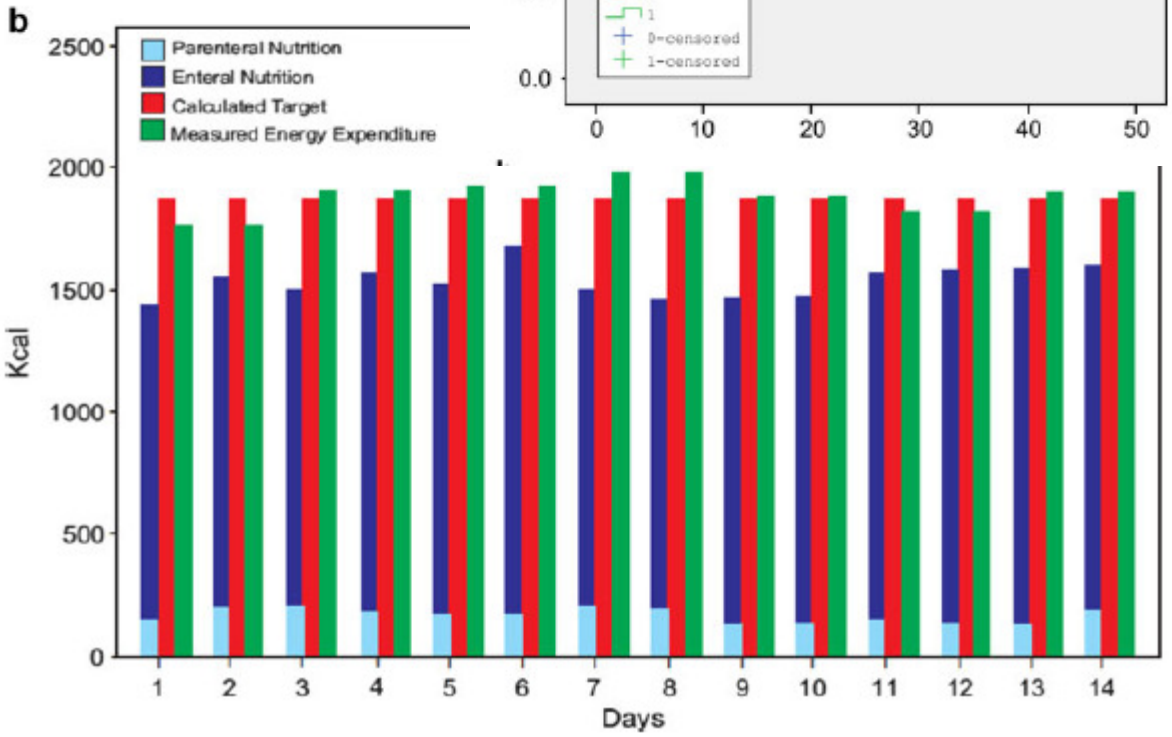
- **Randomized controlled trial**; n=130 (65/65)
- Enery target:
  - Tight calorie control group: measured REE
  - Control group: 25 kcal/kg
- Protein target: 1.3 g/kg?
- Energy intake: **96% / 73%** (2086/1480 kcal/d)
- Protein intake: **79% / 57%** (~1.0 / 0.68 g/kg.d)
- Mortality ICU 25% / 26%
- Mortality hospital 32% / 48% p=0.058 (ITT) or p=0.023 (PP)
- Infectious complications: 37/20 p=0.05

Singer et al. Intensive Care Med. 2011 Feb 22

TICACOS study 2011







Arabi et al. 2011

- **Randomized controlled trial;** N=240
  - "permissive underfeeding": 60-70% energy req
  - "target feeding": 90-100% energy req
- Energy requirement: HB+stress factors
- Protein requirement: 0.8-1.5 g/kg
- Energy intake: **59% / 71%** (1066 / 1251 kcal/d)
- Protein intake: **65% / 64%** (both 0.6 g/kg)
- Mortality: 28d p=0.34; 180d p=0.07; ICU p=0.42; hospital p=0.04; Log rank p=0.16

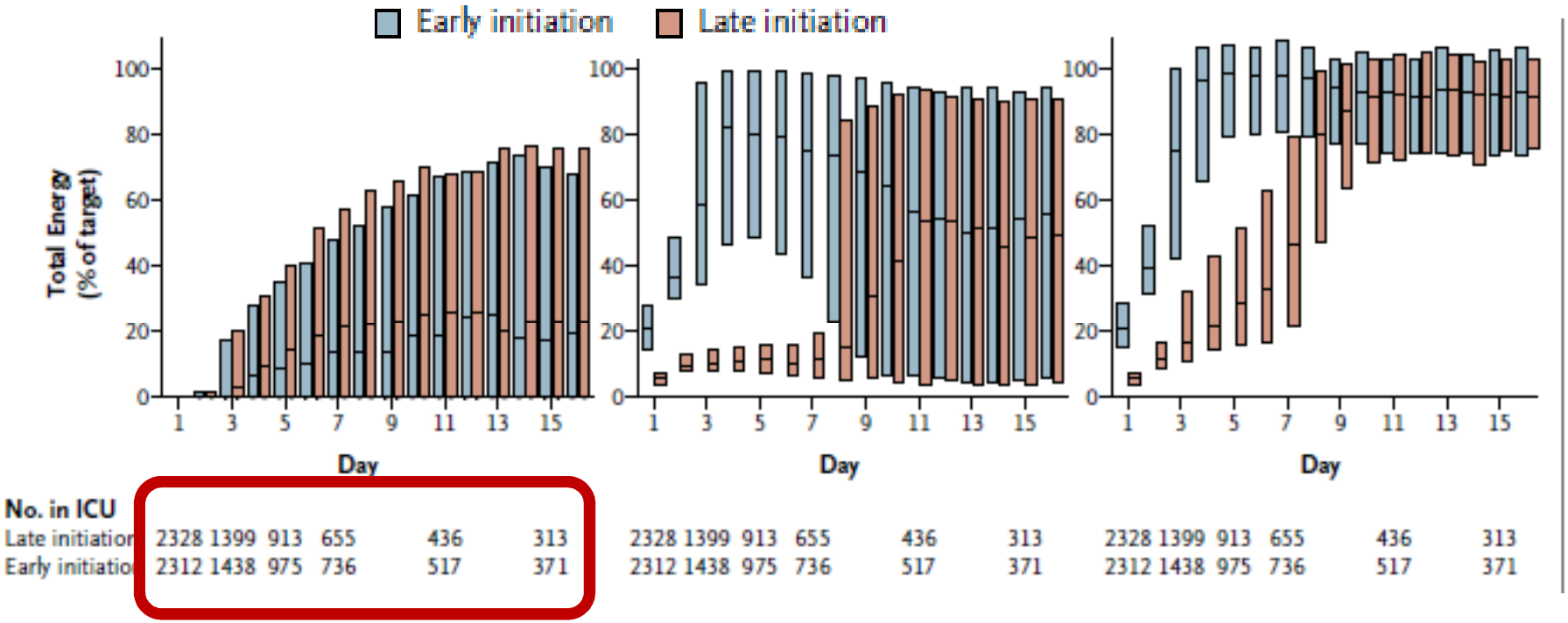
Arabi et al. Am J Clin Nutr. 2011;93:569-577.

EDEN trial 2012

- **Randomized controlled trial;** N=1000
- Energy requirement for 6 days:
  - "trophic feeding": 25% energy req (20 kcal/kg)
  - "full feeding": 80% energy req (25-30 kcal/kg)
- Protein requirement: 1.2-1.6 g/kg?
- Energy intake: **25% / 80%** (400/ 1300 kcal/d)
- Protein intake: 0.16 / 0.80 g/kg
- Mortality: =

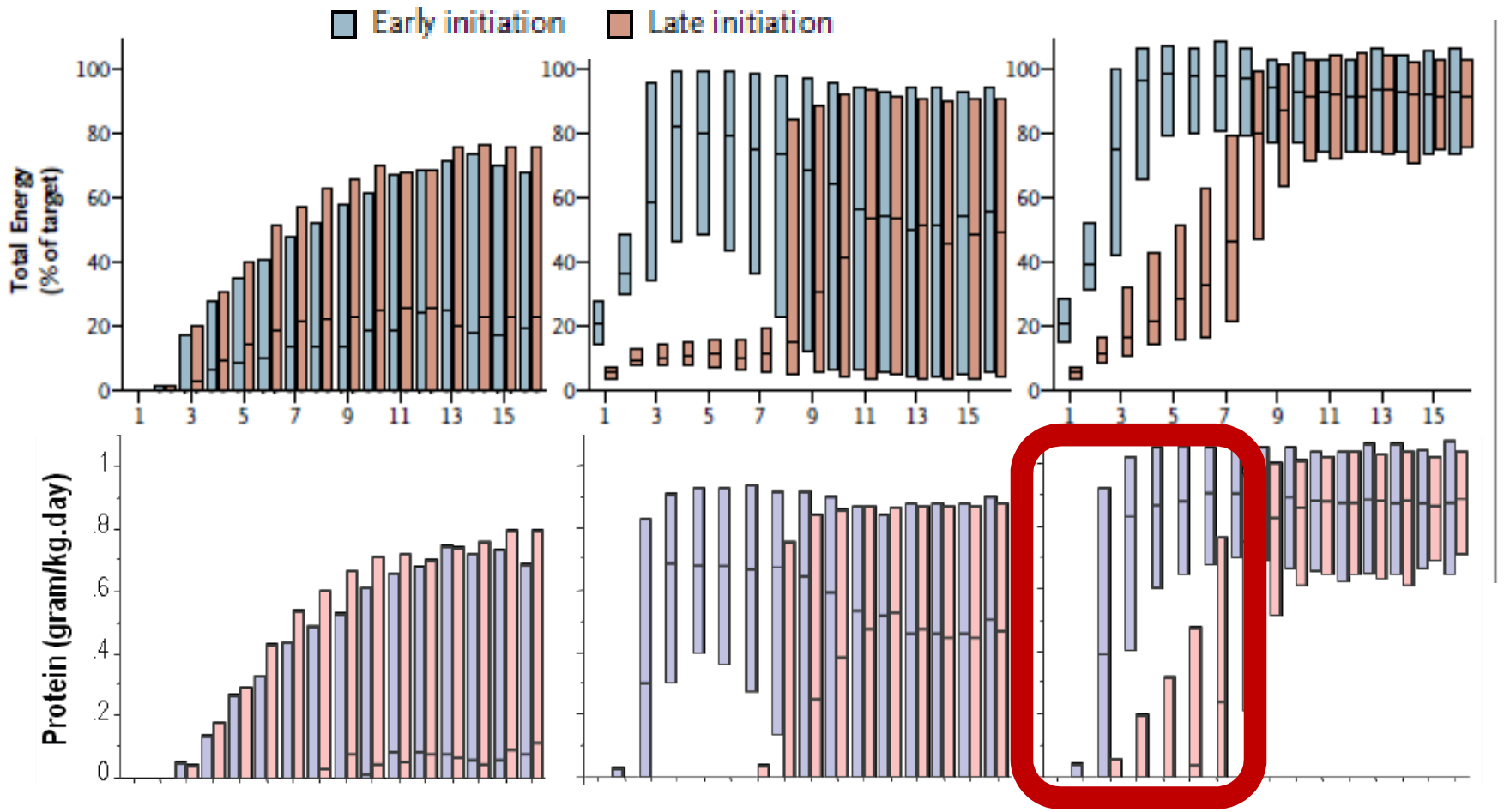
Eden trial JAMA 2012

EPaNIC study 2011

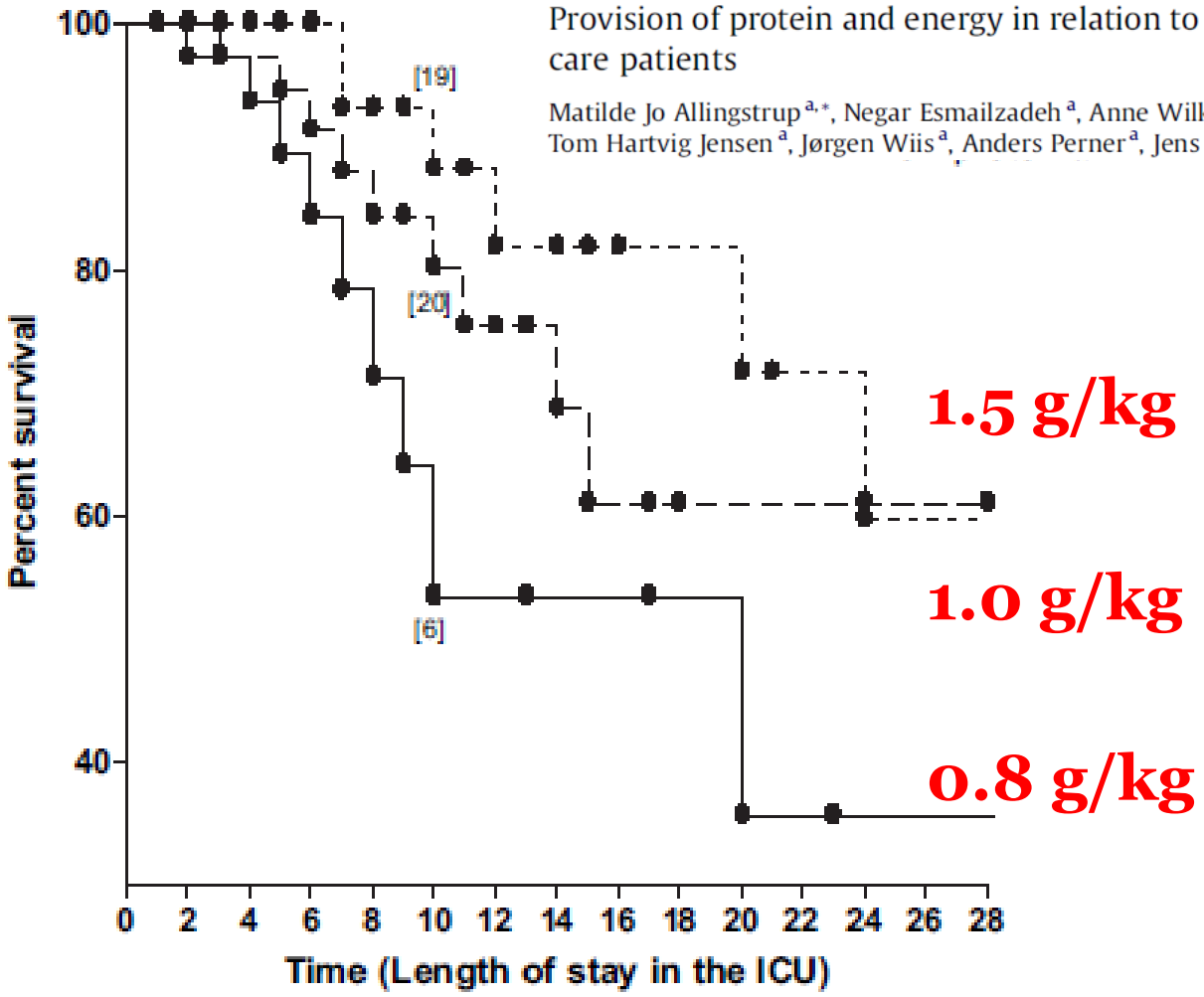


- including very short stay patients
- mortality: not different
- infections and ICU stay: increased

EPaNIC study: energy, protein



Allingstrup et al. 2012



Provision of protein and energy in relation to measured requirements in intensive care patients

Matilde Jo Allingstrup [a,*], Negar Esmailzadeh [a], Anne Wilkens Knudsen [a], Kurt Espersen [a], Tom Hartvig Jensen [a], Jørgen Wiis [a], Anders Perner [a], Jens Kondrup [b]

Clinical Nutrition xxx (2012) 1–7

Optimal nutrition and outcome in critically ill patients

JPEN 2012 (Vars Award Candidate Paper)

Original Communication

Journal of Parenteral and Enteral Nutrition
Volume XX Number X
Month XXXX 1-9

10.1177/0148607111415109
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Optimal Protein and Energy Nutrition Decreases Mortality in Mechanically Ventilated, Critically Ill Patients: A Prospective Observational Cohort Study

Peter J. M. Weijs, PhD[1,2,3]; Sandra N. Stapel, MD[3]; Sabine D. W. de Groot, RD[1]; Ronald H. Driessen, BSc[3]; Evelien de Jong, MD[3]; Armand R. J. Girbes, MD, PhD[3]; Rob J. M. Strack van Schijndel, MD[3,†]; and Albertus Beishuizen, MD, PhD[3]

Methods

- Prospective observational cohort study, mixed medical-surgical ICU, academic hospital
- Mechanically ventilated patients were included 3-5d after admission
- Optimal nutrition targets:
  - **Energy target**: >90% REEx1.1 (Deltatrac)
  - **Protein target**: >1.2 g/kg
- Cumulative balances were calculated for the period of mechanical ventilation

Statistics

- Cox regression analysis: mortality
- Independent variable:
  1. **Protein and energy target** achieved
  2. **Energy target** achieved

  Both versus no target achieved
- Adjustments for gender, age, BMI, Apache II, diagnosis, and hyperglycemic index

Results: Patient characteristics

N=886; n=24 (3%) protein target achieved

	No target	Protein +energy	Energy
N (%)	412	245	205
Female, %	28%	48%	44%
Weight, kg	82	69	75
BMI, kg/m^2	27	24	25
Apache II	23	23	23

Results: Diagnosis

	No	Protein +energy	Energy
Trauma	5.4%	6.7	4.9
Sepsis	11.8	17.1	16.8
Respiratory	17.2	22.9	25.7
Surgical	23.8	26.2	23.5
Neurologic	6.9	8.6	9.3
Reanimation	13.2	2.4	5.3
Cardiovascular	17.6	10.5	11.5
Others	4.2	5.7	3.1

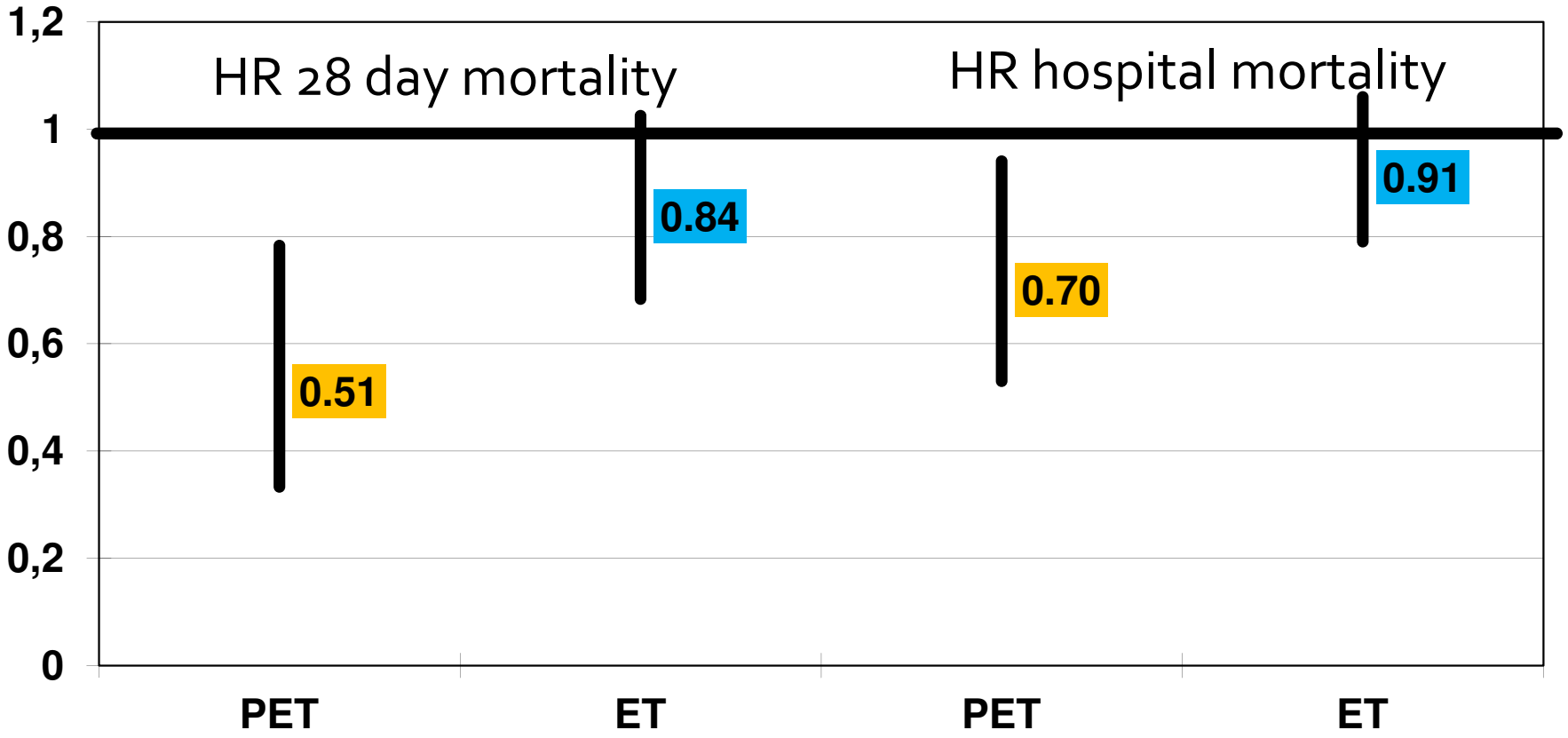
Results: Nutrition

	No	Protein +energy	Energy
Energy intake			
kcal/d	1572	1897	1819
% of target	74%	99%	96%
Protein intake			
gram/kg.d	0.83	1.31	1.06
% of target	70%	112%	89%

Results: Outcome

Length of stay (median, d)	No	Protein +energy	Energy
LOV	12	25	20
ICU LOS	15	27	22
Hosp LOS	28	46	38
28d mort. (%)	20	15	20
ICU mort. (%)	18	22	24
Hosp mort. (%)	31	39	37

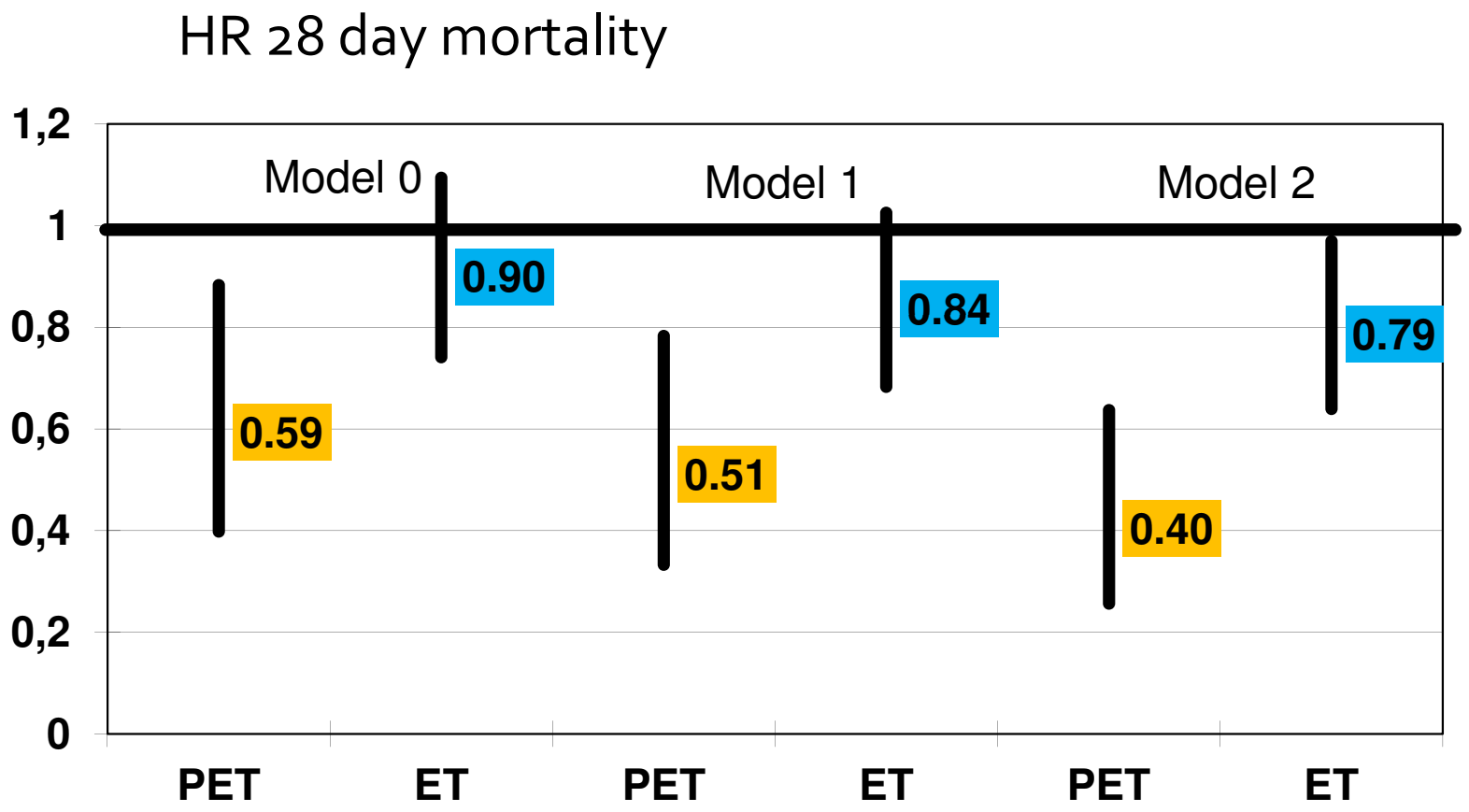
Optimal nutrition and outcome



HR adjusted for sex, age, BMI, APACHE II score, diagnosis category, and hyperglycaemic index

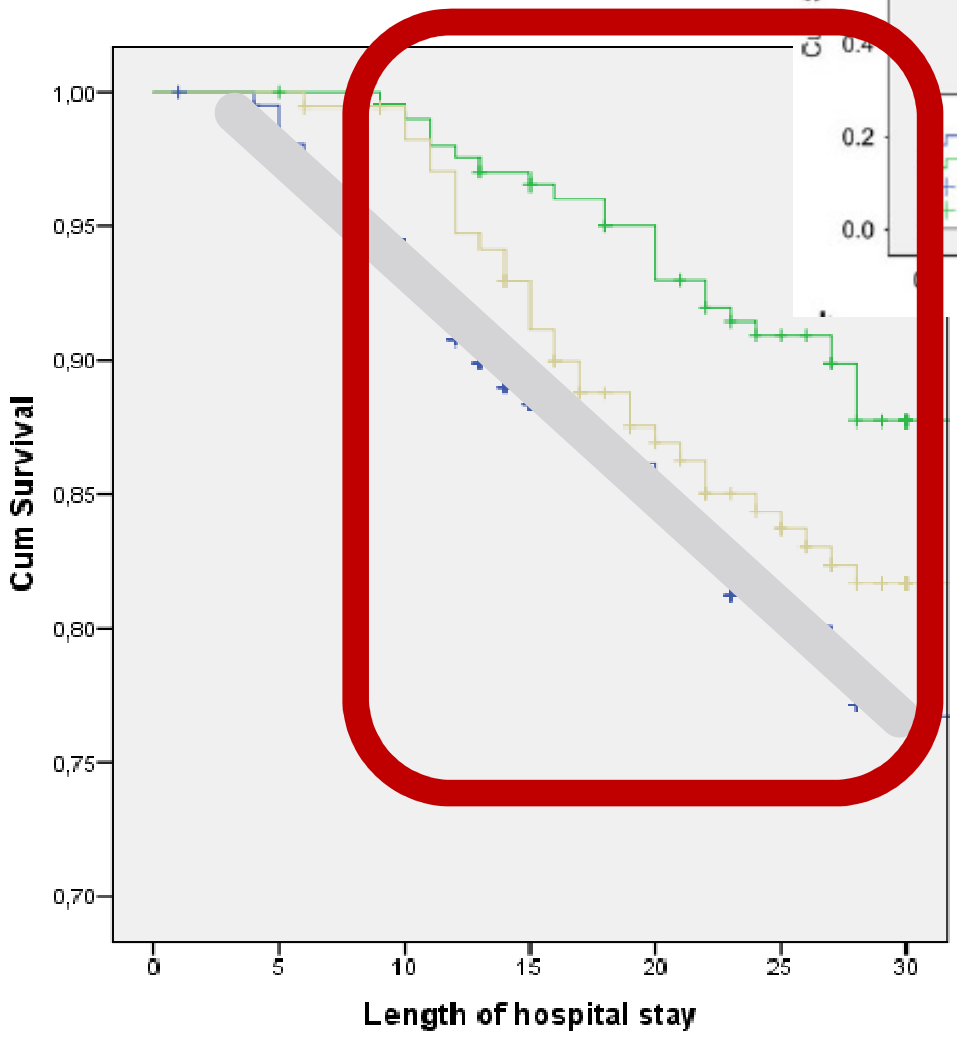
Weijs et al. JPEN 2012

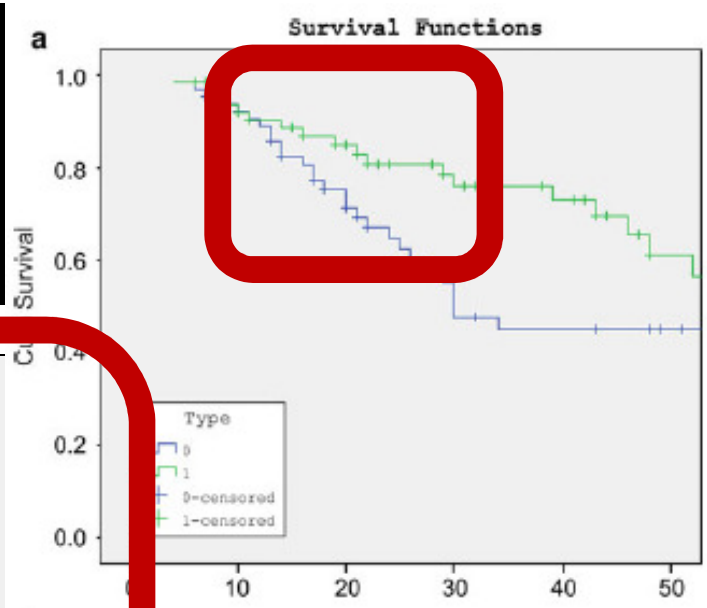
Optimal nutrition and outcome



Model 0 = unadjusted;
Model 1 = HR adjusted for sex, age, BMI, APACHE II score, diagnosis category, and hyperglycaemic index (HGI);
Model 2 = adjusted for model 1 and time to reach the energy target (in days) and the amount of parenteral nutrition (in mL/day).

Survival





Protein + energy

Energy

No target reached

Results: Outcome

Length of stay (median, d)	No	**Protein**	Protein +energy	Energy
LOV	12	**20**	25	20
ICU LOS	15	**21**	27	22
Hosp LOS	28	**44**	46	38
28d mort. (%)	20	**13**	15	20
ICU mort. (%)	18	**17**	22	24
Hosp mort(%)	31	**21**	39	37

Conclusion

- Read: Sauerwein & Strack van Schijndel!
- Critically ill patients that achieve **both the protein <u>and</u> energy target** have lower mortality compared to patients that only achieve the energy target.
- Role of disease severity? => randomisation

Optimal nutrition and outcome in malnourished hospital patients

Study 2

Stuurgroep Ondervoeding

Wie BETER EET wordt SNELLER BETER

Franciscus Ziekenhuis Roosendaal

Een vanzelfsprekende keuze

Weijs PJ, Leistra E, Schipper M, Oostenbrink J, Kruizenga HM.
Achieving protein and energy targets in malnourished hospitalized patients on day 4 of admission improves length of hospital stay.
Clin Nutr Suppl 2011;6:21(O50)
(full paper submitted for publication)

Methods

- Retrospective analysis
- Patients admitted to Franciscus Hospital in 2008 were screened for malnutrition (SNAQ)
  - SNAQ>=3 (malnourished ~10% of admitted)
  - protein and energy intake assessment: day 4
  - Targets:
    - Energy target: >90% Harris-Benedict x1.3
    - Protein target: >1.2 g/kg

Statistics

- Linear regression analysis
- Dependent variable: Ln(Length of Stay)
- Independent variable:
  - **Protein and Energy target achieved (y/n)**
  - **Energy target achieved (y/n)**

  Both versus No target achieved (y/n)
- Adjustments for age, sex, BMI, and cancer
- Sensitivity analysis was performed for energy intake >25% and >50% of energy requirement (Dupertuis ea)

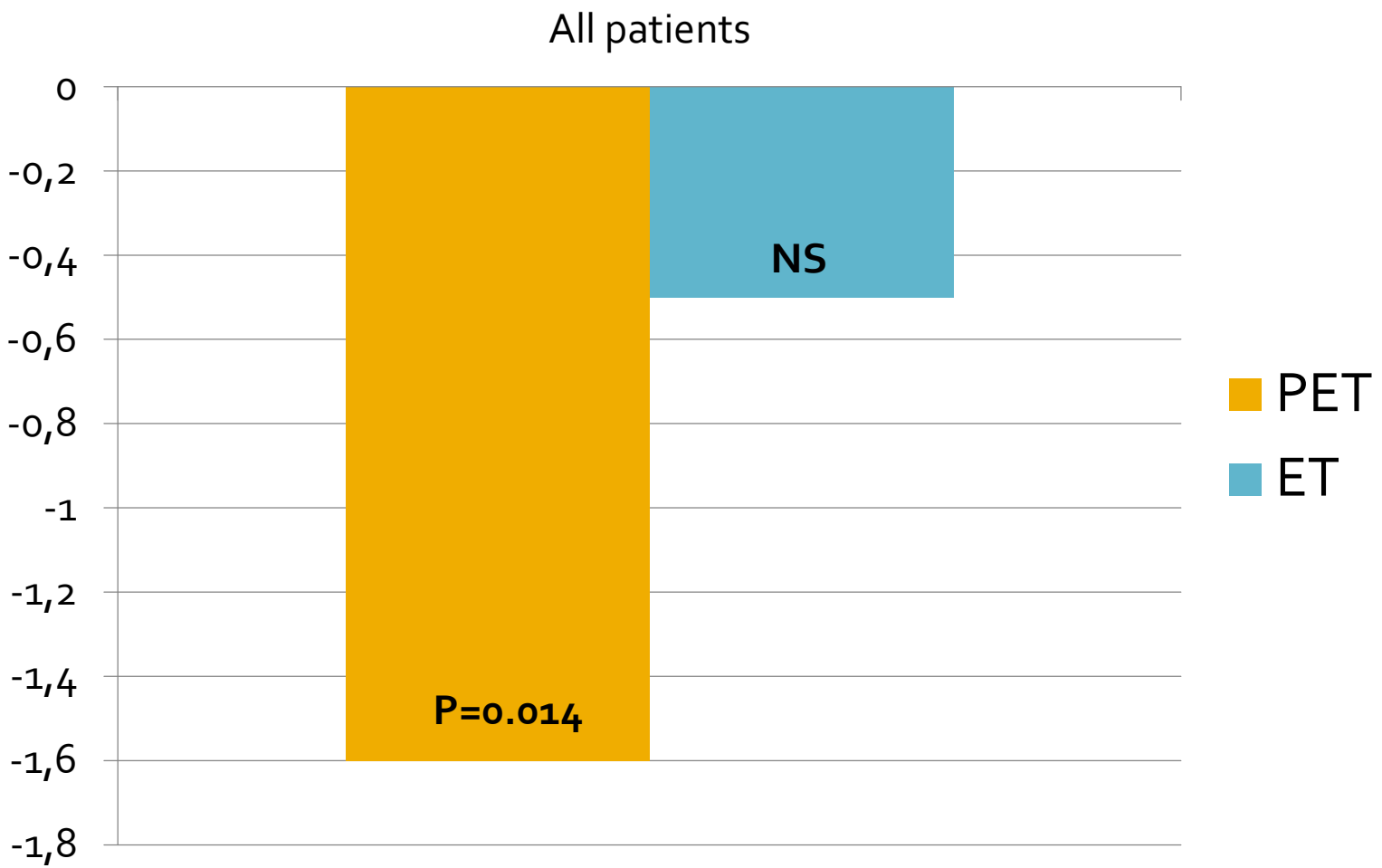
Results: Patient Characteristics

	NT	PET	ET
No. Patients	289	165	147
females, %	51	55	48
Weight, kg	71 ± 15	59 ± 12	68 ± 11
BMI, kg/m2	25 ± 5	21 ± 4	24 ± 4
sipfeed, %	27	36	26
tubefeed, %	4	9	3

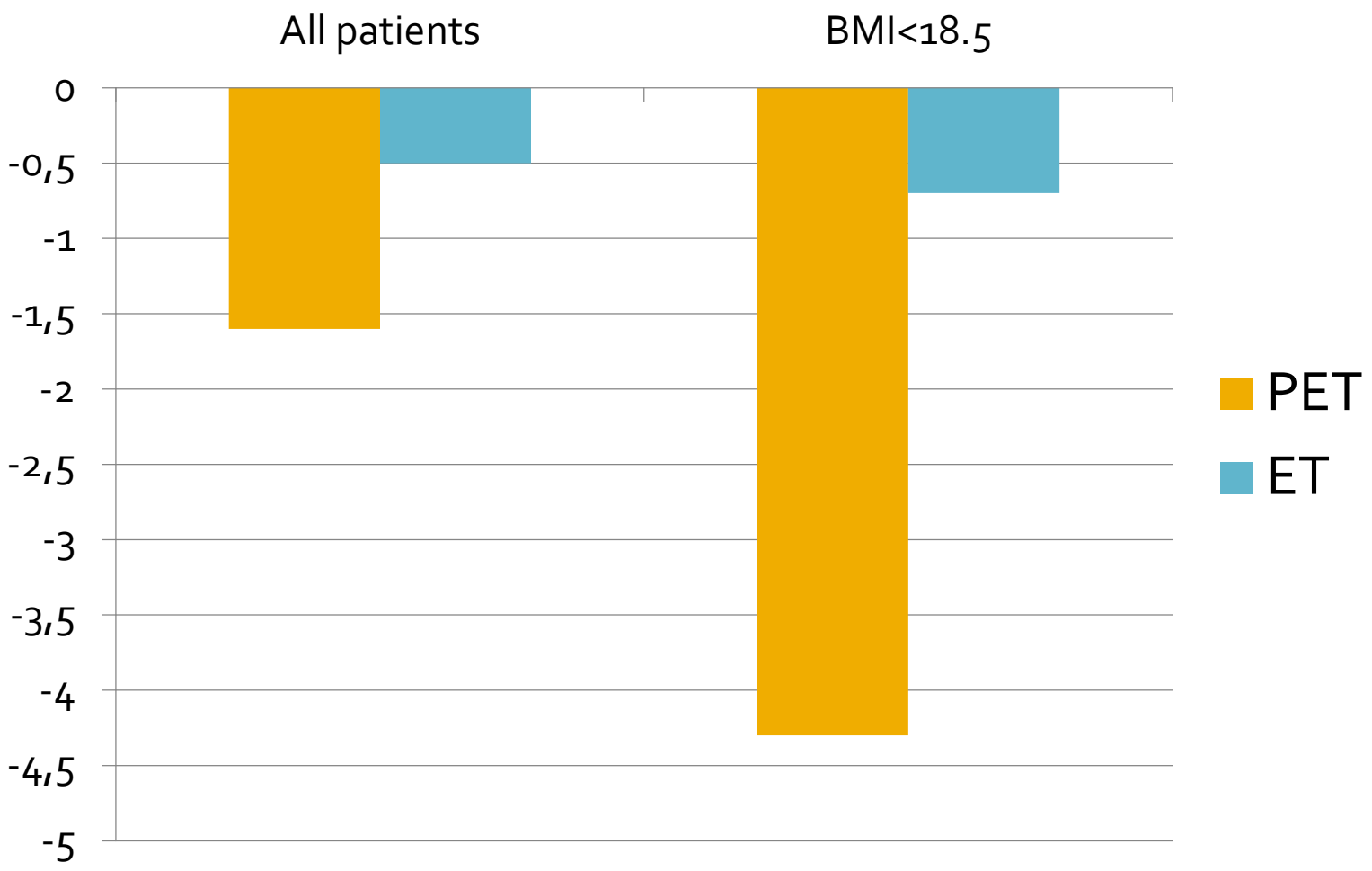
Results: Intake

	NT	PET	ET
Protein, g/kg	0.62 ± 0.30	1.56 ± 0.34	1.00 ± 0.12
Protein, %kcal	14.1 + 5.2	16.7 + 1.9*	14.4 + 1.9
Energy, kcal/d	1128 ± 527	2190 ± 465	1873 ± 291

Reduction of hospital stay (days)



Reduction of hospital stay (days)



Too ill to eat?

Clinical Nutrition (2003) **22(2)**: 115–123
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doi:10.1054/clnu.2002.0623

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ORIGINAL ARTICLE

Food intake in 1707 hospitalised patients: a prospective comprehensive hospital survey

Y. M. DUPERTUIS,* M. P. KOSSOVSKY,† U. G. KYLE,* C. A. RAGUSO,* L. GENTON,* C. PICHARD*

**Clinical Nutrition,† Clinical Medicine, University Hospital of Geneva, Geneva, Switzerland (Correspondence to: CP, Clinical Nutrition, Geneva University Hospital, 1211 Geneva 14, Switzerland)*

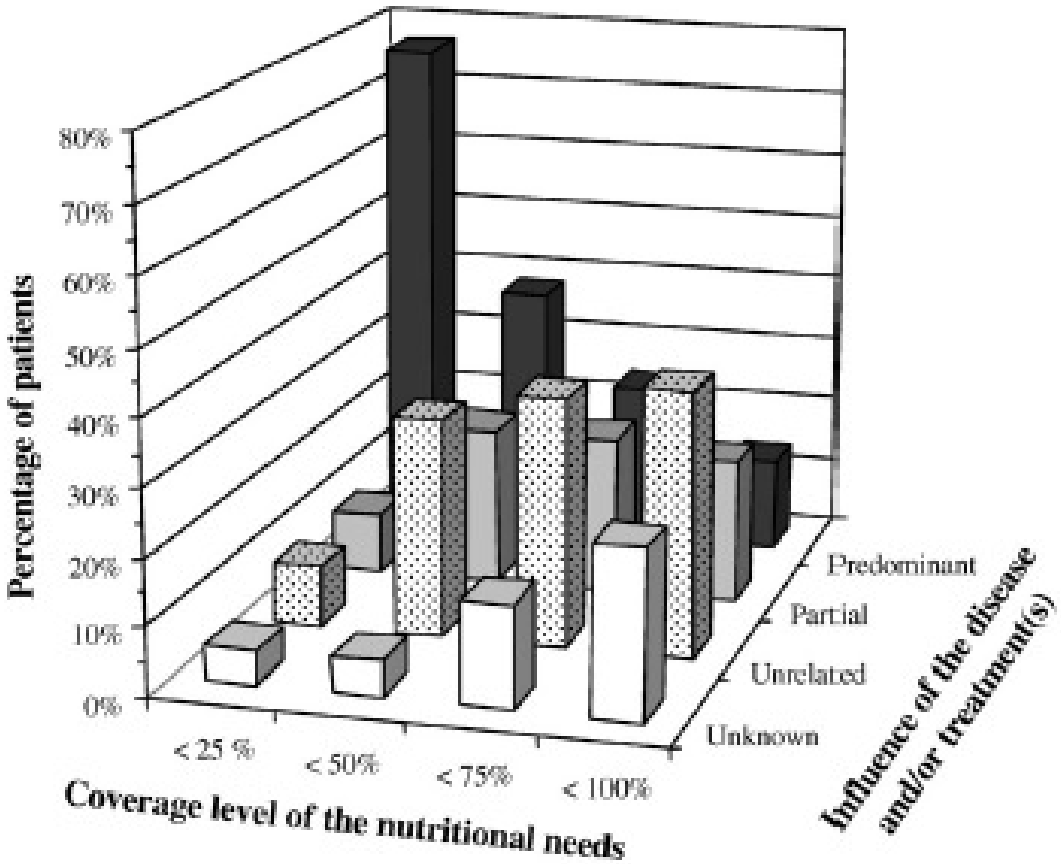
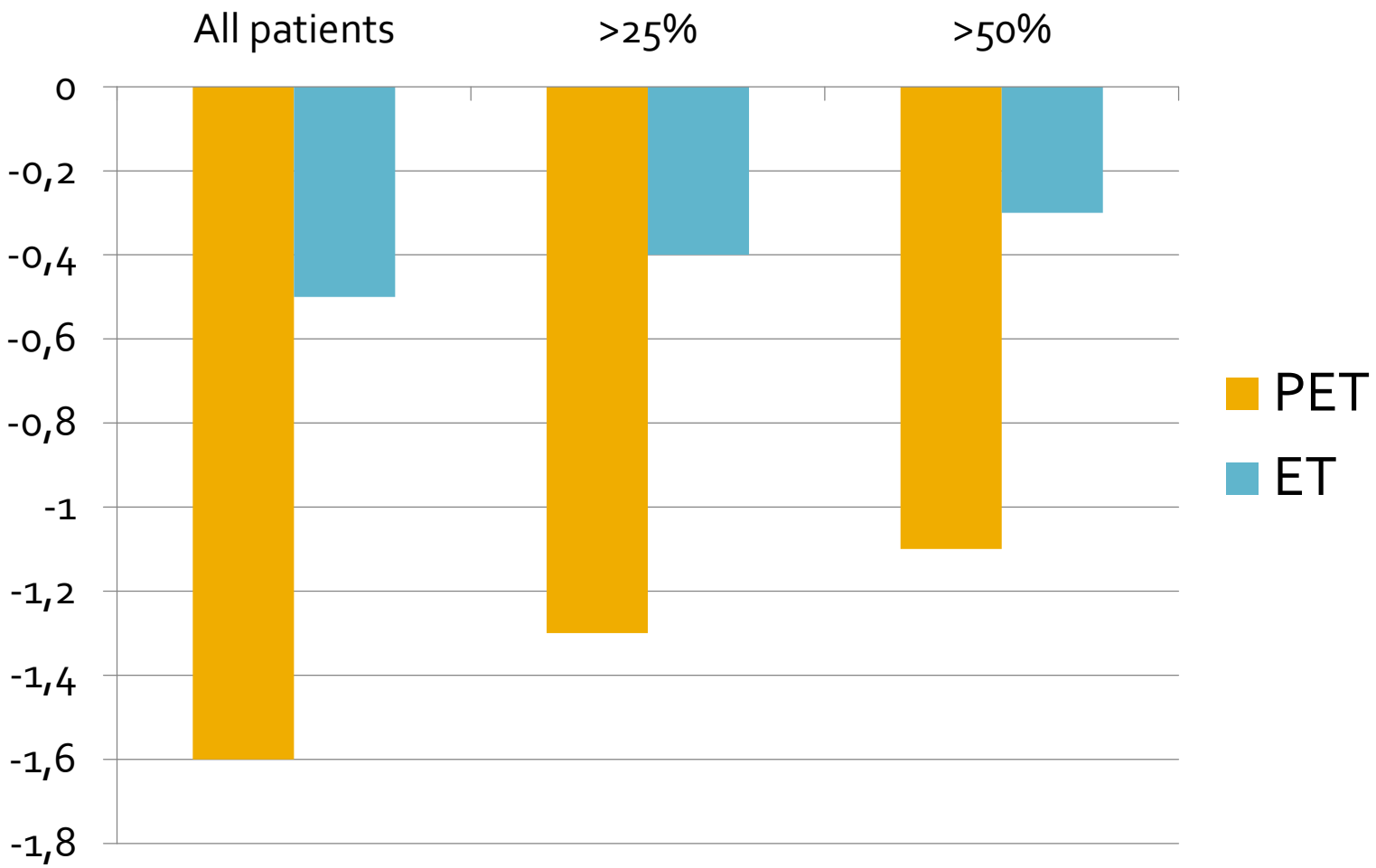


Fig. 2 Influence of disease and/or treatment(s) on the coverage level of the recommended nutritional needs of patients not consuming all of the food provided by hospital.

Sensitivity analysis



Current Opinion april 2012

EDITORIAL

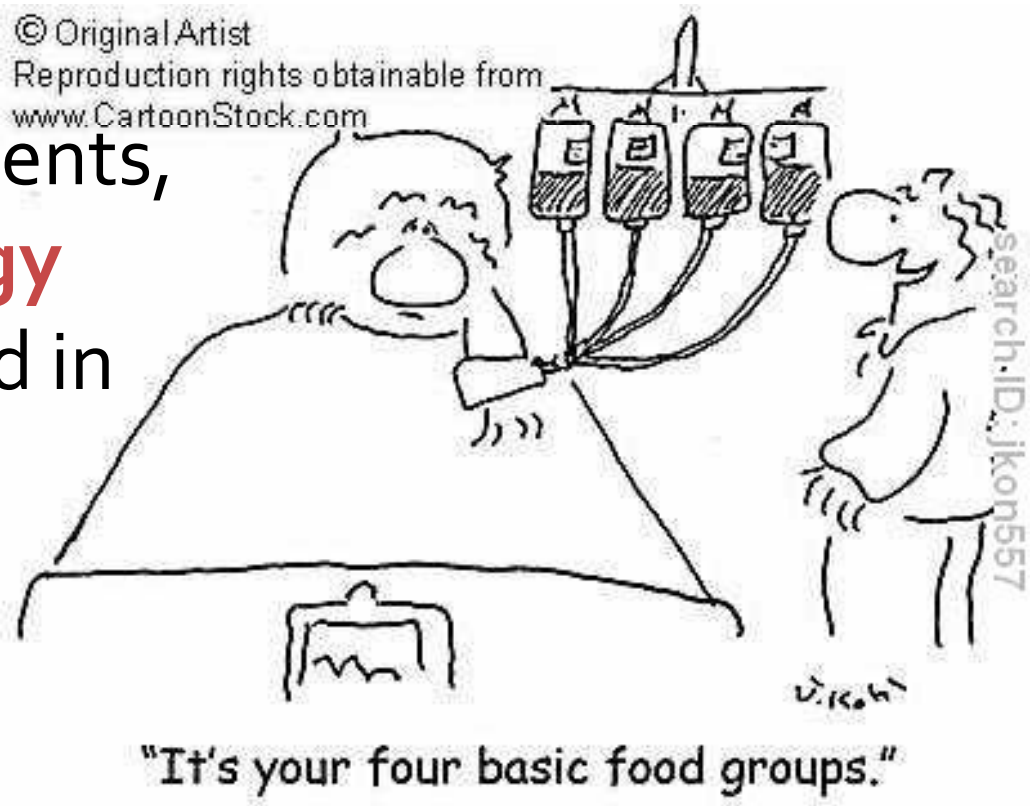
Parenteral nutrition and calorie delivery in the ICU: controversy, clarity, or call to action?

Paul Wischmeyer

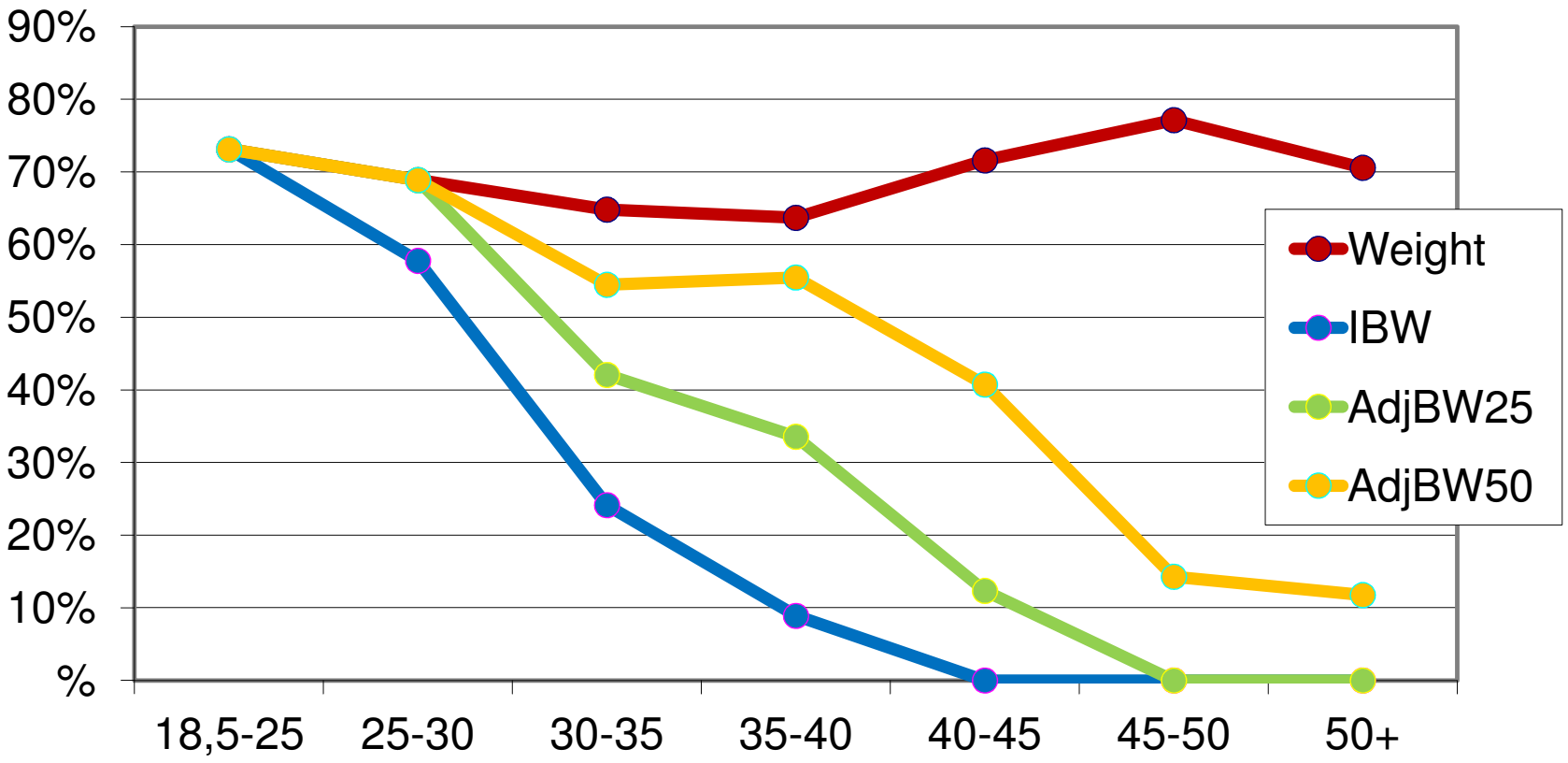
Conclusion

- In mechanically ventilated ICU patients and hospitalized malnourished patients, **protein and energy** should be provided in optimal amounts

- Thank you!



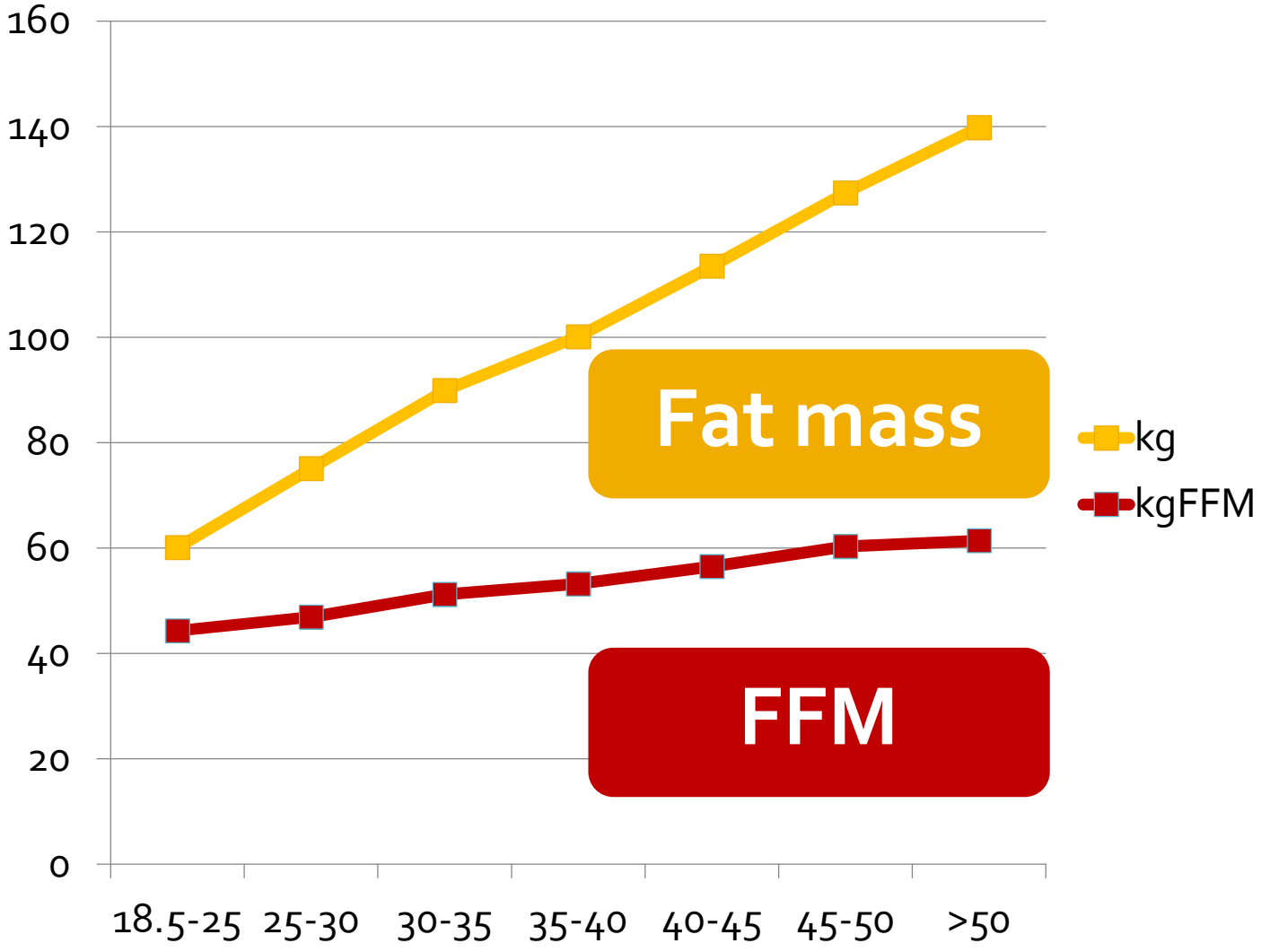
Harris-Benedict (adj. 1984): weight



Weijs & Vansant, 2009

BMI and FFM

kg ≠ kg



Protein target: weight

Clinical Nutrition xxx (2012) 1–2

Contents lists available at SciVerse ScienceDirect

Clinical Nutrition

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Letter to the Editor

Protein recommendations in the ICU: g protein/kg body weight – which body weight for underweight and obese patients?

Protein target:

- BMI 20–30: 1.2 g/kg actual body weight (ABW);
- BMI <20: 1.2 g × height $(m)^2$ × 20;
- BMI >30: 1.2 g × height $(m)^2$ × 27.5.

Weijs, Sauerwein, Kondrup, 2012

Protein target (g/d): avg male