Colours of Sepsis, Ostrava, Jan 30, 2018

Nutrient requirements during the acute phase:

The ”baby stomach” concept

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Disclosure of potential conflicts of interest during the last 2 years:

Member of the Medical Advisory Boards and also invited speaker for Baxter, Danone, Fresenius-Kabi, GE Health Care, Grifols, and Nestlé

Nutrient requirements during the acute phase:

The ”baby stomach” concept

EDITORIALS

Provision of Nutrients to the Acutely Ill

Introducing the “Baby Stomach” Concept

Preiser & Wernerman, AJRCCM 2017;196:1089-90

ORIGINAL ARTICLE

Role of Glucagon in Catabolism and Muscle Wasting of Critical Illness and Modulation by Nutrition

Steven E. Thiessen[1], Sarah Derde[1], Inge Derese[1], Thomas Dufour[1], Chloé Albert Vega[1], Lies Langouche[1], Chloë Goossens[1], Nele Peersman[2], Pieter Vermeersch[2], Sarah Vander Perre[1], Jens J. Holst[3,4], Pieter J. Wouters[1], Ilse Vanhorebeek[1*], and Greet Van den Berghe[1*]

[1]Clinical Division and Laboratory of Intensive Care Medicine, Department of Cellular and Molecular Medicine, and [2]Department of Laboratory Medicine, KU Leuven, Leuven, Belgium; and [3]Novo Nordisk Foundation Center for Basic Metabolic Research and [4]Department of Biomedical Sciences, Panum Institute, University of Copenhagen, Copenhagen, Denmark

Rule of theTumb

1. Set nutrition target (kcal+prot)
2. Start EN when possible
3. Calculate caloric and protein balances
4. Complementary PN on day 4-5-8

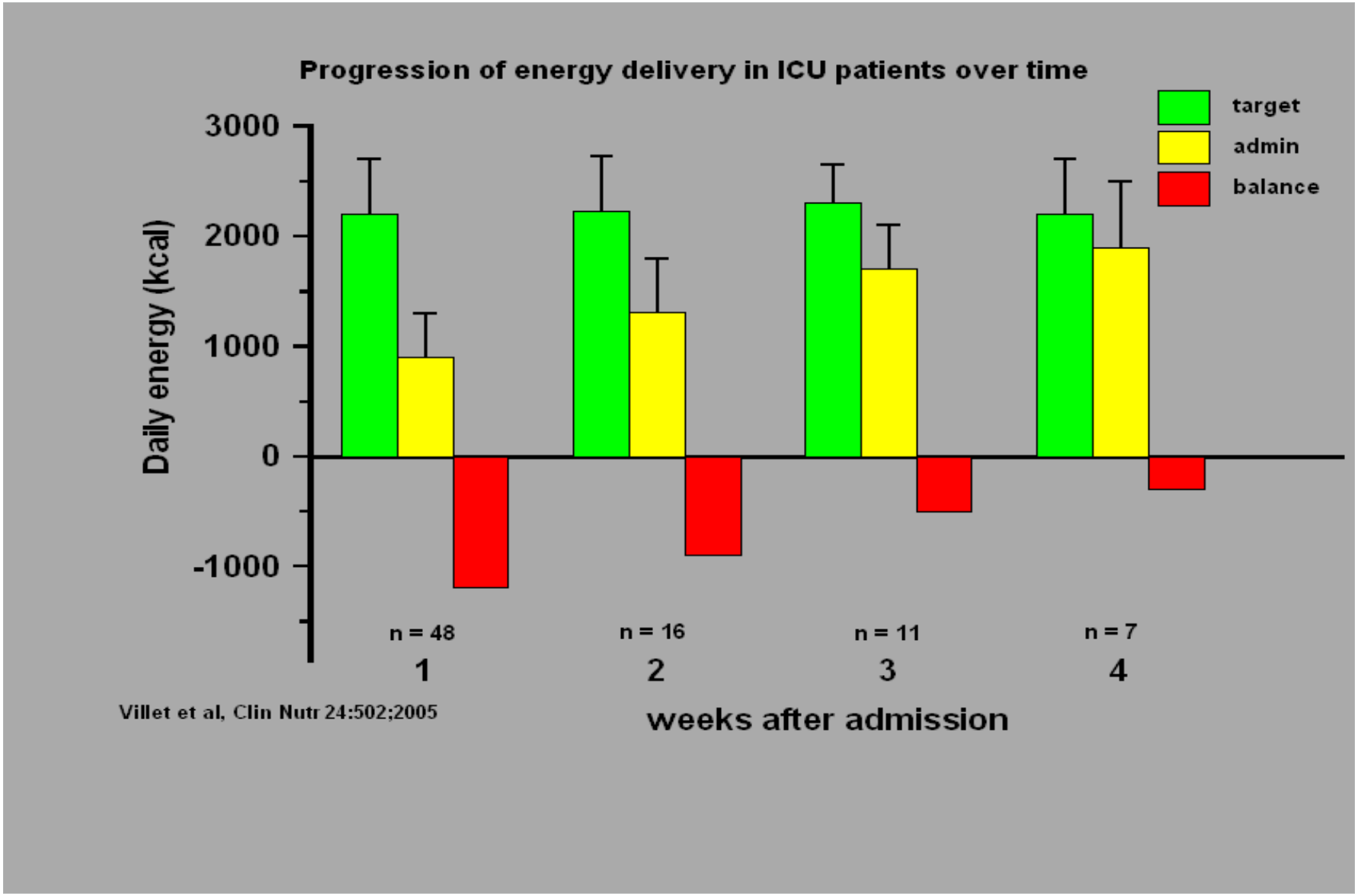
Intensive Care Med (2017) 43:380–398
DOI 10.1007/s00134-016-4665-0

CONFERENCE REPORTS AND EXPERT PANEL

Early enteral nutrition in critically ill patients: ESICM clinical practice guidelines

Annika Reintam Blaser[1,2*], Joel Starkopf[1,3], Waleed Alhazzani[4,5], Mette M. Berger[6], Michael P. Casaer[7], Adam M. Deane[8], Sonja Fruhwald[9], Michael Hiesmayr[10], Carole Ichai[11], Stephan M. Jakob[12], Cecilia I. Loudet[13], Manu L. N. G. Malbrain[14], Juan C. Montejo González[15], Catherine Paugam-Burtz[16], Martijn Poeze[17], Jean-Charles Preiser[18], Pierre Singer[19,20], Arthur R.H. van Zanten[21], Jan De Waele[22], Julia Wendon[23], Jan Wernerman[24], Tony Whitehouse[25], Alexander Wilmer[26], Heleen M. Oudemans-van Straaten[27] and ESICM Working Group on Gastrointestinal Function

What do we know about energy needs?


Progression of energy delivery in ICU patients over time
target
admin
balance
3000
2000
1000
0
-1000
Daily energy (kcal)
n = 48
n = 16
n = 11
n = 7
1
2
3
4
Villet et al, Clin Nutr 24:502;2005
weeks after admission

Cumulated energy deficit v. infections

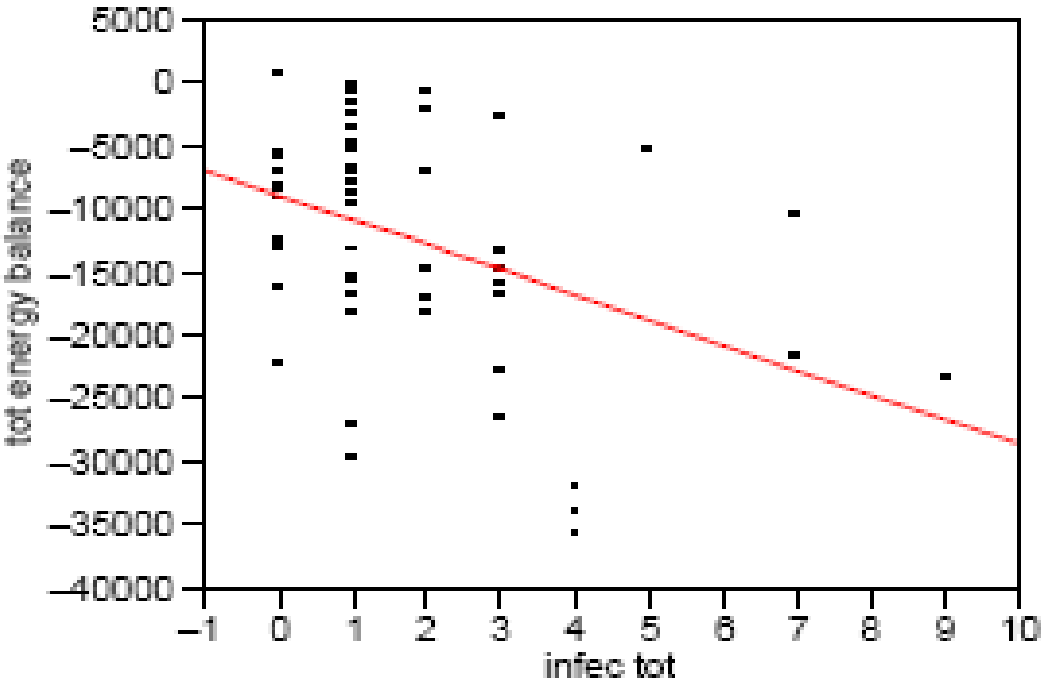
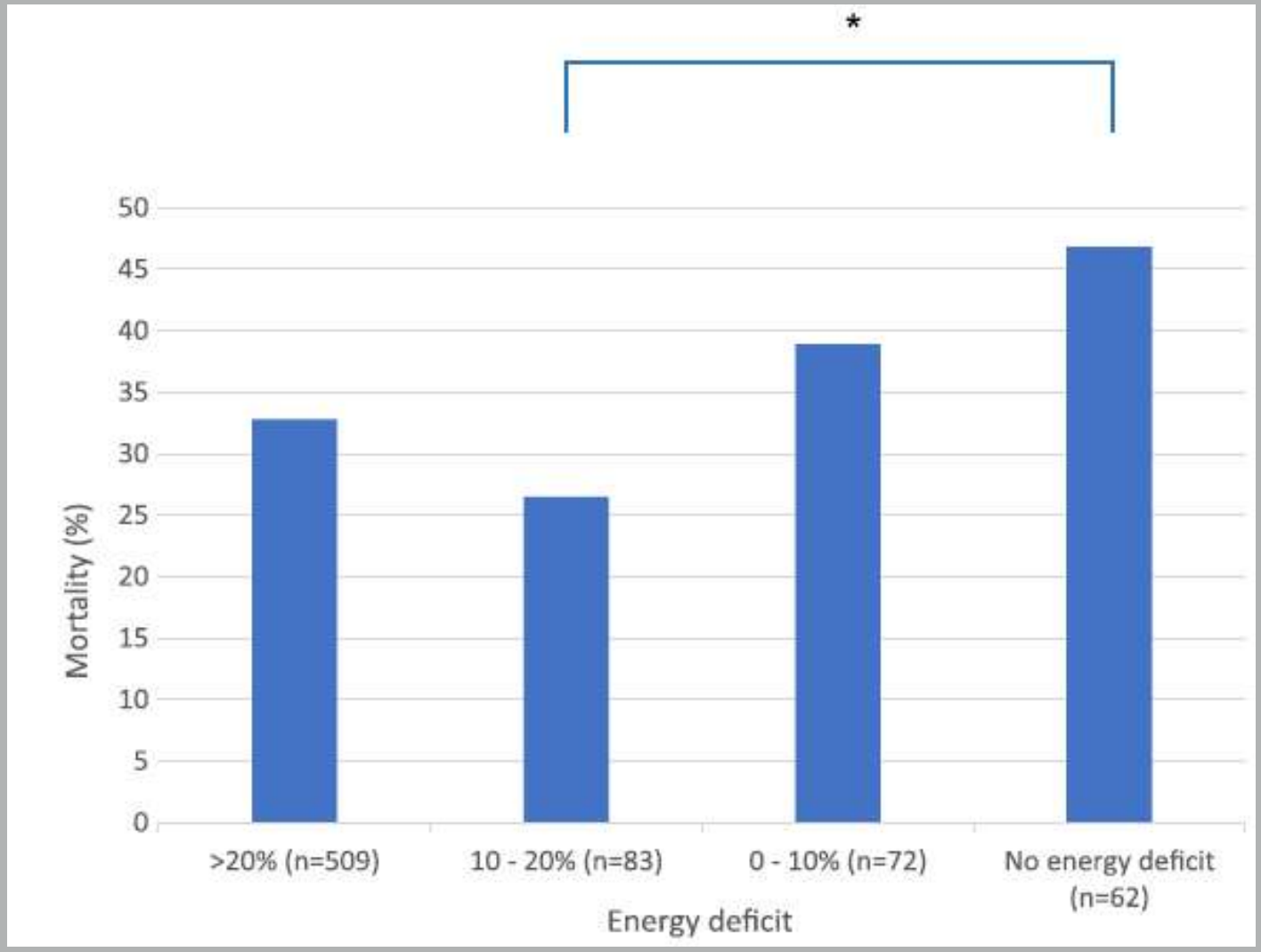
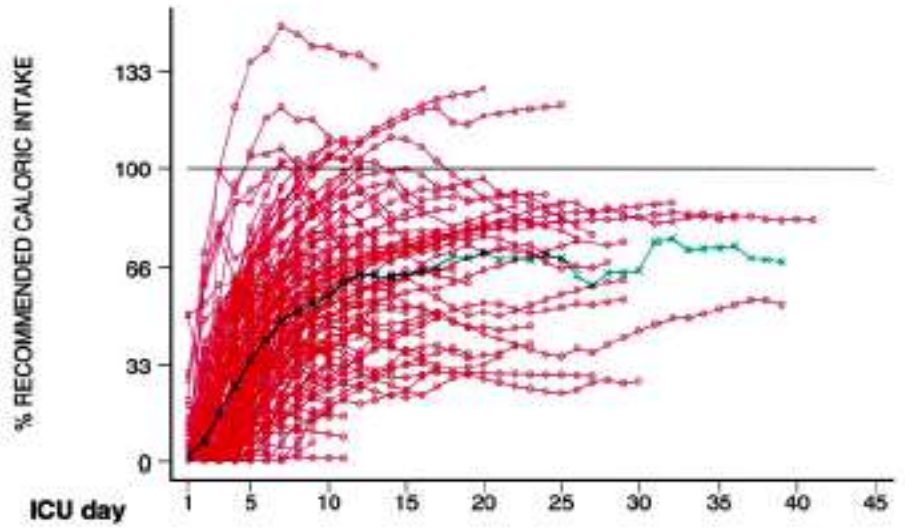


Figure 2 Relation between the progressive negative energy balance and the number of infectious complications.

Villet et al, Clin Nutr 24:502 (2005)



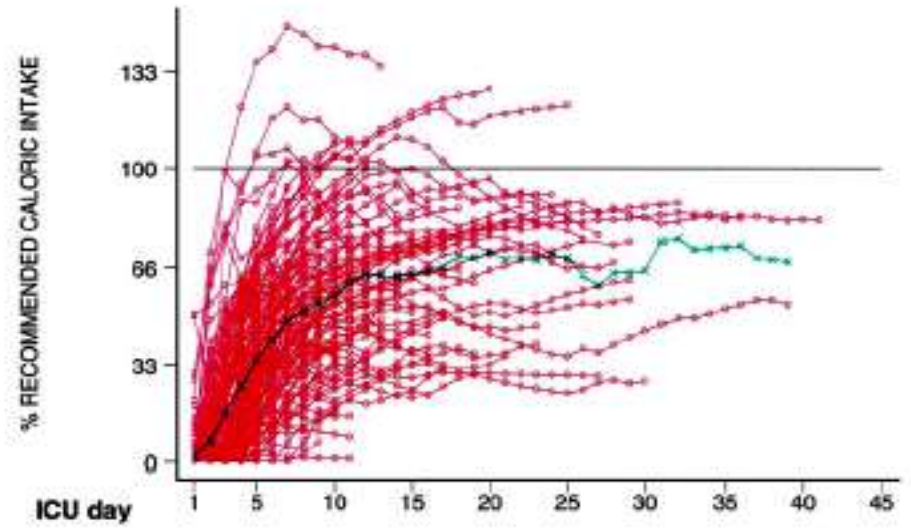
Weijs et al, cc 2014



# Participants	187	186	95	45	26	16	5	3	1	0

FIGURE 1. The cumulative average caloric intake since ICU admission for each of 187 participants (○) is shown. For example, a participant's cumulative average caloric intake for ICU day 5 is the mean for days 1 to 5. Similarly, a participant's cumulative average caloric intake for ICU day 10 is the mean caloric intake for ICU days 1 to 10. The last cumulative average caloric intake for each participant thus represents the average caloric intake from nutritional support over all ICU days for that participant. The mean caloric intake for each ICU day (x) for all participants in the ICU is also shown. The horizontal line at caloric intake represents 100% of the target caloric intake recommended by ACCP guidelines.

Krishnan et al. Chest124:297 (2003)



27 kcal/kg

FIGURE 1. The cumulative average caloric intake since ICU admission for each of 187 participants (○) is shown. For example, a participant's cumulative average caloric intake for ICU day 5 is the mean for days 1 to 5. Similarly, a participant's cumulative average caloric intake for ICU day 10 is the mean caloric intake for ICU days 1 to 10. The last cumulative average caloric intake for each participant thus represents the average caloric intake from nutritional support over all ICU days for that participant. The mean caloric intake for each ICU day (x) for all participants in the ICU is also shown. The horizontal line at caloric intake represents 100% of the target caloric intake recommended by ACCP guidelines.

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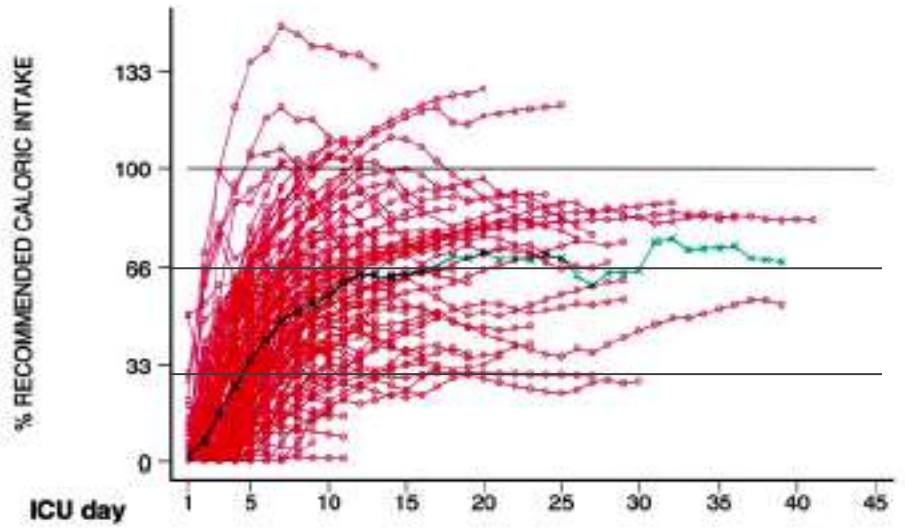

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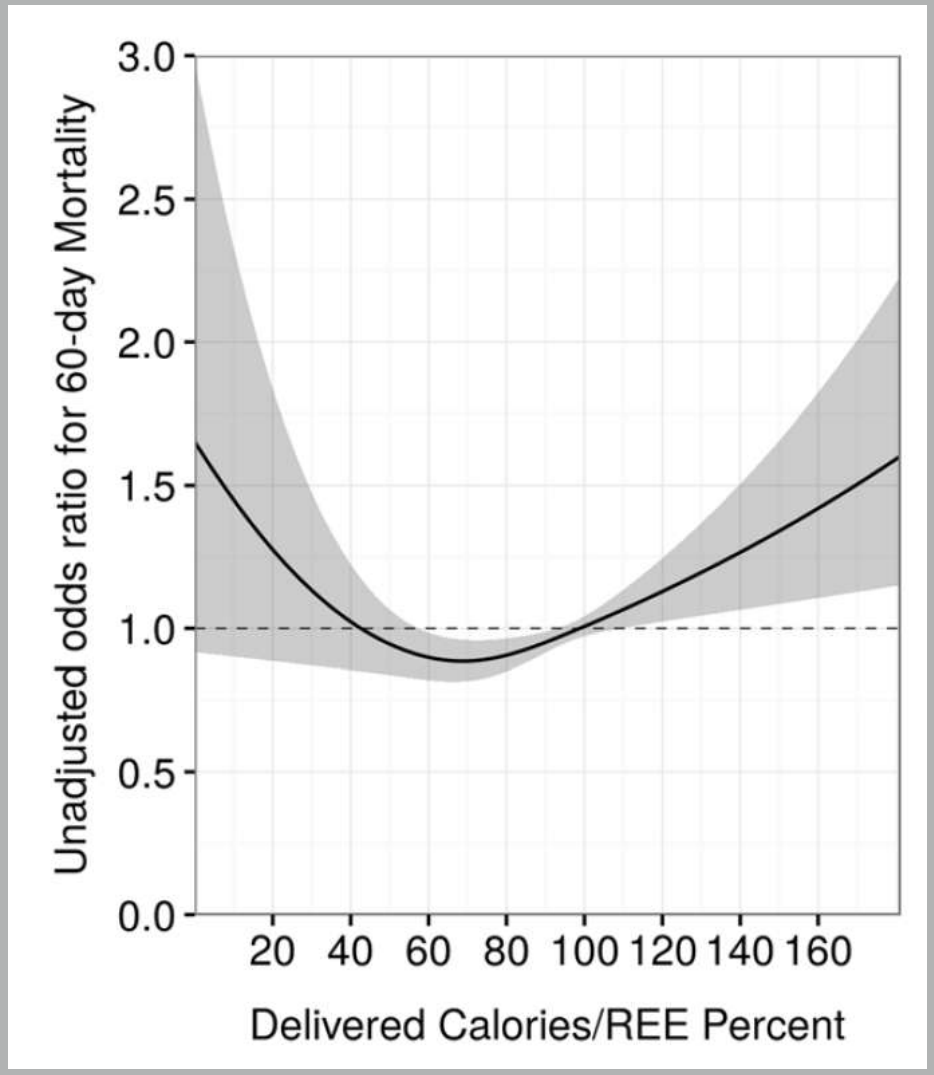
27 kcal/kg

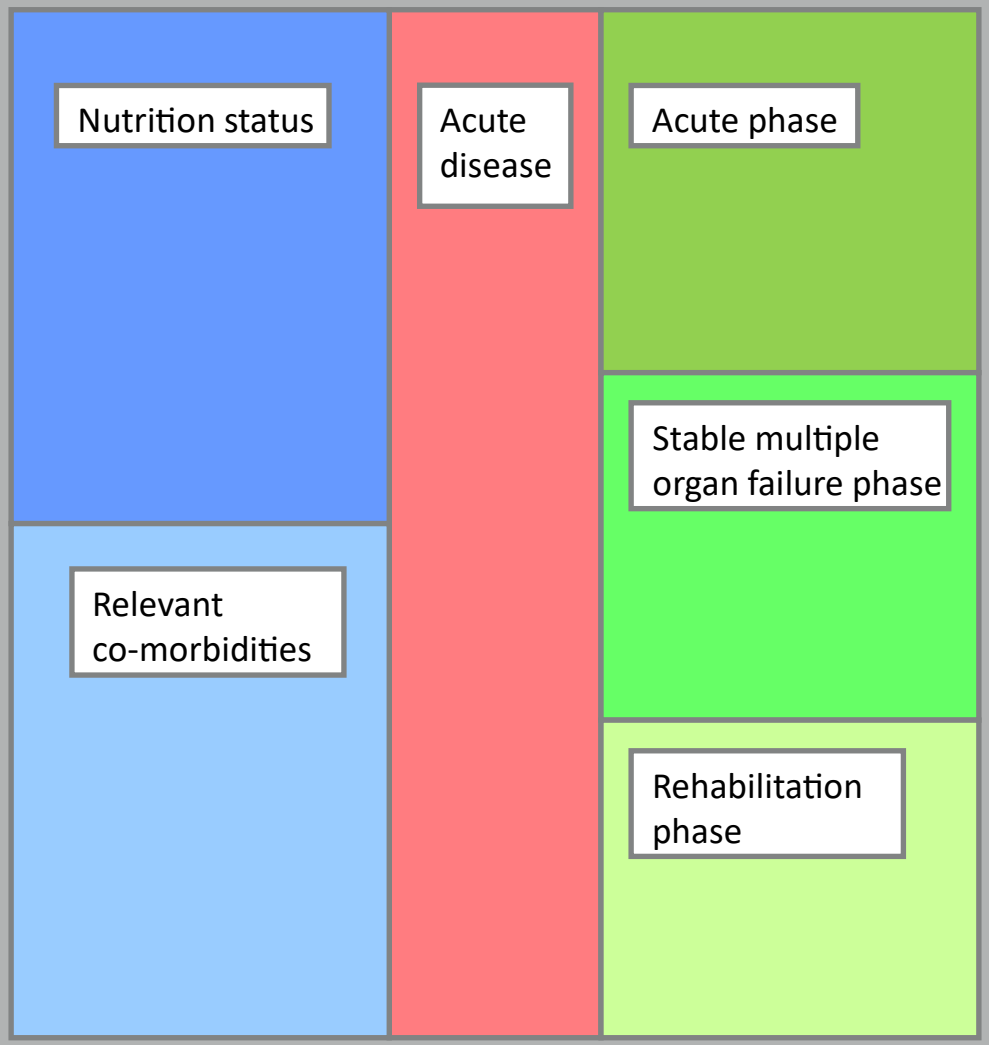
9-18 kcal/kg

Krishnan et al. Chest124:297 (2003)

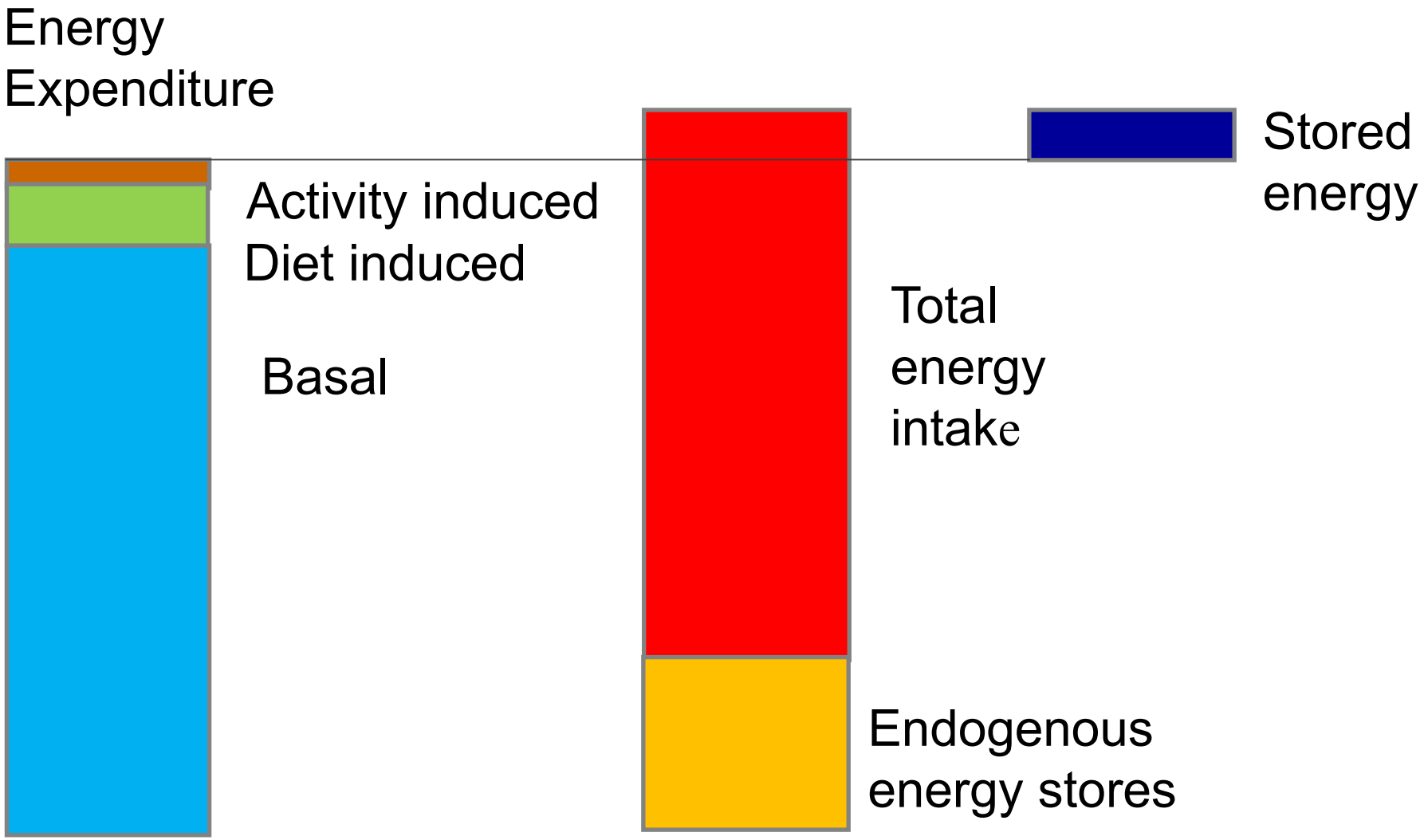
Zusman et al, Crit Care 2016;20:367




Mortalitet 100 %
efter 3 månader
Mortalitet 0 %
efter 3 månader


Nutrition status
Acute disease
Acute phase
Stable multiple organ failure phase
Relevant co-morbidities
Rehabilitation phase

Over-fed ICU patient



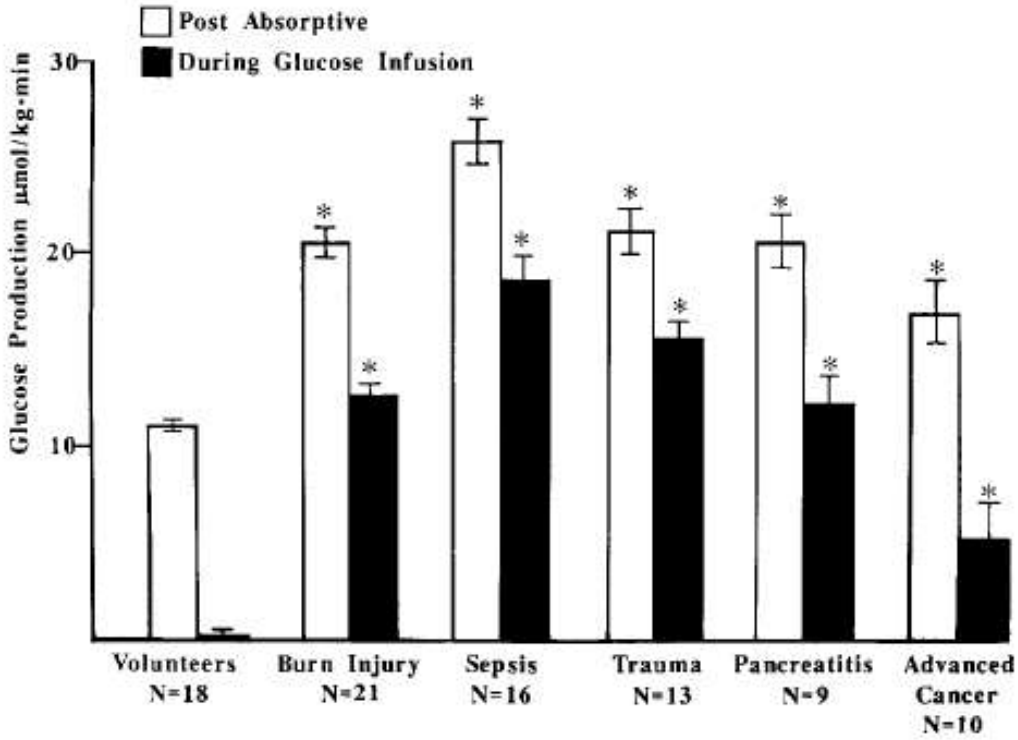


Figure 1 Rate of basal glucose production (□) and endogenous glucose production during glucose infusion (■) in a variety of critically ill patients. Values were determined by means of the infusion of 6,6-^{2}H-glucose. *$P < 0.05$ *vs* normal volunteers. From: Wolfe *et al*, 1979a,b; Shaw & Wolfe, 1986a,b, 1987, 1989; Shaw *et al*, 1985.

Wolfe,
ejcn 1999;53(suppl 1):S136-S142

Glucose uptake in septic patients and volunteers

Parameter	Septic patients	Volunteers	Significance (between groups)[1]
Glucose uptake in step 1	3.61 (2.31–5.58)	11.0 (9.74–12.85)	-
Glucose uptake in step 2	6.4 (5.25–8.21)	17.2 (14.05–19.20)	-
Significance (within groups)[2]: step 1 versus step 2	$P < 0.001$	$P < 0.01$	-
Difference between step 2 and step 1	2.5 (0.93, 4.47)	5.3 (4.14, 6.40)	$P < 0.01$

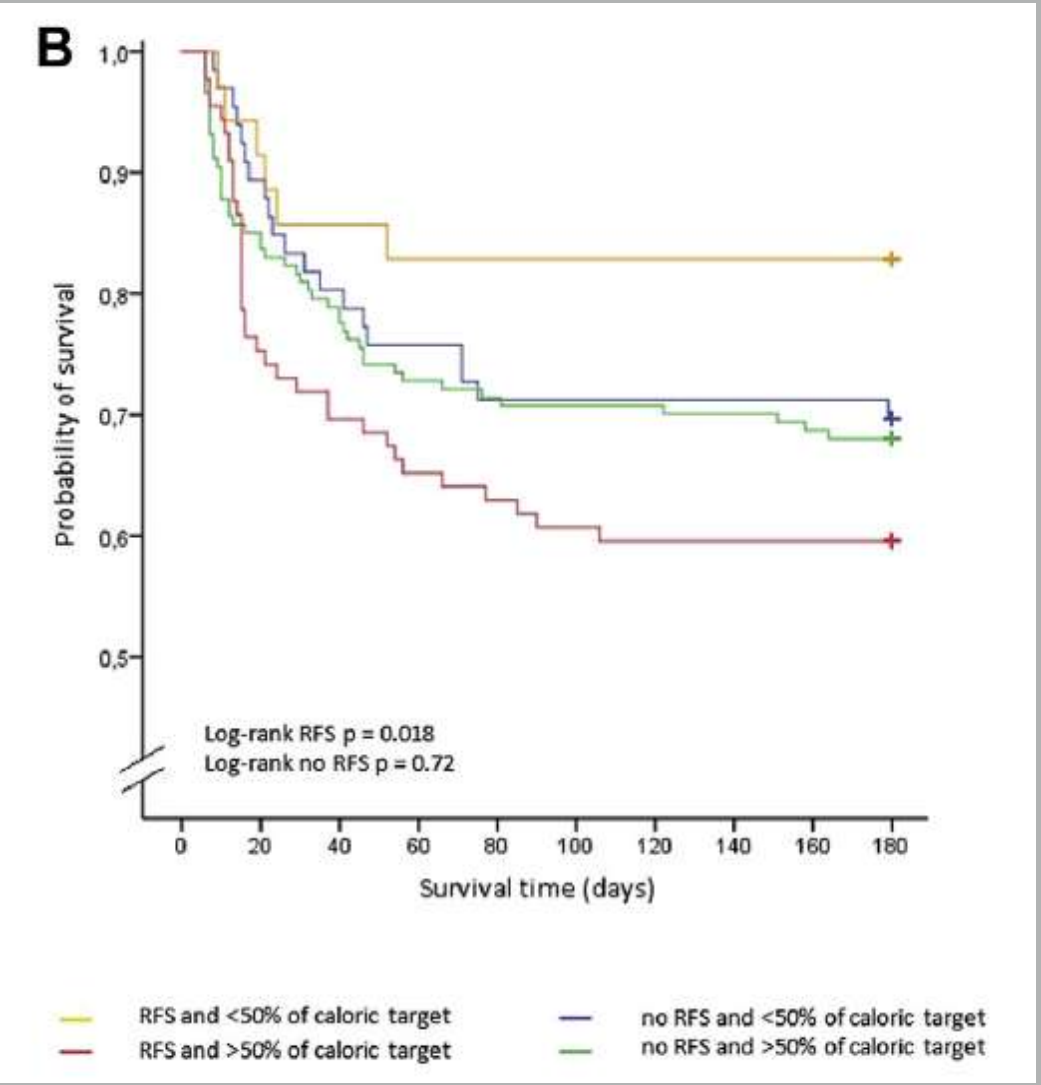
Values are expressed as median (interquartile range). [1]By Wilcoxon's nonpaired test. [2]By Wilcoxon's paired test.

Glucose storage in septic patients and volunteers

Parameter	Septic patients	Volunteers	Significance (between groups)[1]
Glucose storage in step 1	0.4 (-0.4 to +3.19)	7.6 (5.80–9.50)	-
Glucose storage in step 2	2.3 (0.92–4.16)	11.6 (9.70–13.60)	-
Significance (within groups)[2]: step 1 versus step 2	$P < 0.01$	$P < 0.01$	-
Difference between step 2 and step 1	1.51 (0.24–2.69)	4.0 (2.95–5.30)	$P < 0.01$

Values are expressed as median (interquartile range). [1]By Wilcoxon's nonpaired test. [2]By Wilcoxon's paired test.

Rusavy et al, Crit Care 2004,8;R213-R220



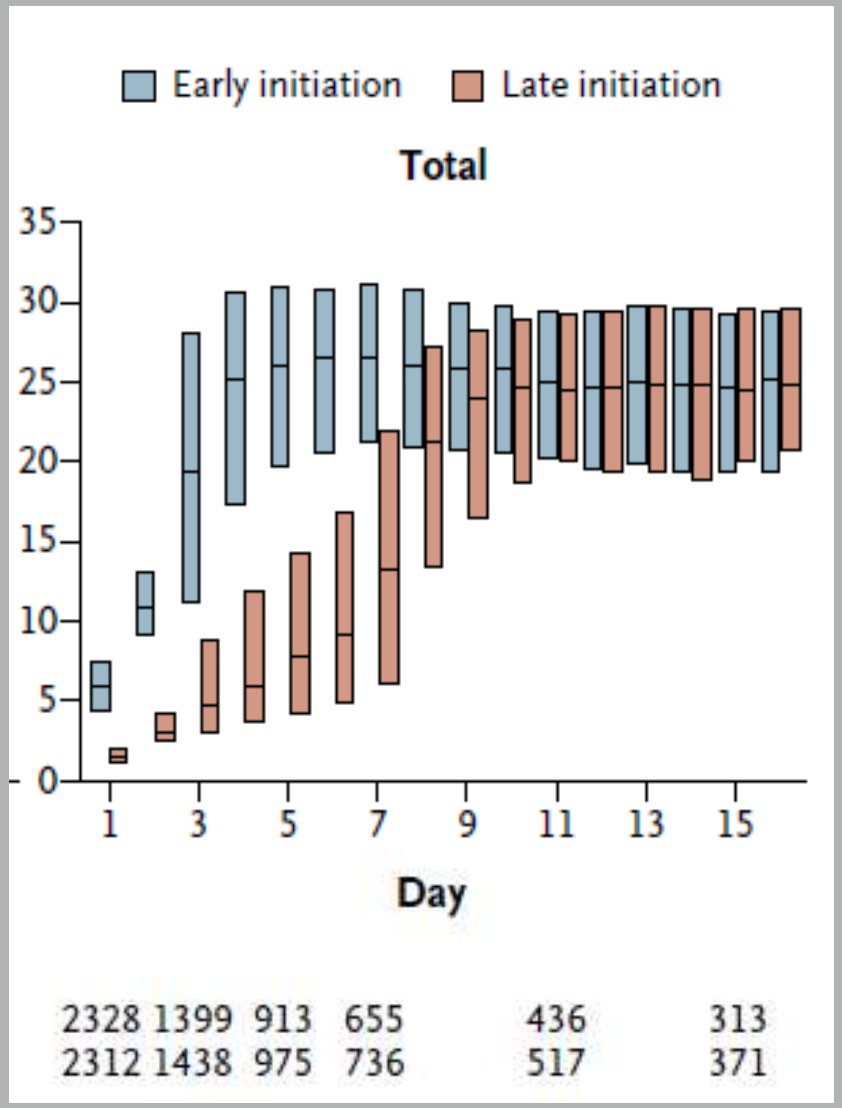
Olthof et al,
Clin Nutr 2017 (Epubl)

What do we know about energy needs?

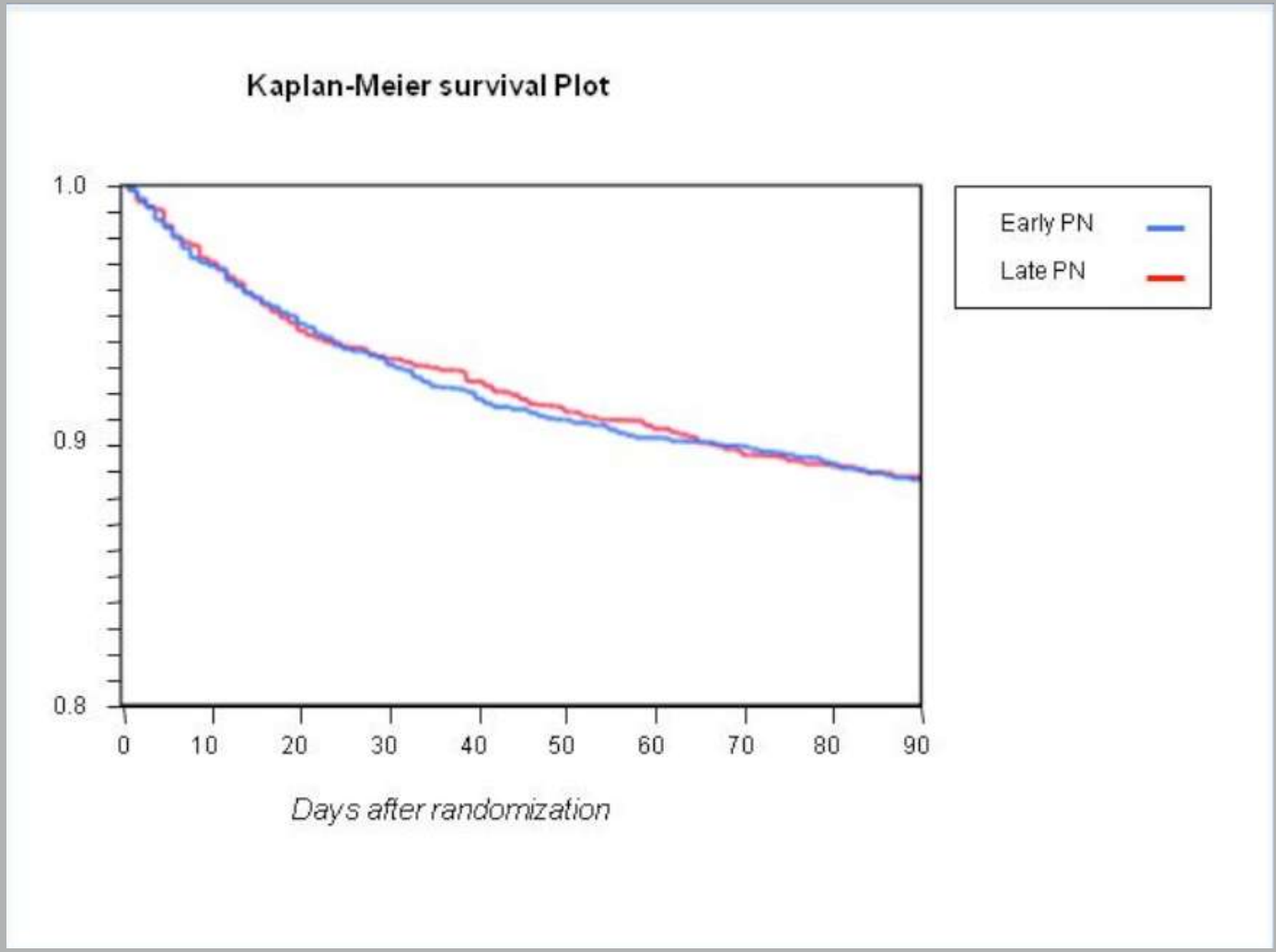
In the early phase of critical illness there is a mobilisation of endogenous stores that cannot be inhibited by exogenous nutrition supply.

Adjust energy target accordingly in particular when there are symptoms (or suspicion) of refeeding

What about the Leuven experience?



Casaer et al, nejm 2011;365:506-17



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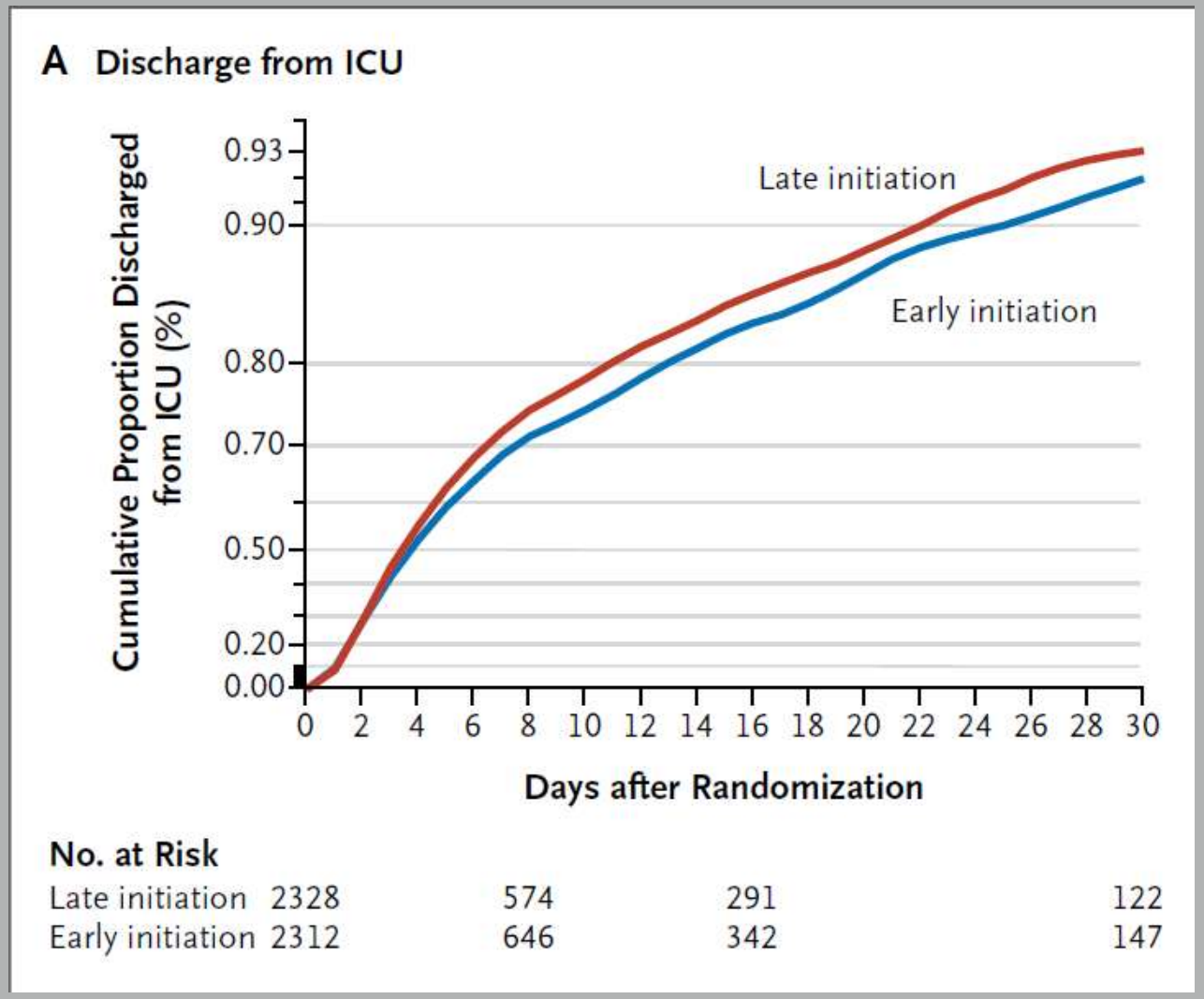
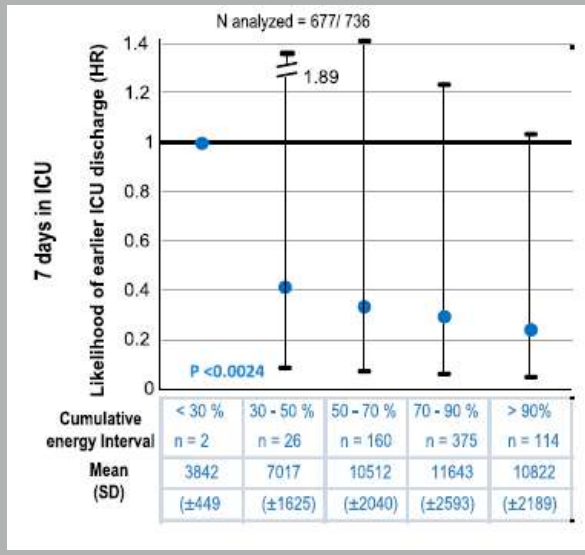


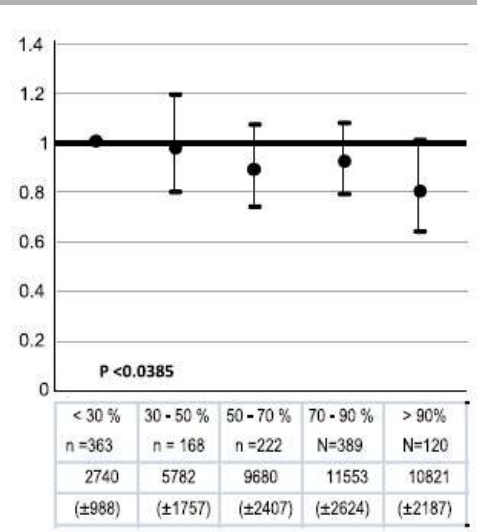
Casaer et al, nejm 2011;365:506-17

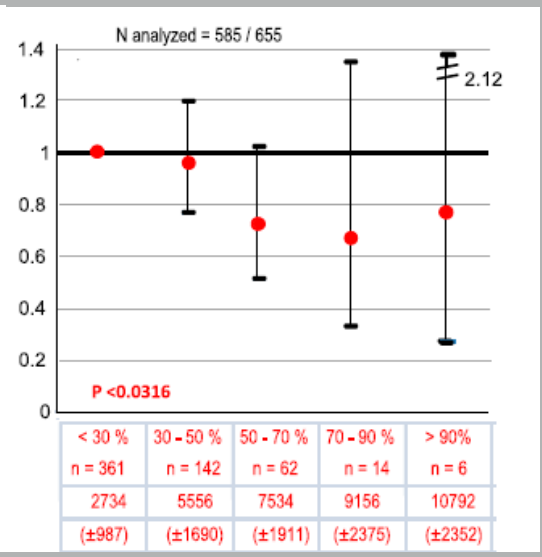
Online-table 6. Subgroup Analysis

	Primary outcome time to alive discharge from ICU		Safety outcome discharged alive from ICU within 8 days	
	HR (95% CI)	interaction P Value	OR (95% CI)	interaction P Value
Overall (N=4640)	1.063 (1.002-1.128)	NA	1.271 (1.080-1.495)	NA
A priori defined subgroups				
BMI (<25 OR ≥40) (N=1989)	1.045 (0.956-1.143)	0.5725	1.239 (0.985-1.560)	0.7985
NRS ≥5 (N=863)	**1.059 (0.916-1.224)**	**0.8454**	**1.222 (0.887-1.685)**	**0.7898**
Cardiac surgery (N=2818)	1.047 (0.971-1.129)	0.8616	1.232 (0.963-1.599)	0.7445
Sepsis admission (N=1015)	**0.991 (0.866-1.134)**	**0.3198**	**1.068 (0.820-1.439)**	**0.2701**
Post-hoc defined subgroup				
Surgical contraindication for EN* (N = 517)	**1.198 (0.999 -1.437)**	**0.1197**	**1.749 (1.141 - 2.683)**	**0.1348**

Casaer et al, nejm 2011;365:506-17





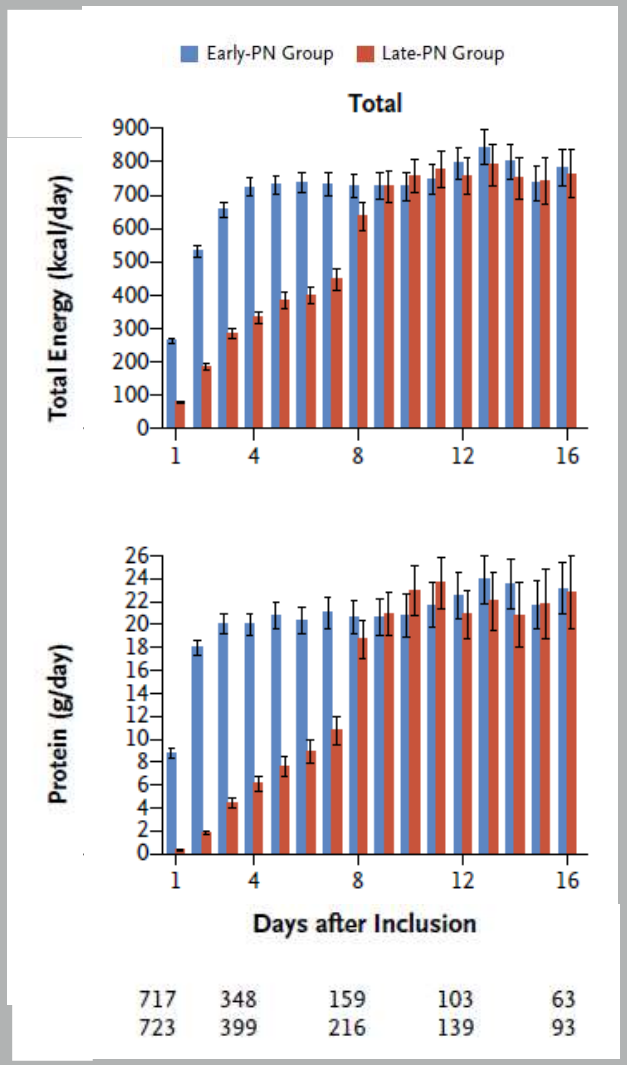


Early PN

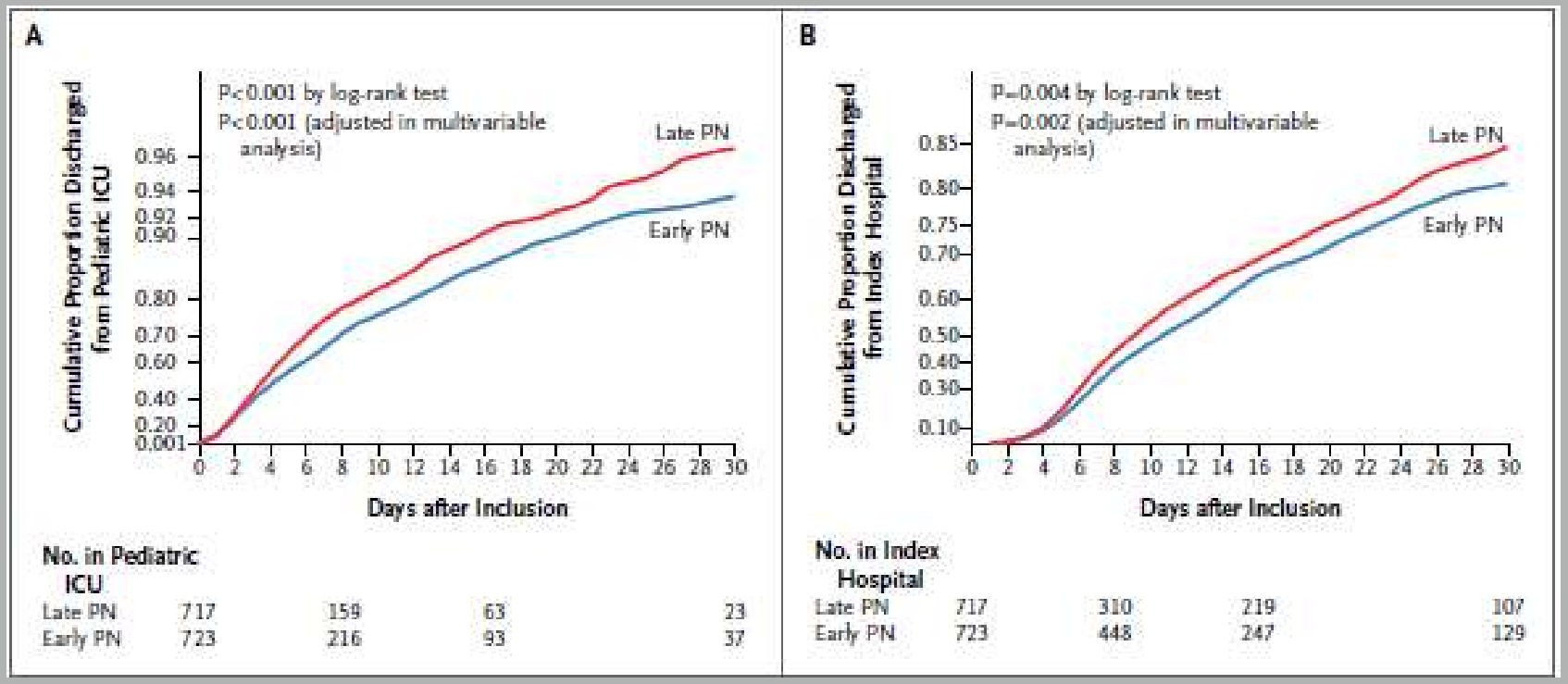
All patients

Late PN

Casaer et al, ajrccm 2013;187:247-255



Fivez et al, nejm 2016;374:1111-22



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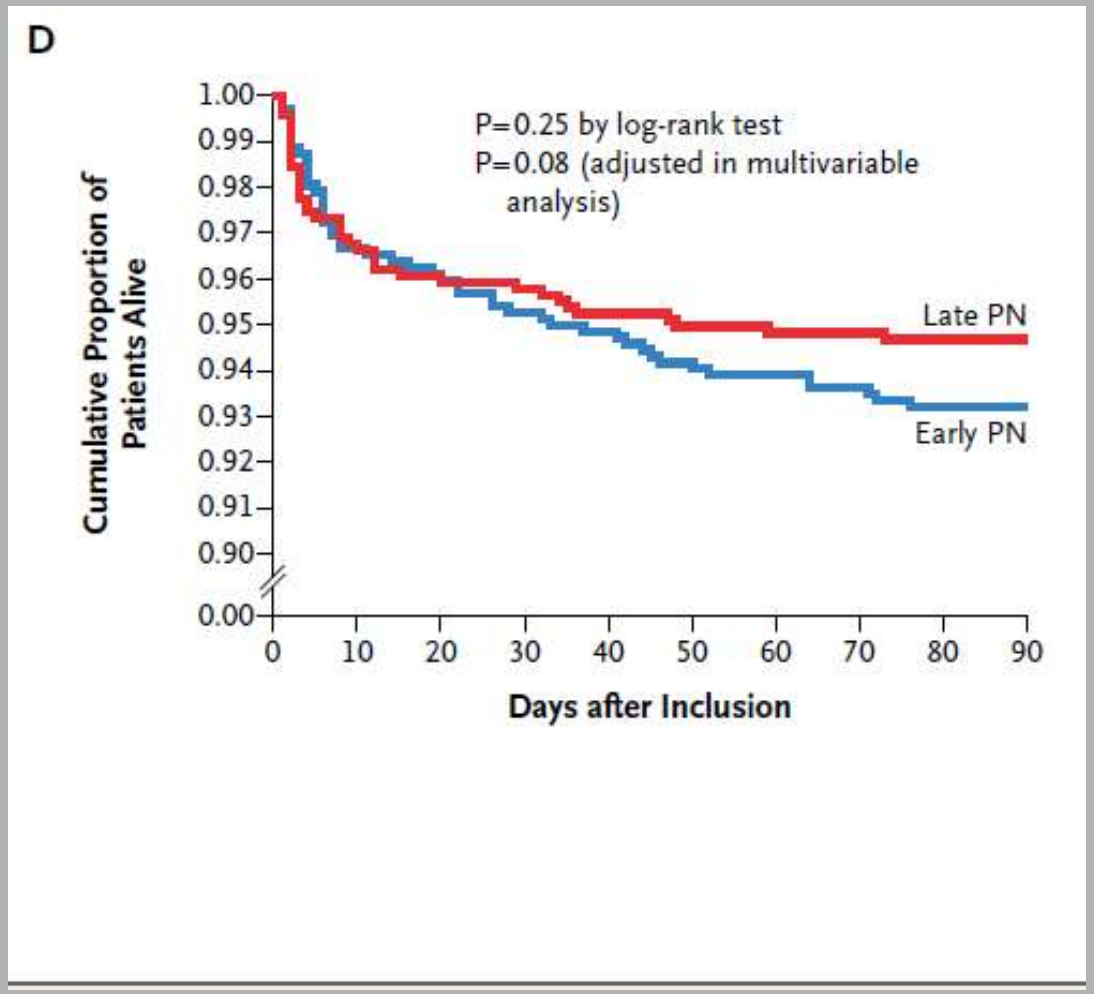
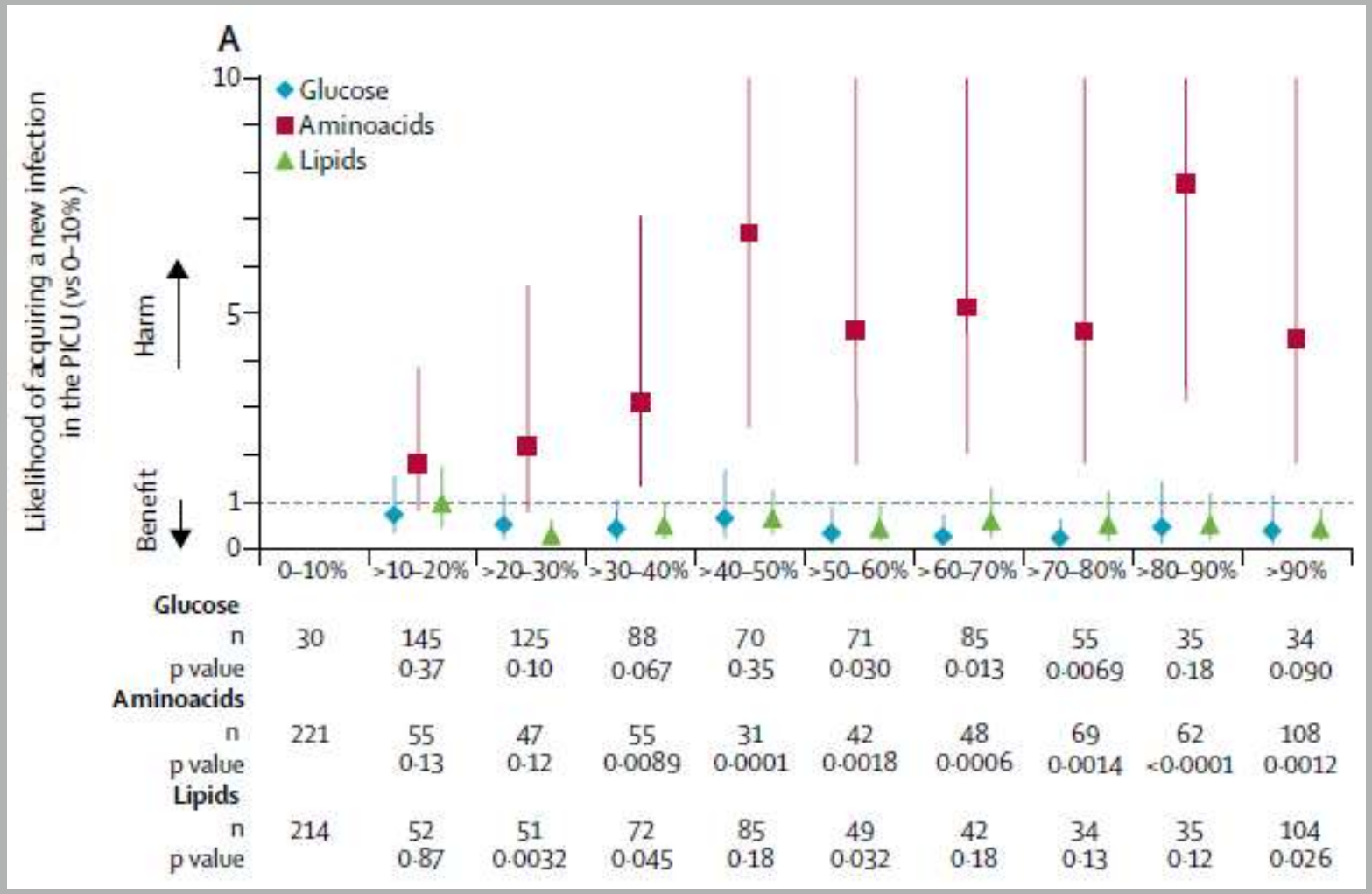
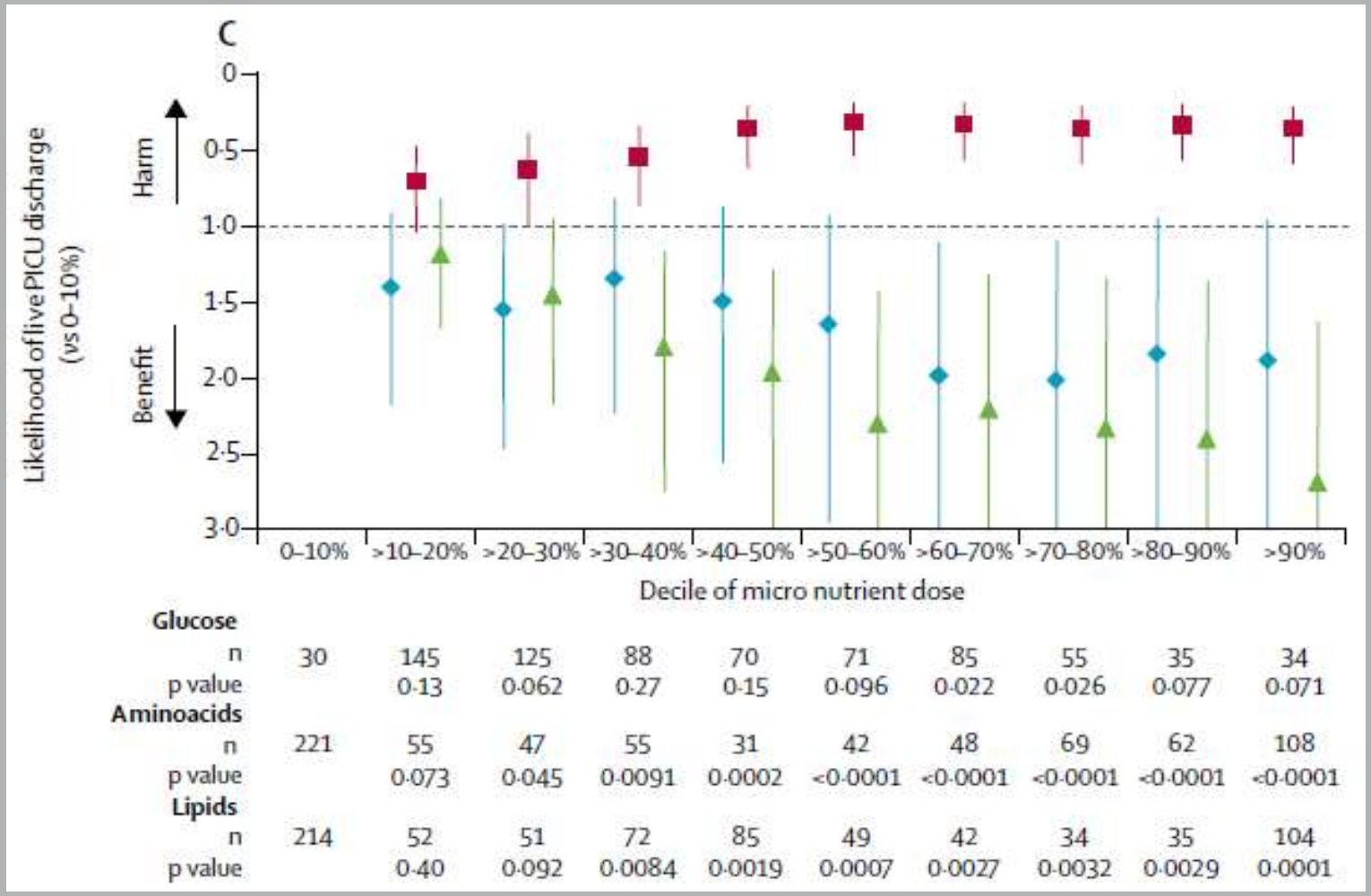


Fivez et al, nejm 2016;374:1111-22



Vanhorebeek et al, lancet resp med 2017;5:475-83



Glucose										
n	30	145	125	88	70	71	85	55	35	34
p value		0·13	0·062	0·27	0·15	0·096	0·022	0·026	0·077	0·071
Aminoacids										
n	221	55	47	55	31	42	48	69	62	108
p value		0·073	0·045	0·0091	0·0002	<0·0001	<0·0001	<0·0001	<0·0001	<0·0001
Lipids										
n	214	52	51	72	85	49	42	34	35	104
p value		0·40	0·092	0·0084	0·0019	0·0007	0·0027	0·0032	0·0029	0·0001

Vanhorebeek et al, lancet resp med 2017;5:475-83

What about the Leuven experience?

Post hoc analysis of Leuven data suggest a lessfavorable outcome related to protein (amio acid) intake during the acute phase of critical illness.

So is hypocaloric feeding better?

Randomized studies with hypocaloric feeding

Table 1. Trials Comparing Standard Amounts of Enteral Nutrition With Lesser Amounts.

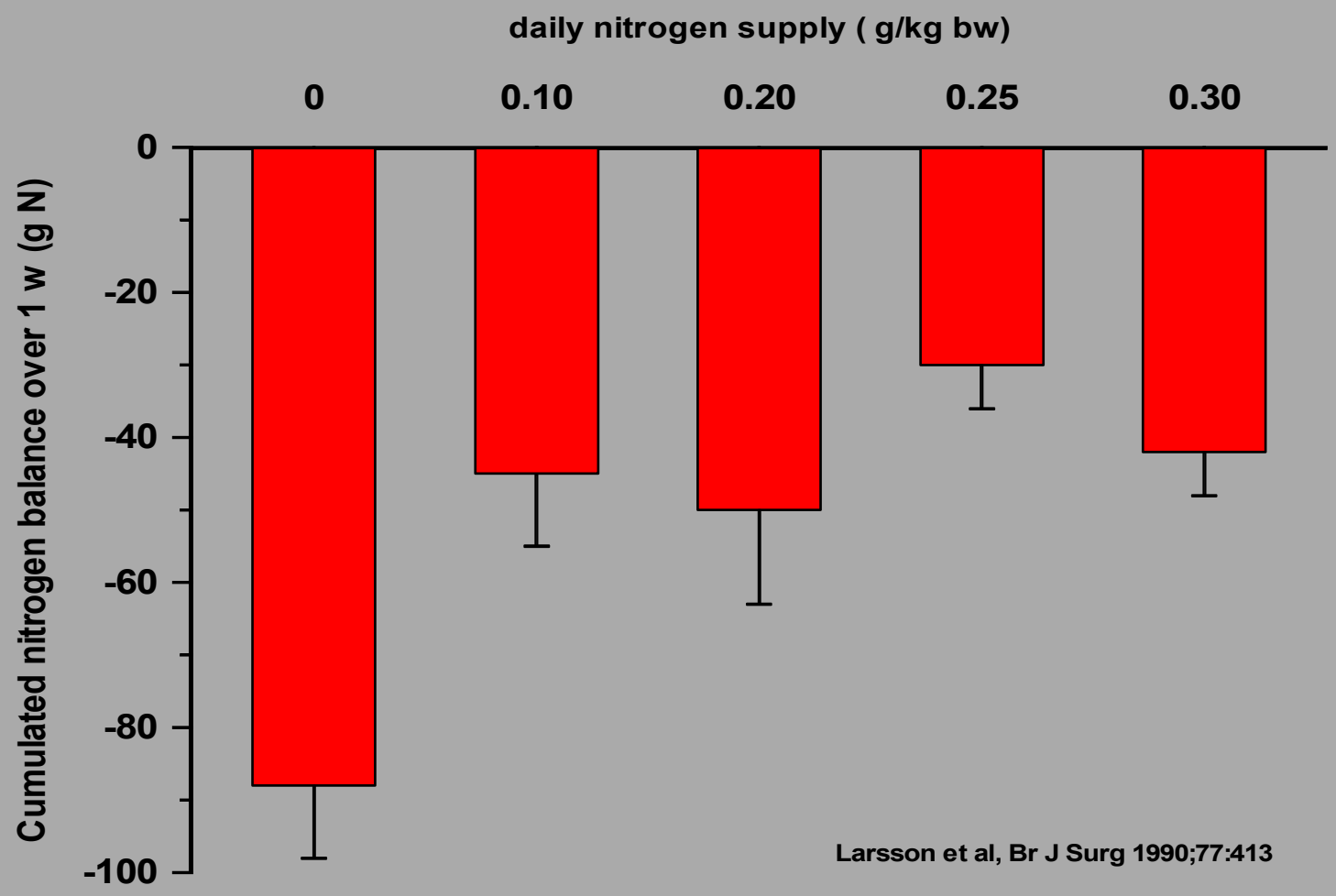
	Energy (kcal/kg/d) Delivered		Mortality, No./Total No. (%)[a]		Infectious Morbidity, No./Total No. (%)	
Study (Reference)	Permissive Underfeeding	Standard Feeding	Permissive Underfeeding	Standard Feeding	Permissive Underfeeding	Standard Feeding
Arabi et al, 2011[8]	14[b]	16.5[b]	22/120 (18)	28/120 (23)	No difference[c]	No difference[c]
Rice et al, 2011[5]	3[b,d]	17[b]	22/98 (22)	20/102 (20)	30/98 (31)	33/102 (32)
NHLBI ARDS CTN, 2012[6]	5[b,d]	15[b]	118/508 (23)	109/492 (22)	37/508 (7)[e]	33/492 (7)[e]
Rugeles et al, 2013[9]	12	14	5/53 (9)[f]	3/62 (5)[f]	No data	No data
Charles et al, 2014[10]	12.3	17.1	3/41 (7)	4/42 (10)	29/41 (71)	32/42 (76)
Arabi et al, 2015[7]	Unable to calculate[g]	Unable to calculate[g]	121/445 (27)	127/440 (29)	161/448 (36)	169/446 (38)
Petros et al, 2016[11]	11.3	19.7	18/46 (39)	18/54 (33)	12/46 (26)[h]	6/54 (11)[h]

Kortez, JPEN 40:1064-6 (2016)

So is hypocaloric feeding better?

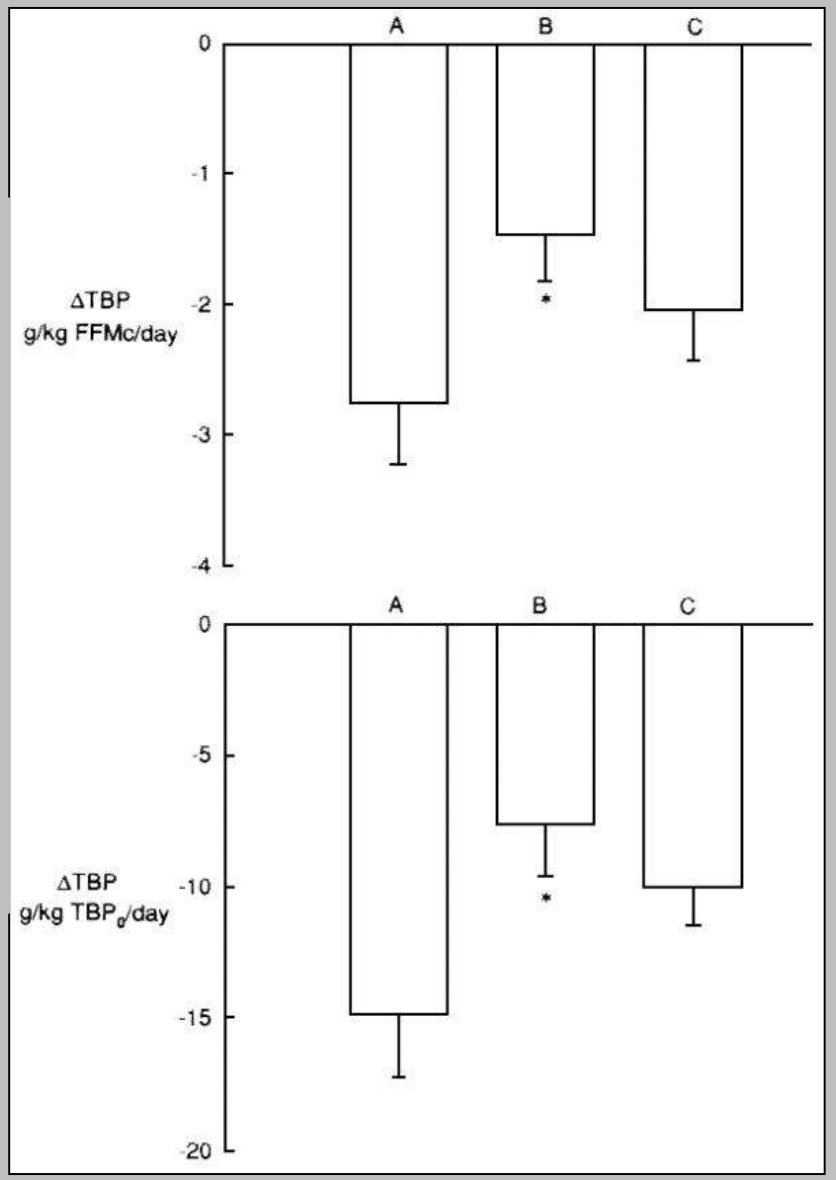
So far there is poor evidence for a systematic hypocaloric feeding

What do we know about protein needs?


daily nitrogen supply (g/kg bw)
0
0.10
0.20
0.25
0.30
Cumulated nitrogen balance over 1 w (g N)
0
-20
-40
-60
-80
-100
Larsson et al, Br J Surg 1990;77:413

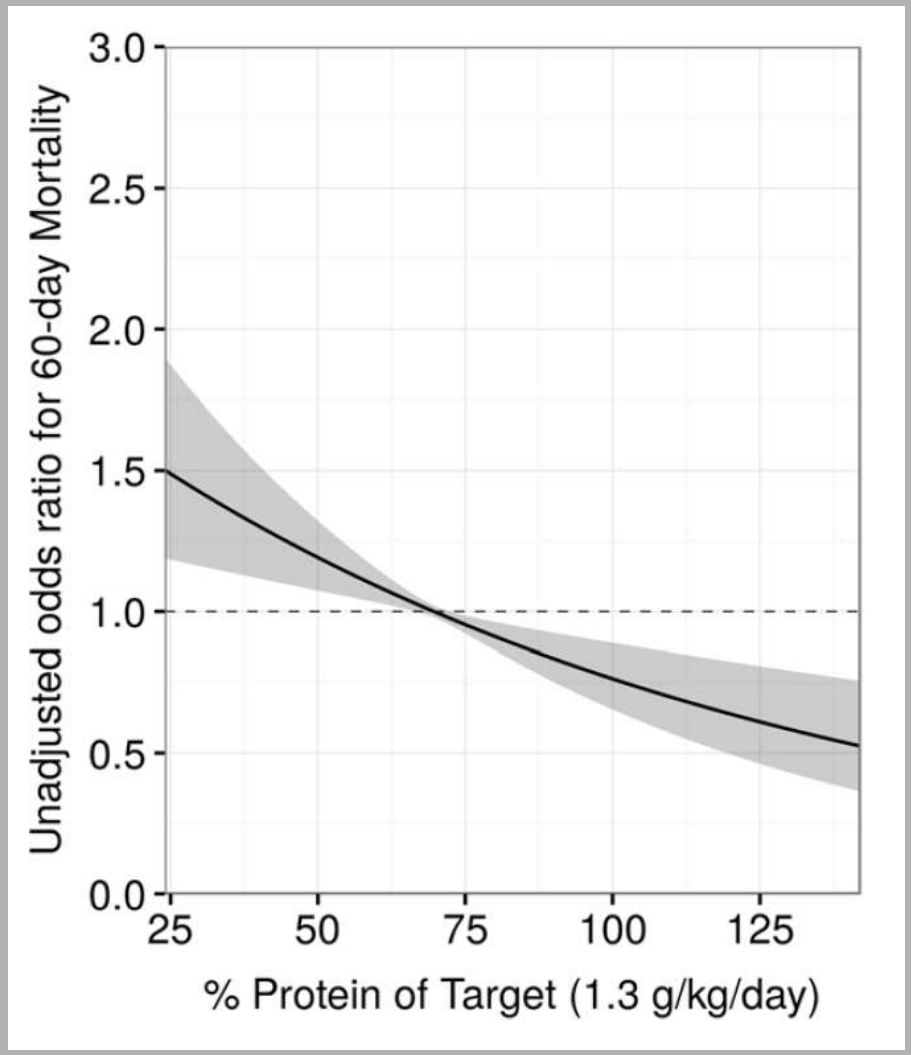
Change in Total Body Protein

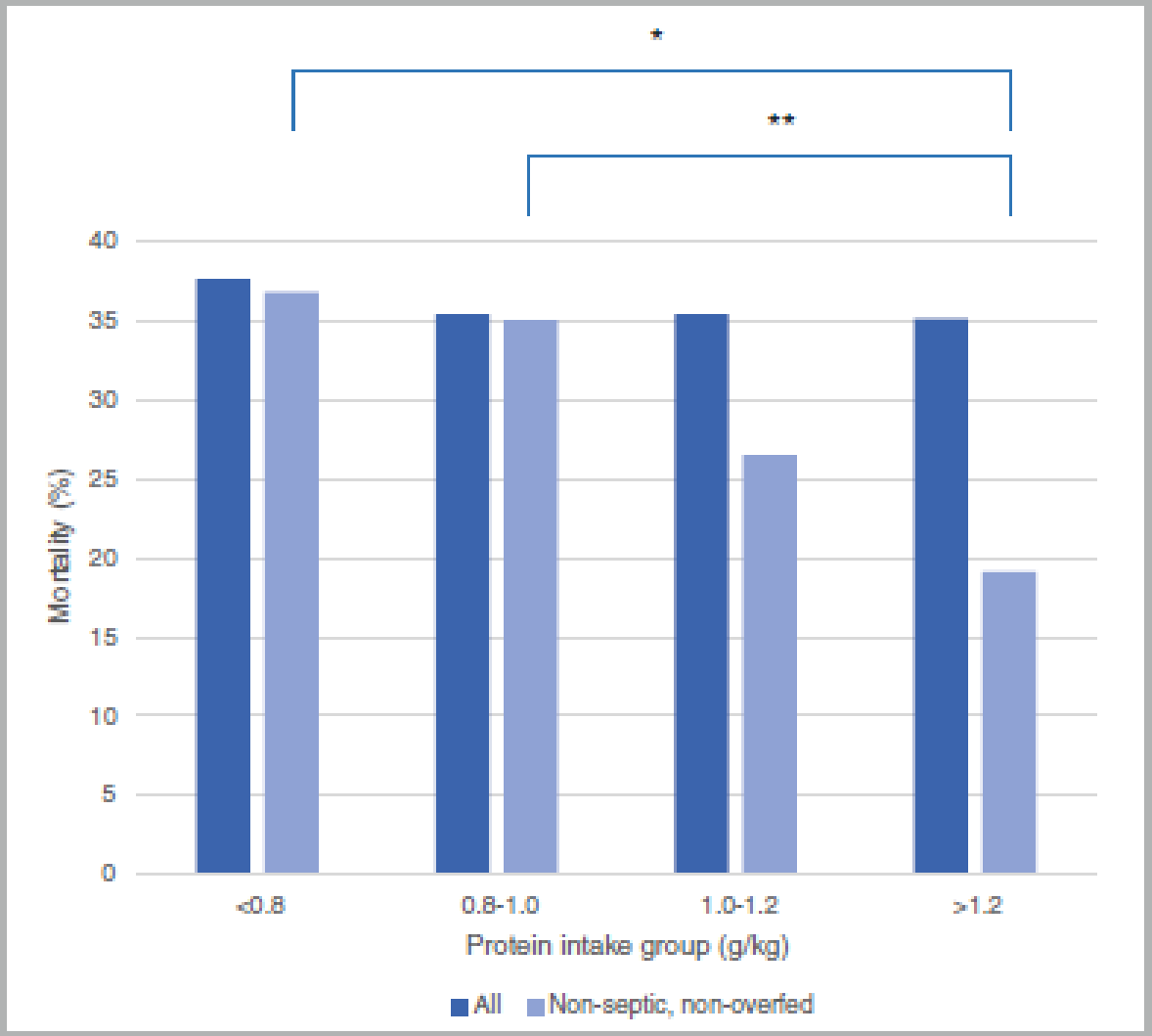
Patient Group	Protein (g/kg/day)
A (n = 7)	1.14 ± 0.13[a,b]
B (n = 8)	1.47 ± 0.11[b]
C (n = 8)	1.86 ± 0.14[b]
p[d]	<.001



Ishibashi et al, CCM 1998;26:1529-35

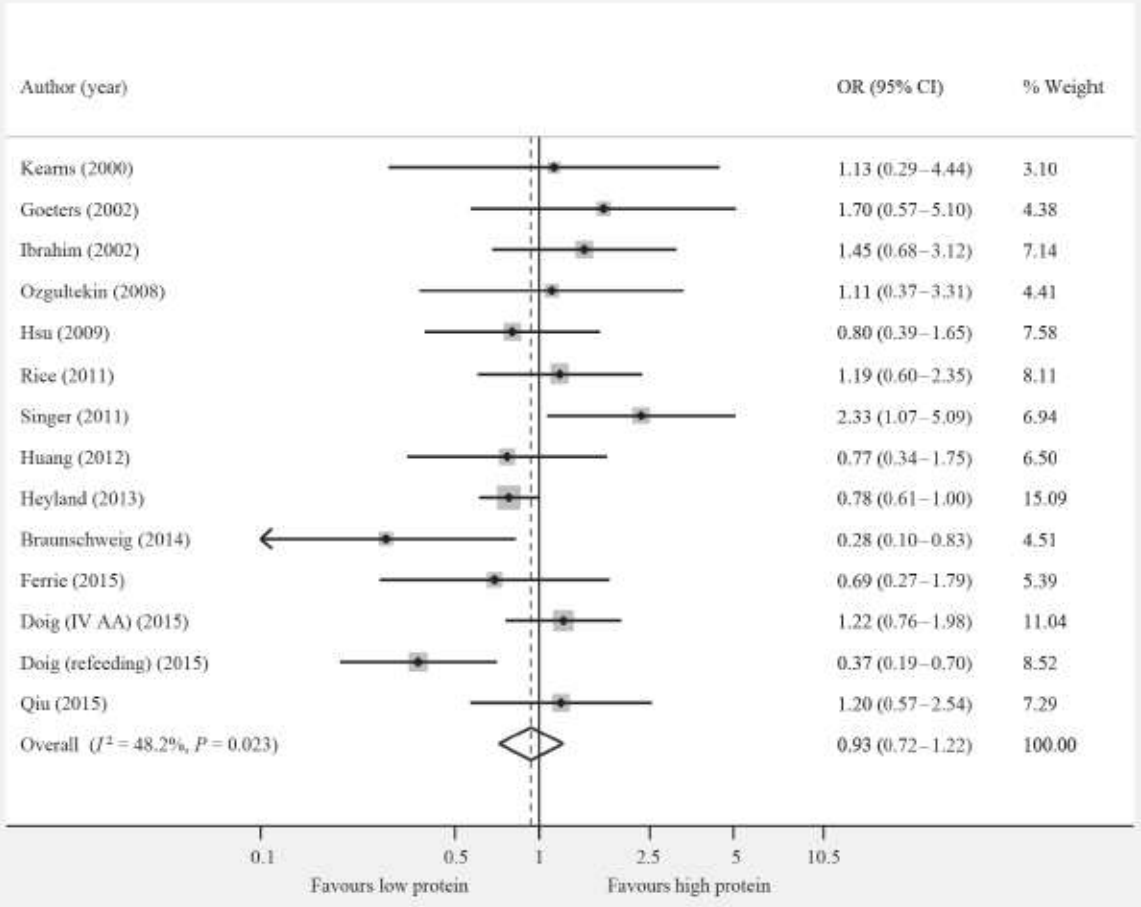
Zusman et al, Crit Care 2016;20:367



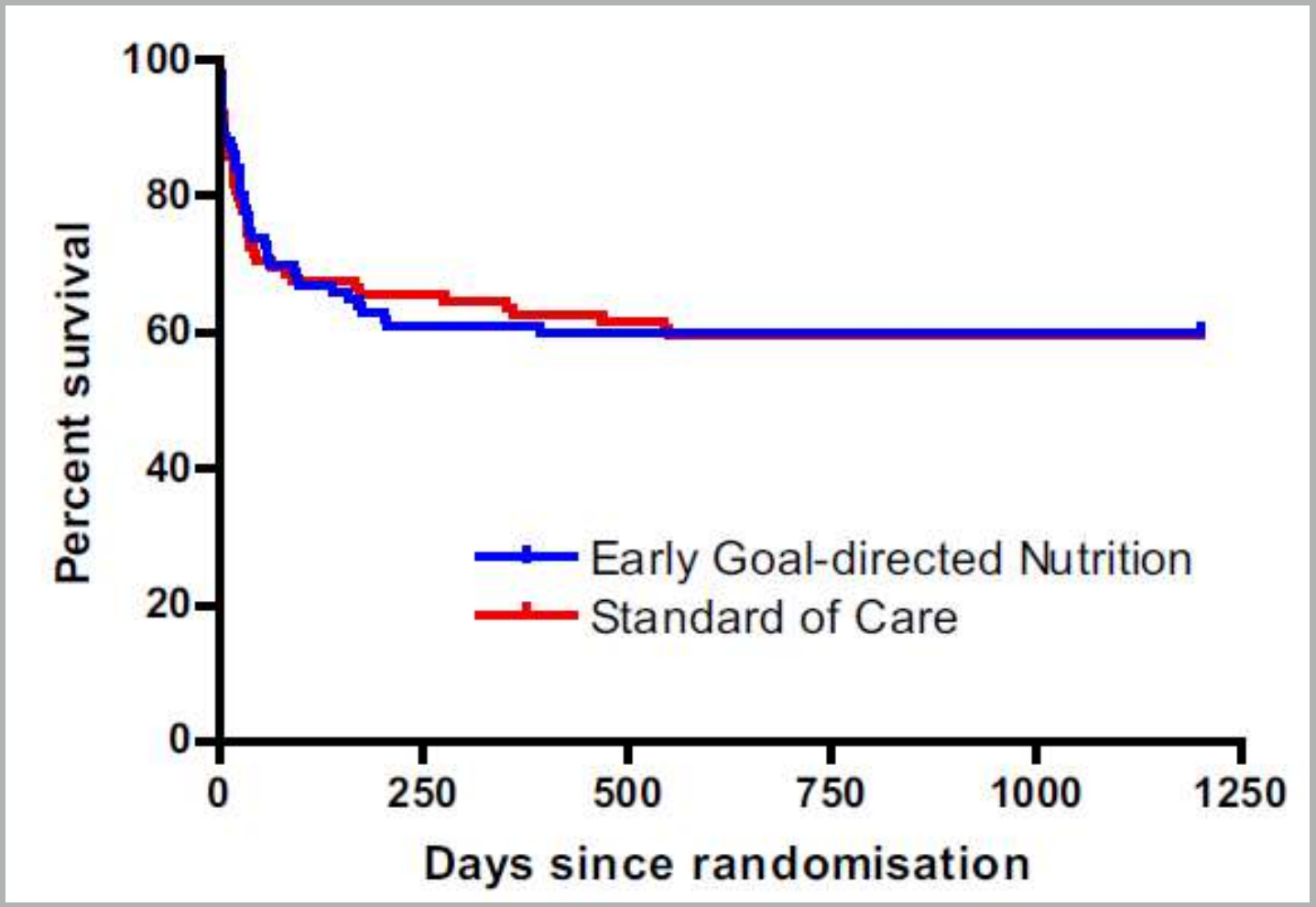


Weijs et al, Crit Care 2014;18:701

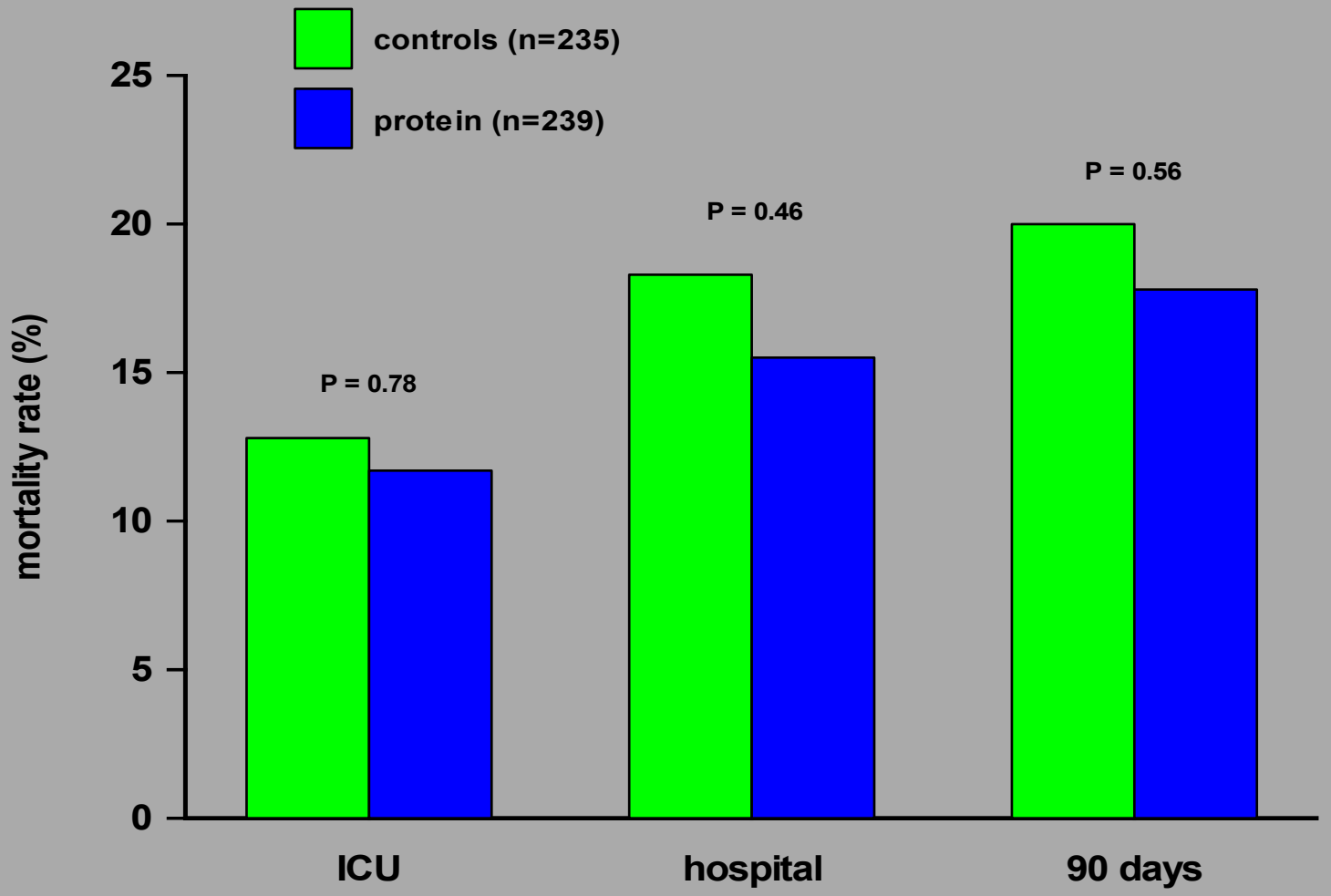
Figure 2. Effect of protein delivery on mortality*



Davis et al, CCR 2017;19:117-127



Allingstrup et al, ICM 2017;43:1637-47



Doig et al, ICM 2015;41:1197-1208

What do we know about protein needs?

There is very limited evidence for a beneficial effect from a high protein intake in the early phase of critical illness, and it rests solely on observational data.

Also safety data are limited, and the Leuven experience is contradictory.

Rule of theTumb

1. Set nutrition target (kcal+prot)
2. Start EN when possible
3. Calculate caloric and protein balances
4. Complementary PN on day 4-5-8

Nutrition target by indirect calorimetry (or 20 kcal/kg), (50-)80-100%, 1.0-1.5 g protein/kg

ICU-metabolism.se © 2010

Home of the research group in ICU Metabolism and Nutrition at Karolinska Institutet and Karolinska University Hospital

Home | Who are we | What do we do | What have we done | Our lab | Tracer site

Our research is dedicated to the metabolic and nutritional problems of critically ill patients treated in the ICU.

We are a small research group dedicated to the metabolic and nutritional problems of critically ill patients in the intensive care unit (ICU).

Latest news/meetings

Program for our weekly wednesday research meeting can be found **here!**

Jonathan Grip will present his poster at the **ESCIM** meeting in Barcelona next week on wednesday.

Thank you for listening!