5.3 Strategies to Optimize Delivery and Minimize Risks of EN: Small Bowel Feeding vs. Gastric

Question: Does enteral feeding via the small bowel compared to gastric feeding result in better outcomes in the critically ill adult patient?

Summary of evidence: There were seventeen randomized trials that were reviewed, all of which were level 2 studies. In the Taylor et al study, only 34% of the patients achieved small bowel access in this study (large number of protocol violations) and hence the meta-analysis was done with and without this study. Minard et al compared outcomes in patients receiving early immune enhanced enteral nutrition via the small bowel to those receiving delayed immune enhanced enteral nutrition via the gastric route. Meta-analyses on mortality, infections & time dependent variables (LOS) were done with and without the Minard study.

Mortality: Based on the 14 studies that reported on mortality, no significant differences between the groups were found (RR 1.01, 95% CI 0.84, 1.22, p=0.89, heterogeneity I^2=0%; figure 1). When the Taylor et al & Minard studies was excluded, the relative risk did not change (RR 1.03, 95% CI 0.85, 1.24, p=0.77, heterogeneity I^2=0%; figure 2).

Infections (Pneumonia): Based on the 14 studies that reported on pneumonia, the meta-analysis showed that small bowel feeding was associated with a reduction in pneumonia when compared to gastric feeding (RR 0.78, 95% CI 0.61, 1.00, p=0.05, heterogeneity I^2=28%; figure 3). When the studies by Taylor et al and Minard et al were removed from the analysis, small bowel feeding was associated with only a trend in the reduction of pneumonia (RR 0.77, 95% CI 0.57, 1.06, p=0.11, heterogeneity I^2=36%; figure 4).

LOS: When all 10 studies that reported ICU LOS were aggregated, enteral feeding via the small bowel had no effect on ICU length of stay (WMD -1.19, 95% CI -3.46, 3.07, p=0.91, heterogeneity I^2=98%; figure 5). When the Minard study was excluded from the analysis, the signal did not change (WMD -0.86, 95% CI -4.25, 2.53, p=0.62, heterogeneity I^2=98%; figure 6). Based on the aggregation of the 5 studies that reported hospital LOS, enteral feeding via the small bowel had no effect on hospital length of stay (WMD 0.56, 95% CI -3.60, 4.73, p=0.79, heterogeneity I^2=24%; figure 7) when compared to gastric feeding.

Ventilator days: Based on the aggregation of the 6 studies that reported duration of ventilation, enteral feeding via the small bowel compared to gastric feeding had no effect on duration of ventilation (WMD -0.89, 95% CI -2.75, 0.97, p=0.35, heterogeneity I^2=81%; figure 8).

Nutritional Outcomes: Many studies reported on nutritional complications, such as GI bleeds, vomiting, diarrhea, constipation and abdominal bloating. There was no difference between the 2 groups in some studies (Davies 2011, White, Eatock, Friedman), while other reported a significant improvement in nutritional outcomes in the group fed via small bowel such as better nutrition efficiency (Hsu, Acosta-Escribano), calorie/protein intake & less time to reach goal (Hsu), vomiting (Hsu) and significantly less gastrointestinal tract colonization and high gastric residual volumes

(Acosta Escribano). The studies that reported nutritional delivery generally showed better success at meeting goal targets and reaching them sooner. However, this could also be explained by the confounded nature of different gastric feeding strategies. When the data from the 6 studies that reported nutritional efficiency (% goal rate received) as a mean ± standard deviation were aggregated, small bowel feeding compared to gastric feeding was associated with a significantly greater percentage of nutritional efficiency (WMD 10.59, 95% CI 4.76, 16.41, p=0.0004, heterogeneity I^2=88%; figure 9). When the data from the 4 studies that reported the time to reach nutritional goal rate were aggregated, small bowel feeding compared to gastric feeding had no effect on the time to reach nutritional goals (WMD -3.41, 95% CI -13.45, 6.62, p=0.51, heterogeneity I^2=87%; figure 10). One study (Friedman 2015) reported a significant increase in cost when using small bowel vs gastric feeds, though the details on this calculation and the statistical significance was not reported.

Other complications: The group that had a more aggressive feeding regimen and small bowel feeding (Taylor) had fewer major complications and a better neurological outcome at 3 months than the group receiving gastric feeds.

Conclusions:

1) Small bowel feeding, compared to gastric feeding may be associated with a reduction in pneumonia in critically ill patients.
2) Small bowel feeding, compared to gastric feeding has no effect on mortality or ventilator days in critically ill patients receiving small bowel vs. gastric feedings.
3) Small bowel feeding is associated with improved calorie and protein intake and with less time taken to reach target rate of enteral nutrition when compared to gastric feeding.

Level 1 study: if all of the following are fulfilled: concealed randomization, blinded outcome adjudication and an intention to treat analysis.
Level 2 study: If any one of the above characteristics are unfulfilled.

Table 1. Randomized studies evaluating small bowel feeding vs. gastric in critically ill patients

Study	Population	Methods (score)	Mortality # (%)†		Pneumonia # (%)‡	
			Small bowel	Gastric	Small bowel	Gastric
1. Montecalvo 1992	Med/Surg ICU Anticipated feed >3days N=38 from 2 ICUs	C.Random: not sure ITT: no Blinding: no (8)	5/19 (26)	5/19 (26)	4/19 (21)	6/19 (32)
2. Kortbeek 1999	Trauma ISS>16 Vent >48h N=80 from 2 ICUs	C.Random: yes ITT: yes Blinding: no (11)	4/37 (11)	3/43 (7)	10/37 (27)	18/43 (42)
3. Taylor 1999	Head injured ventilated > 10 yrs N=82	C.Random: not sure ITT: yes Blinding: no (10)	6-month 5/41(12)	6-month 6/41 (15)	Pneumonia 18/41 (44) Total Infections 25/41 (61)	 26/41 (63) 35/41 (85)
4. Kearns 2000	MICU Feed >3days APACHE ~21 N=44	C.Random: not sure ITT: yes Blinding: no (9)	5/21 (24)	6/23 (26)	4/21 (19)	3/23 (13)
5. Minard 2000	Trauma GCS 3-10 N=27	C.Random: not sure ITT: no Blinding: no (7)	1/12 (8)	4/15 (27)	6/12 (50)	7/15 (47)
6. Esparaza 2001	MICU MV = 98% APACHE ~25 N=54	C.Random: not sure ITT: yes Blinding: no (8)	10/27 (37)	11/27 (41)	NR	NR
7. Boivin 2001	Med/Surg/Neuro MV~98% Feed >72h APACHE~16 N=80	C.Random: not sure ITT: no Blinding: no (6)	18/39 (46)	18/39 (46)	NR	NR

8. Day 2001	Neurological ICU APACHE ~ 48 N=25	C.Random: not sure ITT: yes Blinding: no (5)	NR	NR	0/14 (0)	2/11 (18)
9. Davies 2002	Med/surg/trauma Feed > 3days MV=90%; APACHE~21 N=73	C.Random: not sure ITT: no Blinding no (8)	4/34 (12)	5/39 (13)	2/31 (6)	1/35 (3)
10. Neumann 2002	MICU N=60	C.Random: not sure ITT: yes Blinding: no (6)	NR	NR	NR	NR
11. Montejo 2002	14 ICU APACHE ~18 Feed >5days N=101 from 11 ICUs	C.Random: not sure ITT: yes Blinding: no (6)	19/50 (38)	22/51 (43)	16/50 (32)	20/51 (39)
12. Hsu 2009	Medical ICU Anticipated feed >3days N=121	C.Random: Yes ITT: Yes Blinding: No (9)	26/59 (44)	24/62 (39)	5/59 (9)	15/62 (24)
13. White 2009	Medical ICU mechanically ventilated >24hrs N=108	C.Random: Yes ITT: Yes Blinding: No (7)	11/50 (22)	5/54 (9)	5/50 (10)	11/54 (20)
14. Acosta-Escribano 2010	Traumatic brain injury, mechanically ventilated patients in ICU required EN for >5 days N=104	C.Random: No ITT: Yes Blinding: No (9)	30-day 6/50 (12)	30-day 9/54 (17)	16/50 (32)	31/54 (57)

15. Davies 2012	Critically ill , mechanically ventilated, on narcotic infusion with elevated GRV from 17 ICUs N=181	C.Random: Yes ITT: Yes Blinding: No (11)	13/91 (14)	12/89 (13)	18/91 (20)	19/89 (21)
16. Friedman 2015	Critically ill adults withour contraindication for enteral nutrition, expected ICU LOS >48 hrs N=115	C.Random: Yes ITT: Yes Blinding: No (9)	ICU 20/54 (37)	ICU 22/61 (36)	13/54 (24)	12/61 (20)
17. Wan 2015	Mixed ICU patients. Single Centre. N=70	C.Random: Yes ITT: Yes Blinding: No (8)	NR	NR	Aspiration pneumonia 0/35	Aspiration pneumonia 10/35

Table 1. Randomized studies evaluating small bowel feeding vs. gastric in critically ill patients (continued)

Study	LOS days		Ventilator days		Nutritional Outcomes		Other	
	Small bowel	Gastric	Small bowel	Gastric	Small bowel	Gastric	Small bowel	Gastric
1. Montecalvo 1992	ICU 11.7 ± 8.2 (19)	ICU 12.3 ± 10.8 (19)	10.2 ± 7.1 (19)	11.4 ± 10.8 (19)	Daily caloric intake (%) 61 ± 17	46.9 ± 25.9	GI bleeding 7/19 (37) Diarrhea 12/19 (63) Vomiting 3/19 (16)	GI bleeding 6/19 (32) Diarrhea 9/19 (47) Vomiting 3/19 (16)
2. Kortbeek 1999	ICU 10 (3-24) Hospital 30 (16-47)	ICU 7 (3-32) Hospital 25 (9-88)	9 (2-13)	5 (3-15)	Time to tolerate full feeds 34 ± 7.1	43.8 ± 22.6	NR	NR

3. Taylor 1999	NR	NR	NR	NR	% energy needs met (mean) 59.2 36.8 % nitrogen needs met (mean) 68.7 37.9	37 % major complications 61 % had better neurological outcome at 3 months	61 % major complications 39 % had better neurological outcome at 3months
4. Kearns 2000	ICU 17 ± 2 (21) Hospital 39 ± 10 (21)	ICU 16 ± 2 (23) Hospital 43 ± 11 (23)	NR	NR	Calories (kcal/kg/day) 18 ± 1 12 ± 2 Protein (gm/kg/day) 0.7 ± 0.1 0.4 ± 0.1 % REE delivered 69 ± 7 47 ± 7	Diarrhea 3 days	Diarrhea 2 days
5. Minard 2000	ICU 18.5 ± 8.8 (12) Hospital 30 ± 14.7 (12)	ICU 11.3 ± 6.1 (12) Hospital 21.3 ± 14.7 (12)	15.1 ± 7.5 (12)	10.4 ± 6.1 (15)	Time feeding initiated (hours) 33 ± 15 84 ± 41 Avg kcals/ day 1509 ± 45 1174 ± 425 Days fed 13 ± 3.7 8 ± 4.5 # patients with > 50 % goal for ≥ 5 days 10/12 (83) 7/15 (47)	Diarrhea 11/12 (92) Vomiting 1/12 (8)	Diarrhea 8/15 (53) Vomiting 3/15 (20)
6. Esparaza 2001	NR	NR	NR	NR	Feed days (average) 3.6 4.1 Average daily % of goal 66 64	NR	NR
7. Boivin 2001	NR	NR	NR	NR	Time of placement 304 minutes 13 minutes Time to goal rate achieved and maintained for 4 hours 33 hours 32 hours	NR	NR
8. Day 2001	NR	NR	NR	NR	Calories and protein received were significantly higher only on days 2 and 3 in the gastric group. No difference between the groups on Days 1, 4-10. Replaced tubes 16/14 9/11	Diarrhea 7/14 (50)	Diarrhea 5/11 (45)

9. Davies 2002	ICU 13.9 ± 1.8 (34)	ICU 10.4 ± 1.2 (39)	NR	NR	Time to reach target rate 23.2 ± 3.9 23.0 ± 3.4 Time to start feeds 81.2 ± 13.4 54.5 ± 4.9	GI bleeding 3/31 (10) Diarrhea 4/31 (13)	GI bleeding 0/35 (0) Diarrhea 3/35 (9)
10. Neumann 2002	NR	NR	NR	NR	Time from initial attempt to start of feeding 27.0 ± 22.6 11.2 ± 11.0 Time to reach goal rate (from initial placement attempt) 43 ± 24.1 28.8 ± 15.9 Time to reach goal rate (from successful tube placement) 17.3 ± 15.7 17.0 ± 11.9	Aspiration 1/30 (3)	Aspiration 0/30 (0)
11. Montejo 2002	ICU 15 ± 10 (50)	ICU 18 ± 16 (50)	NR	NR	High gastric residuals 1/50 (2) 25/51 (49) Caloric intake (mean) 1286 ± 344 1237 ± 342 Volume ratio at day 7 (%) 80 ± 28 75 ± 30	Diarrhea 7/50 (14) Vomiting 4/50 (8)	Diarrhea 7/51 (14) Vomiting 2/51 (4)
12. Hsu 2009	ICU 18.20 ± 11.80 Hospital 36.0 ± 24.2	ICU 18.20 ± 11.20 Hospital 31.7 ± 21.1	28.5 ± 24.9 (59)	23.8 ± 18.2 (62)	Mean % of daily goal calorie fed 95 ± 5 83 ± 6 Caloric intake (kcal/day) 1658 ± 118 1426 ±110 Protein (grams/day) 67.9 (4.9) 58.8 (4.9)	Vomiting 1/59 (2) GI bleeding 7/59 (12) Time to reach goal 32.4 (27.1) hrs	Vomiting 8/62 (13) GI bleeding 9/62 (15) Time to reach goal 54.5 (51.4) hrs
13. White 2009	ICU 5.3 (2.73-9.89) 7.12 ± 6.00 (51)	ICU 5.02 (1.98-9.99) 9.10 ± 10.55 (55)	3.93 (2.3-8.38) 5.73 ± 5.29 (51)	3.92 (1.5-8.54) 7.68 ± 9.81 (55)	Caloric intake (median, IQR) 1463 (1232-1804) 1588 (913-1832) Protein intake (median, IQR) 63 (50-78) 69 (45-87)	Time to reach goal 4.1 (3.4-5.0) hrs	Time to reach goal 4.3 (4.0-5.0)
14. Acosta-Escribano 2010	ICU 16 ± 9 (50) Hospital 38 ± 24 (50)	ICU 18 ± 7 (54) Hospital 41 ± 28 (54)	7.3 ± 4 (50)	8.9 ± 4 (54)	Nutritional efficiency (%) 92 ± 7 84 ± 15	High GRVs 3/50 (6) GIT complications 7/50 (14)	High GRVs 15/54 (28) GIT complications 27/54 (47)

15. Davies 2012	ICU 10 (7-15) 12.5 ± 8.6 (91) Hospital 20 (11-33) 28.8 ± 26.1 (91)	ICU 11 (7-16) 12.7 ± 9.8 (89) Hospital 24 (15-32) 27.4 ± 21.1 (89)	8 (6-12) 9.8 ± 6.2 (91)	8 (5-14) 9.7 ± 6.3 (89)	Nutritional efficiency (%) 72 71 p=0.66 Caloric intake (mean) 1497 ± 521 1444 ± 485	Major haemorrhage 2/91 (2) Minor haemorrhage 12/91 (13) Vomiting 30/91 (33) Aspiration 5/91 (5) Diarrhea 26/91 (29) Abdom distention 16/91 (18)	Major haemorrhage 2/89 (2) Minor haemorrhage 3/89 (3) Vomiting 30/89 (30) Aspiration 4/89 (5) Diarrhea 26/89 (30) Abdom distention 18/89 (20)
16. Friedman 2015	ICU 10 (7-21) (54)	ICU 12 (8-20) (61)	4 (2-11) (54)	7 (3-13) (61)	NR	Cost, US$ 1163 Diarrhea 15/54 (28) Vomiting 14/54 (26) Constipation 9/54 (17)	Cost, US$ 467 Diarrhea 11/61 (18), p=0.306 Vomiting 18/61, p=0.826 Constipation 14/61 (23), p=0.544
17. Wan 2015	ICU 12.2 ± 0.7 (35)	ICU 17.1 ± 1.0 (35)	5.2 ± 0.3 (35)	8.5 ± 0.5 (35)	NR	Cost 5203 ± 247 Diarrhea 9/35 Reflux 1/35	Cost 7786 ± 555, P <0.01 Diarrhea 9/35 Reflux 14/35, P <0.01

C.Random: concealed randomization
ITT: intent to treat
† presumed ICU mortality unless otherwise specified
‡ refers to the # of patients with infections unless specified

± ( ) : mean ± Standard deviation (number)
(-) : median (range)
NR: not reported

Figure 1. Mortality

Study or Subgroup	Small Bowel Events	Small Bowel Total	Gastric Events	Gastric Total	Weight	Risk Ratio M-H, Random, 95% CI
Montecalvo	5	19	5	19	3.1%	1.00 [0.35, 2.90]
Kortbeek	4	37	3	43	1.7%	1.55 [0.37, 6.48]
Taylor	5	41	6	41	2.8%	0.83 [0.28, 2.52]
Kearns	5	21	6	23	3.3%	0.91 [0.33, 2.55]
Minard	1	12	4	15	0.8%	0.31 [0.04, 2.44]
Esparaza	10	27	11	27	7.7%	0.91 [0.47, 1.78]
Boivin	18	39	18	39	15.1%	1.00 [0.62, 1.62]
Davies 2002	4	34	5	39	2.3%	0.92 [0.27, 3.14]
Montejo	19	50	22	51	15.4%	0.88 [0.55, 1.42]
Hsu	26	59	24	62	19.1%	1.14 [0.74, 1.74]
White	11	51	5	57	3.6%	2.46 [0.92, 6.60]
Acosta-Escribano	6	50	9	54	3.8%	0.72 [0.28, 1.88]
Davies 2012	13	91	12	89	6.5%	1.06 [0.51, 2.19]
Friedman	20	54	22	61	14.9%	1.03 [0.63, 1.66]
Total (95% CI)		**585**		**620**	**100.0%**	**1.01 [0.84, 1.22]**
Total events	147		152			

Heterogeneity: Tau² = 0.00; Chi² = 6.11, df = 13 (P = 0.94); I² = 0%
Test for overall effect: Z = 0.14 (P = 0.89)

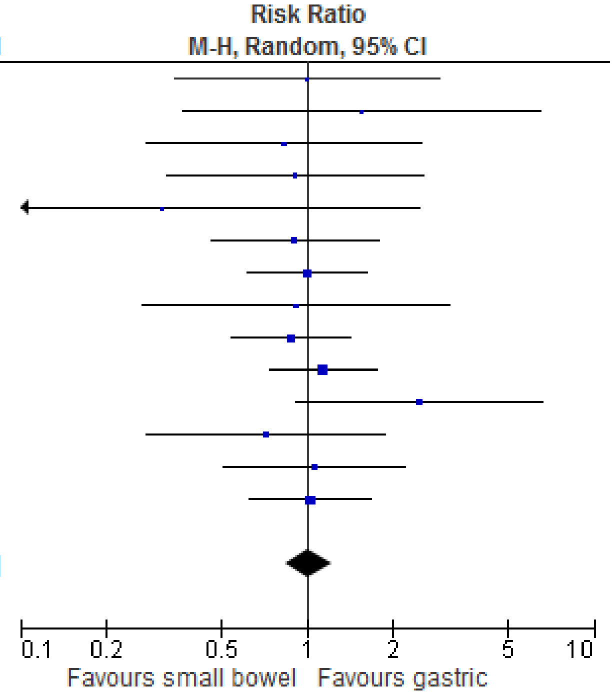

Figure 2. Mortality (excluding Taylor and Minard)

	Small Bowel		Gastric			Risk Ratio	
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% CI	Year
Montecalvo	5	19	5	19	3.2%	1.00 [0.35, 2.90]	1992
Kortbeek	4	37	3	43	1.8%	1.55 [0.37, 6.48]	1999
Kearns	5	21	6	23	3.4%	0.91 [0.33, 2.55]	2000
Esparaza	10	27	11	27	8.0%	0.91 [0.47, 1.78]	2001
Boivin	18	39	18	39	15.6%	1.00 [0.62, 1.62]	2001
Davies 2002	4	34	5	39	2.4%	0.92 [0.27, 3.14]	2002
Montejo	19	50	22	51	16.0%	0.88 [0.55, 1.42]	2002
Hsu	26	59	24	62	19.9%	1.14 [0.74, 1.74]	2009
White	11	51	5	57	3.7%	2.46 [0.92, 6.60]	2010
Acosta-Escribano	6	50	9	54	3.9%	0.72 [0.28, 1.88]	2010
Davies 2012	13	91	12	89	6.8%	1.06 [0.51, 2.19]	2012
Friedman	20	54	22	61	15.4%	1.03 [0.63, 1.66]	2015
Total (95% CI)		**532**		**564**	**100.0%**	**1.03 [0.85, 1.24]**	
Total events	141		142				

Heterogeneity: Tau² = 0.00; Chi² = 4.73, df = 11 (P = 0.94); I² = 0%
Test for overall effect: Z = 0.30 (P = 0.77)

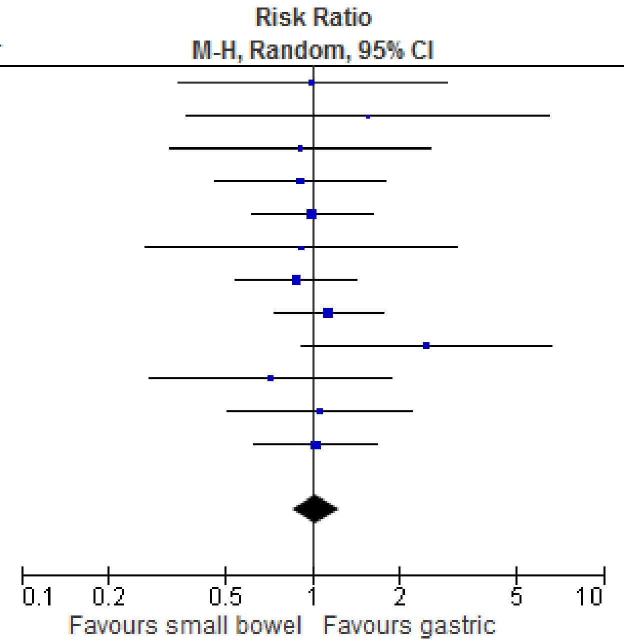

Figure 3. Pneumonia

	Small Bowel		Gastric			Risk Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% CI
Montecalvo	4	19	6	19	4.3%	0.67 [0.22, 1.99]
Kortbeek	10	37	18	43	9.9%	0.65 [0.34, 1.22]
Taylor	18	41	26	41	15.8%	0.69 [0.46, 1.05]
Kearns	4	21	3	23	2.9%	1.46 [0.37, 5.78]
Minard	6	12	7	15	7.4%	1.07 [0.49, 2.34]
Day	0	14	2	11	0.7%	0.16 [0.01, 3.03]
Davies 2002	2	31	1	35	1.1%	2.26 [0.22, 23.71]
Montejo	16	50	20	51	12.4%	0.82 [0.48, 1.39]
Hsu	5	59	15	62	5.5%	0.35 [0.14, 0.90]
White	11	57	5	51	5.1%	1.97 [0.73, 5.28]
Acosta-Escribano	16	50	31	54	14.2%	0.56 [0.35, 0.89]
Davies 2012	18	91	19	89	11.2%	0.93 [0.52, 1.65]
Friedman	13	54	12	61	8.8%	1.22 [0.61, 2.45]
Wan	0	35	10	35	0.8%	0.05 [0.00, 0.78]
Total (95% CI)		**571**		**590**	**100.0%**	**0.78 [0.61, 1.00]**
Total events	123		175			

Heterogeneity: Tau² = 0.06; Chi² = 18.07, df = 13 (P = 0.15); I² = 28%
Test for overall effect: Z = 1.99 (P = 0.05)

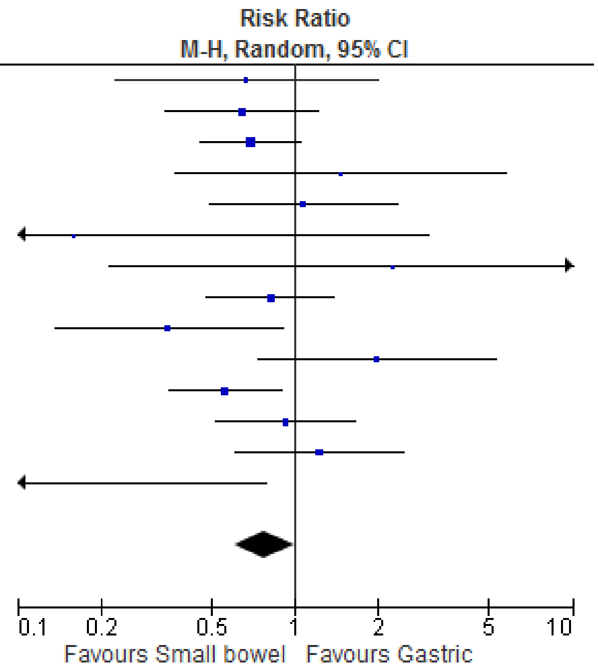

Figure 4. Pneumonia (excluding Taylor and Minard)

	Small Bowel		Gastric			Risk Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% CI
Montecalvo	4	19	6	19	6.3%	0.67 [0.22, 1.99]
Kortbeek	10	37	18	43	12.7%	0.65 [0.34, 1.22]
Kearns	4	21	3	23	4.3%	1.46 [0.37, 5.78]
Day	0	14	2	11	1.1%	0.16 [0.01, 3.03]
Davies 2002	2	31	1	35	1.7%	2.26 [0.22, 23.71]
Montejo	16	50	20	51	15.2%	0.82 [0.48, 1.39]
Hsu	5	59	15	62	7.8%	0.35 [0.14, 0.90]
White	11	57	5	51	7.3%	1.97 [0.73, 5.28]
Acosta-Escribano	16	50	31	54	16.8%	0.56 [0.35, 0.89]
Davies 2012	18	91	19	89	14.1%	0.93 [0.52, 1.65]
Friedman	13	54	12	61	11.6%	1.22 [0.61, 2.45]
Wan	0	35	10	35	1.2%	0.05 [0.00, 0.78]
Total (95% CI)		**518**		**534**	**100.0%**	**0.77 [0.57, 1.06]**
Total events	99		142			

Heterogeneity: Tau² = 0.10; Chi² = 17.16, df = 11 (P = 0.10); I² = 36%
Test for overall effect: Z = 1.60 (P = 0.11)

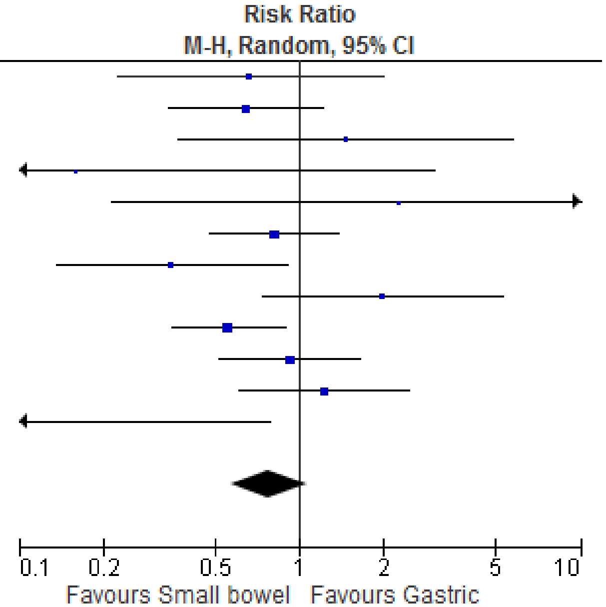

Figure 5. ICU LOS

Study or Subgroup	Small Bowel Mean	Small Bowel SD	Small Bowel Total	Gastric Mean	Gastric SD	Gastric Total	Weight	Mean Difference IV, Random, 95% CI
Montecalvo	11.7	8.2	19	12.3	10.8	19	8.1%	-0.60 [-6.70, 5.50]
Kearns	17	2	21	16	2	23	11.2%	1.00 [-0.18, 2.18]
Minard	18.5	8.8	12	11.3	6.1	15	8.3%	7.20 [1.34, 13.06]
Davies 2002	13.9	1.8	34	10.4	1.2	39	11.3%	3.50 [2.79, 4.21]
Montejo	15	10	50	18	16	51	8.8%	-3.00 [-8.19, 2.19]
Hsu	18.2	11.8	59	18.2	11.2	62	9.6%	0.00 [-4.10, 4.10]
White	7.12	6	51	9.1	10.55	55	10.2%	-1.98 [-5.22, 1.26]
Acosta-Escribano	16	9	50	18	7	54	10.3%	-2.00 [-5.12, 1.12]
Davies 2012	12.5	8.6	91	12.7	9.8	89	10.6%	-0.20 [-2.90, 2.50]
Wan	12.2	0.7	35	17.1	1	35	11.4%	-4.90 [-5.30, -4.50]
Total (95% CI)			**422**			**442**	**100.0%**	**-0.19 [-3.46, 3.07]**

Heterogeneity: Tau² = 24.35; Chi² = 456.45, df = 9 (P < 0.00001); I² = 98%
Test for overall effect: Z = 0.12 (P = 0.91)

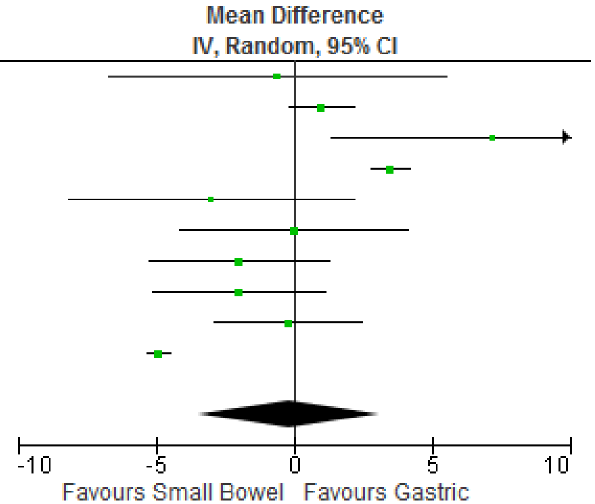

Figure 6. ICU LOS (excluding Minard)

Study or Subgroup	Small Bowel Mean	Small Bowel SD	Small Bowel Total	Gastric Mean	Gastric SD	Gastric Total	Weight	Mean Difference IV, Random, 95% CI	Year
Montecalvo	11.7	8.2	19	12.3	10.8	19	8.9%	-0.60 [-6.70, 5.50]	1992
Kearns	17	2	21	16	2	23	12.3%	1.00 [-0.18, 2.18]	2000
Davies 2002	13.9	1.8	34	10.4	1.2	39	12.4%	3.50 [2.79, 4.21]	2002
Montejo	15	10	50	18	16	51	9.6%	-3.00 [-8.19, 2.19]	2002
Hsu	18.2	11.8	59	18.2	11.2	62	10.5%	0.00 [-4.10, 4.10]	2009
White	7.12	6	51	9.1	10.55	55	11.2%	-1.98 [-5.22, 1.26]	2010
Acosta-Escribano	16	9	50	18	7	54	11.3%	-2.00 [-5.12, 1.12]	2010
Davies 2012	12.5	8.6	91	12.7	9.8	89	11.5%	-0.20 [-2.90, 2.50]	2012
Wan	12.2	0.7	35	17.1	1	35	12.4%	-4.90 [-5.30, -4.50]	2015
Total (95% CI)			**410**			**427**	**100.0%**	**-0.86 [-4.25, 2.53]**	

Heterogeneity: Tau² = 24.06; Chi² = 446.00, df = 8 (P < 0.00001); I² = 98%
Test for overall effect: Z = 0.50 (P = 0.62)

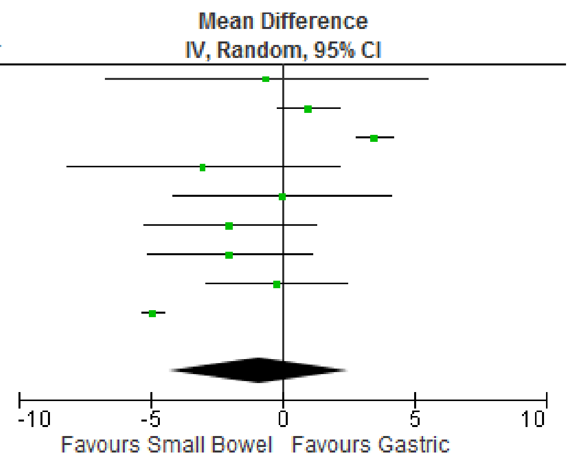

Figure 7. Hospital LOS

Study or Subgroup	Small Bowel Mean	Small Bowel SD	Small Bowel Total	Gastric Mean	Gastric SD	Gastric Total	Weight	Mean Difference IV, Random, 95% CI	Year
Kearns	39	10	21	43	11	23	29.3%	-4.00 [-10.21, 2.21]	2000
Minard	30	14.7	12	21.3	14.7	12	10.9%	8.70 [-3.06, 20.46]	2000
Hsu	36	24.2	59	31.7	21.1	62	20.1%	4.30 [-3.81, 12.41]	2009
Acosta-Escribano	38	24	50	41	28	54	14.4%	-3.00 [-13.00, 7.00]	2010
Davies 2012	28.8	26.1	91	27.4	21.1	89	25.3%	1.40 [-5.53, 8.33]	2012
Total (95% CI)			**233**			**240**	**100.0%**	**0.56 [-3.60, 4.73]**	

Heterogeneity: Tau² = 5.40; Chi² = 5.25, df = 4 (P = 0.26); I² = 24%
Test for overall effect: Z = 0.27 (P = 0.79)

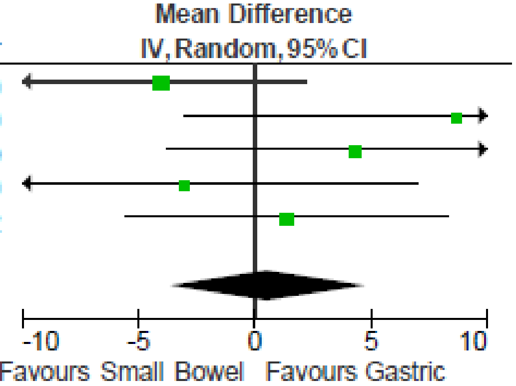

Figure 8. Duration of ventilation

Study or Subgroup	Small Bowel Mean	Small Bowel SD	Small Bowel Total	Gastric Mean	Gastric SD	Gastric Total	Weight	Mean Difference IV, Random, 95% CI
Montecalvo	10.2	7.1	19	11.4	10.8	19	7.2%	-1.20 [-7.01, 4.61]
Minard	15.1	7.5	12	10.4	6.1	15	8.3%	4.70 [-0.55, 9.95]
Hsu	28.5	24.9	59	23.8	18.2	62	4.6%	4.70 [-3.10, 12.50]
White	5.73	5.29	51	7.68	9.81	55	15.0%	-1.95 [-4.92, 1.02]
Acosta-Escribano	7.3	4	50	8.9	4	54	20.9%	-1.60 [-3.14, -0.06]
Davies 2012	9.8	6.2	91	9.7	6.3	89	19.7%	0.10 [-1.73, 1.93]
Wan	5.2	0.3	35	8.5	0.5	35	24.3%	-3.30 [-3.49, -3.11]
Total (95% CI)			**317**			**329**	**100.0%**	**-0.89 [-2.75, 0.97]**

Heterogeneity: Tau² = 3.70; Chi² = 31.48, df = 6 (P < 0.0001); I² = 81%
Test for overall effect: Z = 0.94 (P = 0.35)

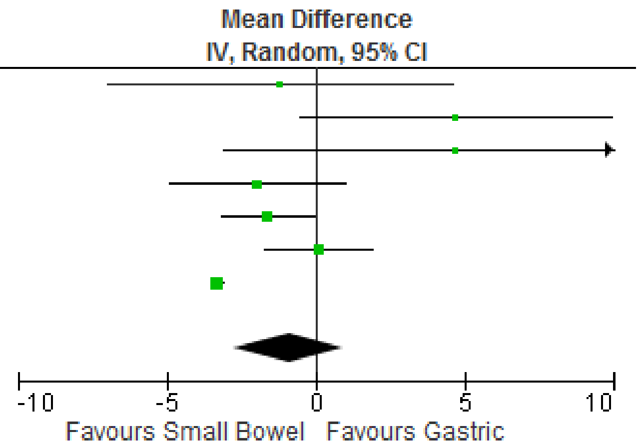

Figure 9. Nutritional efficiency (%)

	Small Bowel			Gastric				Mean Difference	
Study or Subgroup	**Mean**	**SD**	**Total**	**Mean**	**SD**	**Total**	**Weight**	**IV, Random, 95% CI**	**Year**
Montecalvo	61	17	19	46.9	25.9	19	9.7%	14.10 [0.17, 28.03]	1992
Kearns	69	7	21	47	7	23	19.7%	22.00 [17.86, 26.14]	2000
Montejo	80	28	50	75	30	51	12.0%	5.00 [-6.31, 16.31]	2002
Hsu	95	5	59	83	6	62	21.3%	12.00 [10.04, 13.96]	2009
Acosta-Escribano	92	7	50	84	15	54	19.4%	8.00 [3.55, 12.45]	2010
Davies 2012	72	21	91	71	19	89	17.9%	1.00 [-4.85, 6.85]	2012
Total (95% CI)			**290**			**298**	**100.0%**	**10.59 [4.76, 16.41]**	

Heterogeneity: Tau² = 40.41; Chi² = 40.66, df = 5 (P < 0.00001); I² = 88%
Test for overall effect: Z = 3.56 (P = 0.0004)

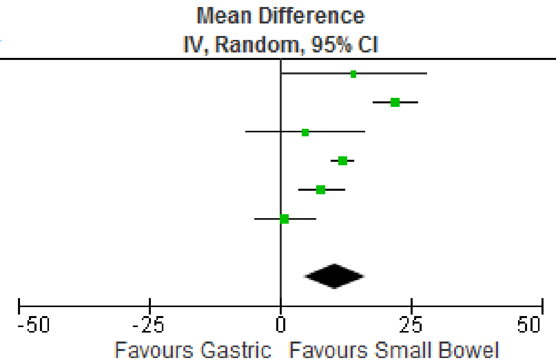

Figure 10. Time to reach EN target

	Small Bowel			Gastric				Mean Difference	
Study or Subgroup	**Mean**	**SD**	**Total**	**Mean**	**SD**	**Total**	**Weight**	**IV, Random, 95% CI**	**Year**
Kortbeek	34	7.1	37	43.8	22.6	43	26.9%	-9.80 [-16.93, -2.67]	1999
Davies 2002	23.2	3.9	31	23	3.4	35	30.8%	0.20 [-1.58, 1.98]	2002
Neumann	43	24.1	30	28.8	15.9	30	23.4%	14.20 [3.87, 24.53]	2002
Hsu	32.4	27.1	59	54.5	51.4	62	18.8%	-22.10 [-36.64, -7.56]	2009
Total (95% CI)			**157**			**170**	**100.0%**	**-3.41 [-13.45, 6.62]**	

Heterogeneity: Tau² = 84.16; Chi² = 23.32, df = 3 (P < 0.0001); I² = 87%
Test for overall effect: Z = 0.67 (P = 0.51)