5.3 Strategies to Optimize Delivery and Minimize Risks of EN: Small Bowel Feeding vs. Gastric February 2014

2013 Recommendation: *Based on 15 level 2 studies, small bowel feeding compared to gastric feeding may be associated with a reduction in pneumonia in critically ill patients. In units where small bowel access is feasible, we recommend the routine use of small bowel feedings. In units where obtaining access involves more logistical difficulties, small bowel feedings should be considered for patients at high risk for intolerance to EN (on inotropes, continuous infusion of sedatives, or paralytic agents, or patients with high nasogastric drainage) or at high risk for regurgitation and aspiration (nursed in supine position). Finally, where obtaining small bowel access is not feasible (no access to fluroscopy or endoscopy and blind techniques not reliable), small bowel feedings should be considered for those select patients that repeatedly demonstrate high gastric residuals and are not tolerating adequate amounts of EN intragastrically.*

2013 Discussion: the committee noted that there were no changes in the treatment effect on mortality and infections with the inclusion of 4 new RCTs (Hsu 2009, White 2009, Acosta- Escribano 2010, Davies 2012). There was a similar direction of findings amongst trials as evidenced by the test for heterogeneity. The committee agreed that feasibility of placing small bowel feeding tubes has improved considerably over the years while the safety concerns about their placement still exists particularly if it involves transporting the patient to an endoscopy suite. The committee also noted the aggregated data on nutritional outcomes that showed small bowel feeding had a favourable effect on optimizing the delivery of calories and protein.

2009 Recommendation: *Based on 11 level 2 studies, small bowel feeding compared to gastric feeding may be associated with a reduction in pneumonia in critically ill patients. In units where small bowel access is feasible, we recommend the routine use of small bowel feedings. In units where obtaining access involves more logistical difficulties, small bowel feedings should be considered for patients at high risk for intolerance to EN (on inotropes, continuous infusion of sedatives, or paralytic agents, or patients with high nasogastric drainage) or at high risk for regurgitation and aspiration (nursed in supine position). Finally, where obtaining small bowel access is not feasible (no access to fluroscopy or endoscopy and blind techniques not reliable), small bowel feedings should be considered for those select patients that repeatedly demonstrate high gastric residuals and are not tolerating adequate amounts of EN intragastrically.*

2009 Discussion: The committee noted an overall modest effect size with respect to pneumonia with wide confidence intervals amongst studies that were heterogenous. There were also concerns expressed around implementation of small bowel feeding and the associated costs, which are institution dependent. In other words, the cost-benefit ratio would vary from institution to institution and the recommendation needed to reflect this fact. The committee also noted that the data on improved nutritional endpoints was favourable and it was decided that a recommendation be made that incorporated these improvements in nutritional intake.

Semi Quantitative Scoring

	Definition	2009 Score	2013 Score (0,1,2,3)
Effect size	Magnitude of the absolute risk reduction attributable to the intervention listed—a higher score indicates a larger effect size	2 (pneumonia)	2 (pneumonia)
Confidence interval	95% confidence interval around the point estimate of the absolute risk reduction, or the pooled estimate (if more than one trial)—a higher score indicates a smaller confidence interval	2 (with Taylor) 1 (without Taylor)	2 (with Taylor/Minard) 1 (without Taylor/Minard)
Validity	Refers to internal validity of the study (or studies) as measured by the presence of concealed randomization, blinded outcome adjudication, an intention to treat analysis, and an explicit definition of outcomes—a higher score indicates presence of more of these features in the trials appraised	2	2
Homogeneity or Reproducibility	Similar direction of findings among trials—a higher score indicates greater similarity of direction of findings among trials	1	2
Adequacy of control group	Extent to which the control group represented standard of care (large dissimilarities = 1, minor dissimilarities=2, usual care=3)	3	3
Biological plausibility	Consistent with understanding of mechanistic and previous clinical work (large inconsistencies =1, minimal inconsistencies =2, very consistent =3)	3	3
Generalizability	Likelihood of trial findings being replicated in other settings (low likelihood i.e. single centre =1, moderate likelihood i.e. multicentre with limited patient population or practice setting =2, high likelihood i.e. multicentre, heterogenous patients, diverse practice settings =3.	2	2
Low cost	Estimated cost of implementing the intervention listed—a higher score indicates a lower cost to implement the intervention in an average ICU	2	2
Feasible	Ease of implementing the intervention listed—a higher score indicates greater ease of implementing the intervention in an average ICU	1 (depending upon technique)	2
Safety	Estimated probability of avoiding any significant harm that may be associated with the intervention listed—a higher score indicates a lower probability of harm	2	3 (bedside placement) 2 (other methods)

5.3 Strategies to Optimize Delivery and Minimize Risks of EN: Small Bowel Feeding vs. Gastric February 2014

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 fifteen 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 13 studies that reported on mortality, no significant differences between the groups were found (RR 1.01, 95% CI 0.83, 1.24, p=0.92, 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 0.84, 1.27, p=0.78, heterogeneity I^2=0%; figure 2).

Infections (Pneumonia): Based on the 12 studies that reported on pneumonia, the meta-analysis showed that small bowel feeding was associated with a significant reduction in pneumonia when compared to gastric feeding (RR 0.75, 95% CI 0.60, 0.93, p=0.01, heterogeneity I^2=11%; figure 3). When the studies by Taylor et al and Minard et al were removed from the analysis, there was little change in the point estimate and the p-value is just at the conventional levels of significance (RR 0.75, 95% CI 0.56, 1.00, p=0.05, heterogeneity I^2=21%; figure 4).

LOS: When all the 9 studies that reported ICU LOS were aggregated, enteral feeding via the small bowel had no effect on ICU length of stay (WMD 0.49, 95% CI -1.36, 2.33, p=0.60, heterogeneity I^2=81%; figure 5). When the Minard study was excluded from the analysis, the signal did not change (WMD 0.04, 95% CI -1.85, 1.93, p=0.97, heterogeneity I^2=82%; 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 -0.36, 95% CI -2.02, 1.30, p=0.67, heterogeneity I^2=42%; figure 8).

Nutritional Outcomes: Many studies reported on nutritional complications, such as GI bleeds, vomiting, diarrhea and abdominal bloating. There was no difference between the 2 groups in some studies (Davies 2011, White, Eatock), 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 5 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 11.35, 95% CI 5.04, 17.65, $p<0.0004$, heterogeneity $I^2=90\%$; 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).

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) No difference in mortality or ventilator days in critically ill patients receiving small bowel vs. gastric feedings.
3) Small bowel feeding improves calorie and protein intake. and is associated 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)	Intervention	Mortality # (%)† Small bowel	Mortality # (%)† Gastric	Pneumonia # (%)‡ Small bowel	Pneumonia # (%)‡ Gastric
1. Montecalvo 1992	Med/Surg ICU Anticipated feed >3days N=38 from 2 ICUs	C.Random: not sure ITT: no Blinding: no (8)	Small bowel feeding vs gastric	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)	Small bowel feeding vs gastric	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)	Small bowel feeding vs gastric	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)	Small bowel feeding vs gastric	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)	Small bowel feeding vs gastric	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)	Small bowel feeding vs gastric	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)	Small bowel feeding vs gastric	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)	Small bowel feeding vs gastric	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)	Small bowel feeding vs gastric	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)	Small bowel feeding vs gastric	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)	Small bowel feeding vs gastric	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)	Small bowel feeding vs gastric	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)	Small bowel feeding vs gastric	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)	Small bowel feeding vs gastric	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)	Small bowel feeding vs gastric	13/91 (14)	12/89 (13)	18/91 (20)	19/89 (21)

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 % nitrogen needs met (mean) 68.7	36.8 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)

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)
NA: not available
Cost : 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	Year
Montecalvo	5	19	5	19	3.6%	1.00 [0.35, 2.90]	1992
Kortbeek	4	37	3	43	2.0%	1.55 [0.37, 6.48]	1999
Taylor	5	41	6	41	3.3%	0.83 [0.28, 2.52]	1999
Kearns	5	21	6	23	3.8%	0.91 [0.33, 2.55]	2000
Minard	1	12	4	15	1.0%	0.31 [0.04, 2.44]	2000
Boivin	18	39	18	39	17.7%	1.00 [0.62, 1.62]	2001
Esparaza	10	27	11	27	9.1%	0.91 [0.47, 1.78]	2001
Davies 2002	4	34	5	39	2.7%	0.92 [0.27, 3.14]	2002
Montejo	19	50	22	51	18.1%	0.88 [0.55, 1.42]	2002
Hsu	26	59	24	62	22.5%	1.14 [0.74, 1.74]	2009
Acosta-Escribano	6	50	9	54	4.4%	0.72 [0.28, 1.88]	2010
White	11	51	5	57	4.2%	2.46 [0.92, 6.60]	2010
Davies 2011	13	91	12	89	7.7%	1.06 [0.51, 2.19]	2011
Total (95% CI)		**531**		**559**	**100.0%**	**1.01 [0.83, 1.24]**	
Total events	127		130				

Heterogeneity: Tau² = 0.00; Chi² = 6.11, df = 12 (P = 0.91); I² = 0%
Test for overall effect: Z = 0.10 (P = 0.92)

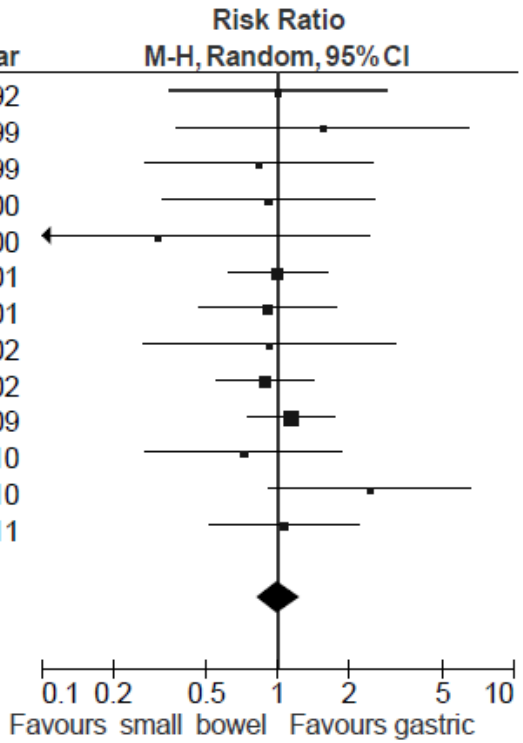

Figure 2. Mortality (excluding Taylor and Minard)

Study or Subgroup	Small Bowel Events	Small Bowel Total	Gastric Events	Gastric Total	Weight	Risk Ratio M-H, Random, 95% CI	Year
Montecalvo	5	19	5	19	3.8%	1.00 [0.35, 2.90]	1992
Kortbeek	4	37	3	43	2.1%	1.55 [0.37, 6.48]	1999
Kearns	5	21	6	23	4.0%	0.91 [0.33, 2.55]	2000
Boivin	18	39	18	39	18.5%	1.00 [0.62, 1.62]	2001
Esparaza	10	27	11	27	9.5%	0.91 [0.47, 1.78]	2001
Davies 2002	4	34	5	39	2.8%	0.92 [0.27, 3.14]	2002
Montejo	19	50	22	51	18.9%	0.88 [0.55, 1.42]	2002
Hsu	26	59	24	62	23.5%	1.14 [0.74, 1.74]	2009
Acosta-Escribano	6	50	9	54	4.6%	0.72 [0.28, 1.88]	2010
White	11	51	5	57	4.4%	2.46 [0.92, 6.60]	2010
Davies 2011	13	91	12	89	8.0%	1.06 [0.51, 2.19]	2011
Total (95% CI)		**478**		**503**	**100.0%**	**1.03 [0.84, 1.27]**	
Total events	121		120				

Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 4.73$, df = 10 (P = 0.91); $I^2 = 0\%$

Test for overall effect: Z = 0.28 (P = 0.78)

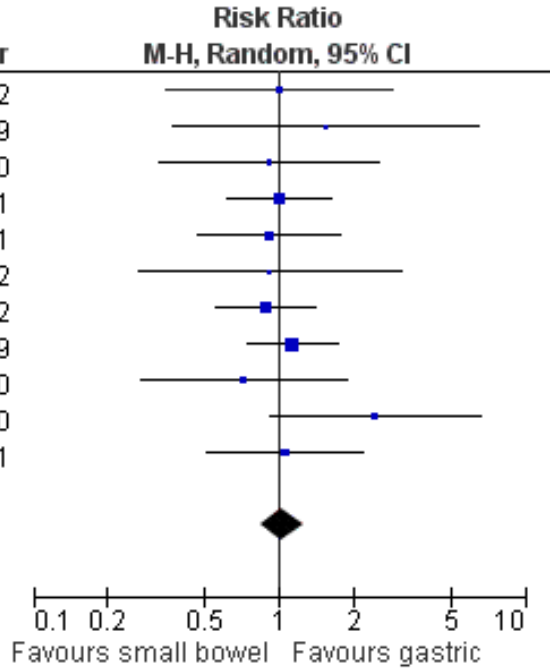

Figure 3. Pneumonia

Study or Subgroup	Small Bowel Events	Small Bowel Total	Gastric Events	Gastric Total	Weight	Risk Ratio M-H, Random, 95% CI	Year
Montecalvo	4	19	6	19	3.9%	0.67 [0.22, 1.99]	1992
Kortbeek	10	37	18	43	10.4%	0.65 [0.34, 1.22]	1999
Taylor	18	41	26	41	20.6%	0.69 [0.46, 1.05]	1999
Minard	6	12	7	15	7.2%	1.07 [0.49, 2.34]	2000
Kearns	4	21	3	23	2.5%	1.46 [0.37, 5.78]	2000
Day	0	14	2	11	0.6%	0.16 [0.01, 3.03]	2001
Montejo	16	50	20	51	14.2%	0.82 [0.48, 1.39]	2002
Davies 2002	2	31	1	35	0.9%	2.26 [0.22, 23.71]	2002
Hsu	5	59	15	62	5.1%	0.35 [0.14, 0.90]	2009
White	11	57	5	51	4.7%	1.97 [0.73, 5.28]	2010
Acosta-Escribano	16	50	31	54	17.5%	0.56 [0.35, 0.89]	2010
Davies 2011	18	91	19	89	12.4%	0.93 [0.52, 1.65]	2011
Total (95% CI)		**482**		**494**	**100.0%**	**0.75 [0.60, 0.93]**	
Total events	110		153				

Heterogeneity: Tau² = 0.02; Chi² = 12.33, df = 11 (P = 0.34); I² = 11%
Test for overall effect: Z = 2.56 (P = 0.01)

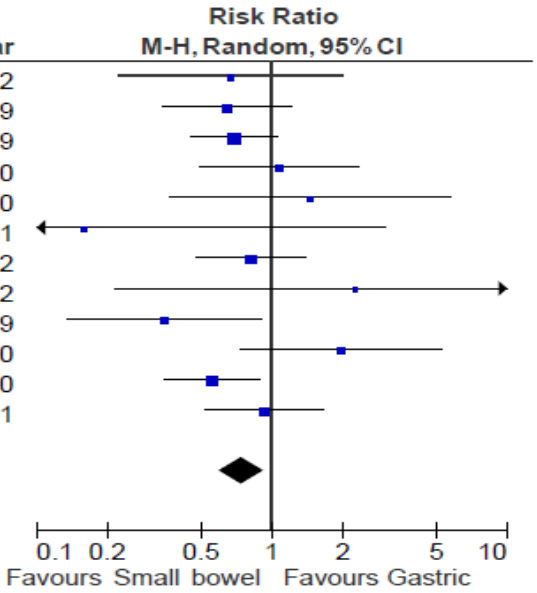

Figure 4. Pneumonia (excluding Taylor and Minard)

Study or Subgroup	Small Bowel Events	Small Bowel Total	Gastric Events	Gastric Total	Weight	Risk Ratio M-H, Random, 95% CI	Year
Montecalvo	4	19	6	19	6.1%	0.67 [0.22, 1.99]	1992
Kortbeek	10	37	18	43	14.7%	0.65 [0.34, 1.22]	1999
Kearns	4	21	3	23	4.1%	1.46 [0.37, 5.78]	2000
Day	0	14	2	11	0.9%	0.16 [0.01, 3.03]	2001
Davies 2002	2	31	1	35	1.5%	2.26 [0.22, 23.71]	2002
Montejo	16	50	20	51	18.8%	0.82 [0.48, 1.39]	2002
Hsu	5	59	15	62	7.9%	0.35 [0.14, 0.90]	2009
Acosta-Escribano	16	50	31	54	21.9%	0.56 [0.35, 0.89]	2010
White	11	57	5	51	7.3%	1.97 [0.73, 5.28]	2010
Davies 2011	18	91	19	89	16.9%	0.93 [0.52, 1.65]	2011
Total (95% CI)		**429**		**438**	**100.0%**	**0.75 [0.56, 1.00]**	
Total events	86		120				

Heterogeneity: Tau² = 0.04; Chi² = 11.38, df = 9 (P = 0.25); I² = 21%

Test for overall effect: Z = 1.98 (P = 0.05)

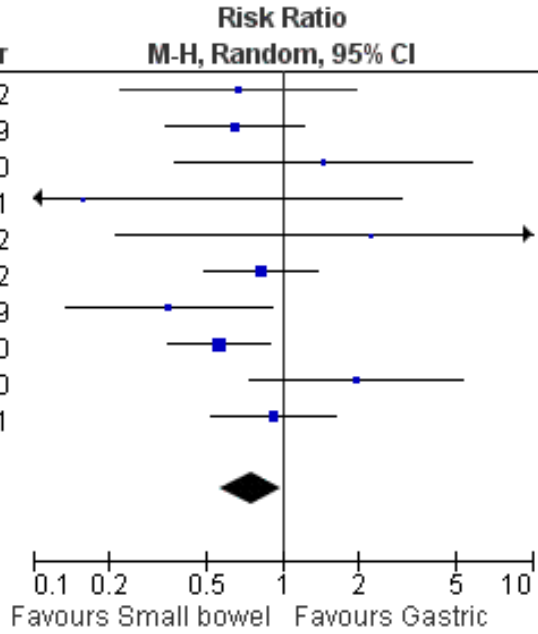

Figure 5. ICU LOS

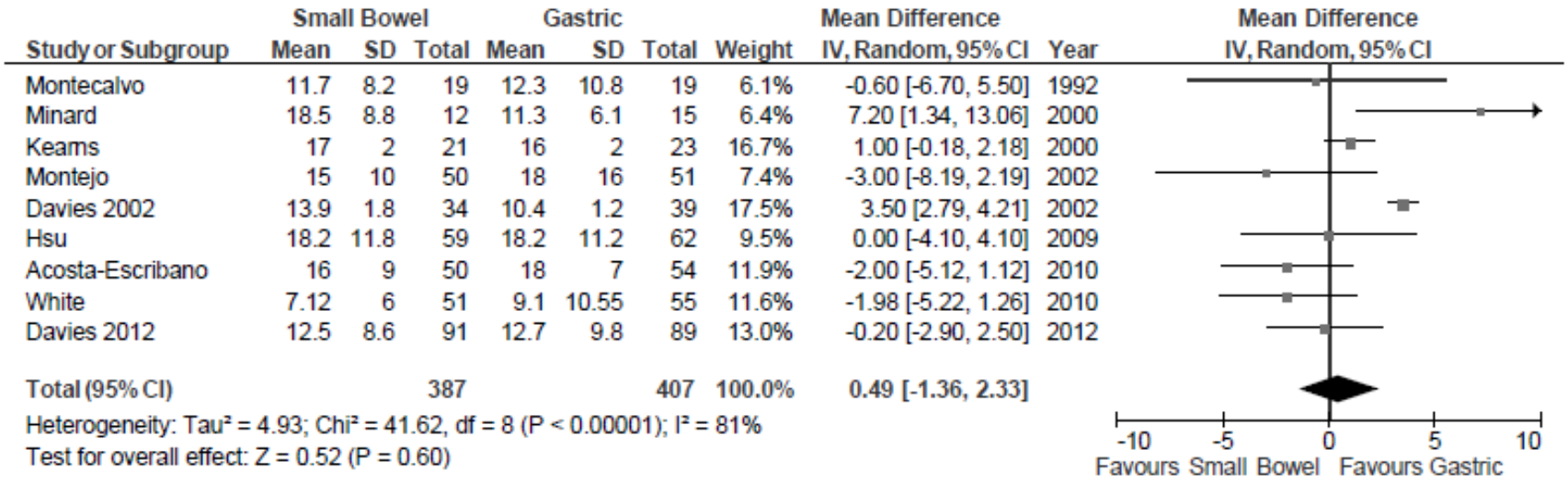

Figure 6. ICU LOS (excluding Minard)

Study or Subgroup	Small Bowel Mean	SD	Total	Gastric Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI	Year
Montecalvo	11.7	8.2	19	12.3	10.8	19	6.4%	-0.60 [-6.70, 5.50]	1992
Kearns	17	2	21	16	2	23	18.0%	1.00 [-0.18, 2.18]	2000
Montejo	15	10	50	18	16	51	7.8%	-3.00 [-8.19, 2.19]	2002
Davies 2002	13.9	1.8	34	10.4	1.2	39	18.8%	3.50 [2.79, 4.21]	2002
Hsu	18.2	11.8	59	18.2	11.2	62	10.1%	0.00 [-4.10, 4.10]	2009
Acosta-Escribano	16	9	50	18	7	54	12.7%	-2.00 [-5.12, 1.12]	2010
White	7.12	6	51	9.1	10.55	55	12.3%	-1.98 [-5.22, 1.26]	2010
Davies 2012	12.5	8.6	91	12.7	9.8	89	13.9%	-0.20 [-2.90, 2.50]	2012
Total (95% CI)			375			392	100.0%	0.04 [-1.85, 1.93]	

Heterogeneity: Tau² = 4.79; Chi² = 38.90, df = 7 (P < 0.00001); I² = 82%
Test for overall effect: Z = 0.04 (P = 0.97)

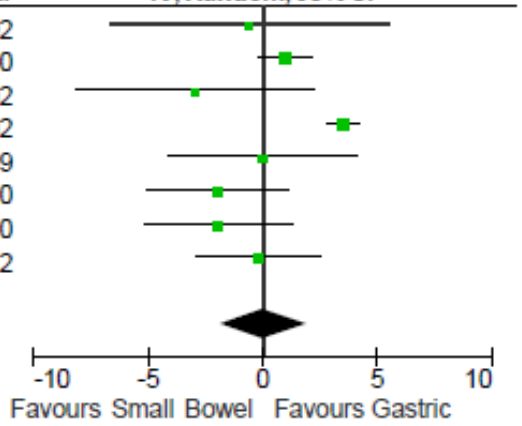

Figure 7. Hospital LOS

Study or Subgroup	Small Bowel Mean	SD	Total	Gastric Mean	SD	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)

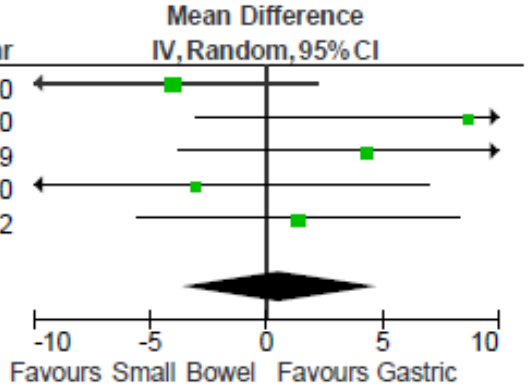

Figure 8. Duration of ventilation

Study or Subgroup	Small Bowel Mean	SD	Total	Gastric Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI	Year
Montecalvo	10.2	7.1	19	11.4	10.8	19	6.9%	-1.20 [-7.01, 4.61]	1992
Minard	15.1	7.5	12	10.4	6.1	15	8.2%	4.70 [-0.55, 9.95]	2000
Hsu	28.5	24.9	59	23.8	18.2	62	4.1%	4.70 [-3.10, 12.50]	2009
White	5.73	5.29	51	7.68	9.81	55	18.5%	-1.95 [-4.92, 1.02]	2010
Acosta-Escribano	7.3	4	50	8.9	4	54	32.8%	-1.60 [-3.14, -0.06]	2010
Davies 2012	9.8	6.2	91	9.7	6.3	89	29.4%	0.10 [-1.73, 1.93]	2012
Total (95% CI)			282			294	100.0%	-0.36 [-2.02, 1.30]	

Heterogeneity: Tau² = 1.57; Chi² = 8.67, df = 5 (P = 0.12); I² = 42%
Test for overall effect: Z = 0.43 (P = 0.67)

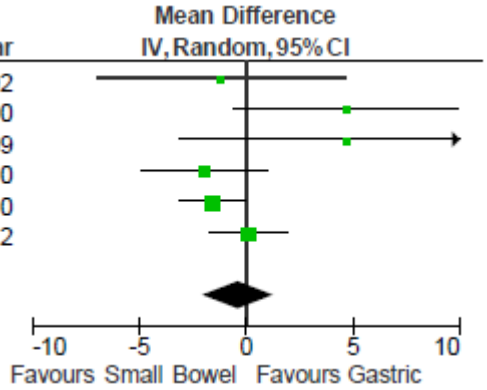

Figure 9. Nutritional efficiency (%)

Study or Subgroup	Small Bowel Mean	SD	Total	Gastric Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI	Year
Montecalvo	61	17	19	46.9	25.9	19	11.2%	14.10 [0.17, 28.03]	1992
Kearns	69	7	21	47	7	23	22.3%	22.00 [17.86, 26.14]	2000
Hsu	95	5	59	83	6	62	24.1%	12.00 [10.04, 13.96]	2009
Acosta-Escribano	92	7	50	84	15	54	22.0%	8.00 [3.55, 12.45]	2010
Davies 2012	72	21	91	71	19	89	20.4%	1.00 [-4.85, 6.85]	2012
Total (95% CI)			**240**			**247**	**100.0%**	**11.35 [5.04, 17.65]**	

Heterogeneity: Tau² = 41.86; Chi² = 39.14, df = 4 (P < 0.00001); I² = 90%
Test for overall effect: Z = 3.53 (P = 0.0004)

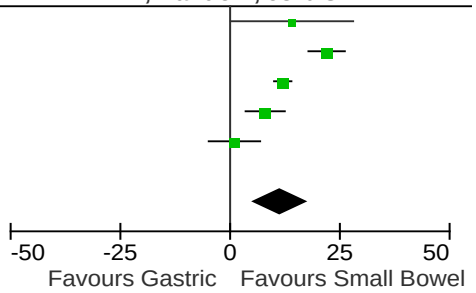

Figure 10. Time to reach EN target

Study or Subgroup	Small Bowel Mean	SD	Total	Gastric Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI	Year
Kortbeek	34	7.1	37	43.8	22.6	43	26.9%	-9.80 [-16.93, -2.67]	1999
Neumann	43	24.1	30	28.8	15.9	30	23.4%	14.20 [3.87, 24.53]	2002
Davies 2002	23.2	3.9	31	23	3.4	35	30.8%	0.20 [-1.58, 1.98]	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)