Supplements to "European Stroke Organization and European Society for Swallowing Disorders guideline for the diagnosis and treatment of post-stroke dysphagia"

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# **Supplement 1: Summarizing tables with key results**

**Table 1**. Grading of outcomes

Scale	OUTCOME	Same level	DEFINITIONS
		Outcomes	
9	Mortality	MRS	Critical for making a
8	Complications	Respiratory tract	decision
	(Malnutrition)	infection	(included in evidence
7	Aspiration risk	Feeding strategy	profile)
6	Swallowing function		
5	Length of stay in hospital	Nutritional	important, but not
		measures,	critical for
		Weight	making a decision
		loss/muscle loss	(included in
4	Quality of life		evidence profile)
3	Laboratory parameters		
	linked to malnutrition		
2	Feeding tube failures and	Withdrawal of	of limited importance for
	adverse events	tube feeding,	making a
		Costs	decision (not included in
			evidence
			profile)

 Table 2. Effect of dysphagia compared to no dysphagia on key outcomes

Outcome	Incidence (%	6)/ Mean±SD	Studies	n (N)	OR [95% CI]/	l <sup>2</sup>	p value
	Dysphagia	No			MD [95% CI]		·
	,	dysphagia					
Mortality							
In-hospital			17, 30, 37, 41, 48,				
			49, 52, 55, 56 40,		9.77 [5.45,		
	19%	1%	55, 56	10(682884)	17.50]	96%	< 0.00001
• 3-months			15, 17, 19, 32, 49,		9.02 [4.50,		
	16%	1%	51	5(13546)	18.09]	73%	< 0.00001
• 1-year			20, 37, 46, 49-51,		8.82 [3.56,		
	42%	32%	54	7(10737)	21.85]	98%	< 0.00001
Pneumonia			7, 15-18, 21, 22,				
			24-29, 34, 35, 37-		7.45 [6.01,		
	22%	3%	43, 45-50, 52, 56	31(767179)	9.24]	94%	< 0.00001
Tube feeding							
<ul> <li>Nasogastric</li> </ul>			17, 37		93.74 [24.33,		
tube	41%	1%		2(8171)	361.14]	35%	< 0.00001
<ul> <li>Percutaneous</li> </ul>			17, 26, 37, 47		71.60 [34.38,		
feeding tube	9%	0.1%		4(8446)	149.11]	0%	< 0.00001
mRS							
• mRS 0, 1			17, 37		0.20 [0.11,		
	6%	30%		2(5582)	0.35]	83%	< 0.00001
• mRS ≥2			15, 17, 37, 48		2.34 [1.24,		
	76%	55%		3(17858)	4.40]	98%	0.08
• mRS 4,5			37		5.03 [4.43,		
	52%	18%		1(5012)	5.72]	NA	< 0.00001
LOS							
<ul><li>overall [days]</li></ul>			7, 15, 17, 20, 23,				
			26, 30, 37, 40, 46-		4.72 [3.53,		
	12.1±9.7	8.4±6.2	49, 56, 57, 126	14(697614)	5.91]	99%	< 0.00001
<ul> <li>Stroke-unit</li> </ul>			17		1.70 [1.12,		
[days]	4.4±3.0	2.7±2.4		1(570)	2.28]	NAs	< 0.00001
Discharge status			47.20.07.40.47				
<ul> <li>Discharged</li> </ul>			17, 28, 37, 40, 47,		0.17 [0.09,		
home	17%	67%	49, 56, 126	8(678519)	0.35]	100%	< 0.00001
<ul> <li>Discharged to</li> </ul>			7, 17, 37, 46-48,				
Institution/Pal			51, 56		3.90 [2.93,		
liative	49%	26%	07.50	7(665094)	5.21]	81%	< 0.00001
<ul> <li>Discharged to</li> </ul>			37, 56		1.95 [0.71,		
long term care	15%	5%		2(663721)	5.32]	100%	0.19
• Readmission,	42%	54%	49	1(395)	0.62 [0.42,	NA	0.02

1 year			0.93]	

CI: Confidence intervals; FOIS: Functional oral intake scale; I<sup>2</sup>: Heterogeneity; LOS, Length of stay in hospital; MD: Mean difference; n: Number of studies; N: Number of patients; NIHSS: National Institute of Health Stroke Scale; p: Statistical significance value; OR: Odds Ratio; SD: Standard deviation

**Table 3**. Effect of screening compared to no screening on key outcomes

Οι	itcome	Incidence (	%)/	Studies	n (N)	OR [95% CI]/	l <sup>2</sup>	P value
		Mean±SD				MD [95% CI]		
		Screening	No					
			Screening					
M	ortality							
•	In-hospital	2%	4%	40, 71-73	4(20806)	0.67 [0.45, 1.02]	57%	0.06
•	1 month	10%	31%	74, 76, 77	3(66162)	0.57 [0.12, 2.80]	99%	0.49
Pn	eumonia			15, 40, 47, 71-				
		7%	10%	74, 76-80	11(536650)	0.55 [0.36, 0.83]	99%	0.004
Na	sogastric tube,			47, 71, 73				
ins	ertion	44%	53%		3(459)	0.86 [0.51, 1.45]	0%	0.58
En	dotracheal tube			71, 73				
ins	sertion	7%	9%		2(260)	0.66 [0.27, 1.63]	0%	0.37
LO	S [days]	7.2±6.4	6.2±5.3	40, 47, 71-73	5(21005)	0.02 [-2.22, 2.26]	99%	0.99
Di	scharge							
•	Discharged			40, 77				<
	home	29%	33%		2(20348)	0.84 [0.79, 0.90]	0%	0.00001
•	Discharged to			77				
	Institution	20%	19%		1(2334)	1.08 [0.86, 1.35]	NA	0.53
•	Skilled nursing			77				
	facility	14%	11%		1(2334)	1.27 [0.97, 1.66]	NA	0.09
•	Hospice	2%	3%	77	1(2334)	0.78 [0.43, 1.39]	NA	0.39
•	Other hospitals	6%	5%	77	1(2334)	1.28 [0.86, 1.92]	NA	0.23

CI: Confidence intervals; I<sup>2</sup>: Heterogeneity; LOS, Length of stay in hospital; MD: Mean difference; n: Number of studies; N: Number of patients; p: Statistical significance value; OR: Odds Ratio; SD: Standard deviation; UTI: Urinary tract infection

**Table 4.** Effect of early screening compared to late screening on key outcomes

Outcome	Incidence (	%)/	Studies	n (N)	OR [95% CI]/	l <sup>2</sup>	p value
	Mean±SD				MD [95% CI]		
	Early	Late					
	Screening	Screening					
Mortality							
<ul> <li>Overall</li> </ul>	15%	23%	74, 81-84	7(144307)	0.62 [0.43, 0.91]	99%	0.01
<ul><li>Hospital/7</li></ul>			81-83				
days	5%	6%		4(55969)	0.74 [0.61, 0.89]	75%	0.002
• 1 month	11%	16%	74, 83, 84	5(140614)	0.66 [0.42, 1.02]	99%	0.06
• 1 year	26%	27%	83	2(52276)	0.94 [0.90, 0.97]	0%	0.0009
Pneumonia			15, 74, 80-82,				
	9%	15%	84-89	10(96367)	0.45 [0.35, 0.58]	83%	< 0.00001
LOS, days	23.8±9.5	27.6±9.2	81-84, 90	6(56085)	-2.27 [-3.12, -1.43]	92%	< 0.00001
Barthel Index			84				
Score, discharge	17±43	12±28		1(116)	5.00 [-8.21, 18.21]	NA	0.46
Discharge							
<ul> <li>Discharged</li> </ul>			83				
home	57%	53%		2(52276)	1.16 [1.08, 1.26]	79%	< 0.0001
• Readmission	2%	6%	85	1(138)	0.35 [0.06, 2.19]	NA	0.69
mRS							
• mRS, 4-5	28%	39%	81	1(3309)	0.59 [0.50, 0.71]	NA	0.00001

CI: Confidence intervals; I<sup>2</sup>: Heterogeneity; LOS, Length of stay in hospital; MD: Mean difference; n: Number of studies; N: Number of patients; p: Statistical significance value; PEG: Percutaneous endoscopic gastrostomy; OR: Odds Ratio; SD: Standard deviation; LOS: Length of stay

**Table 5.** Effect of clinical bedside assessment compared to instrumental assessment on key outcomes

Outcome	Incide	nce (%)	Studies	n (N)	OR [95% CI] /	l <sup>2</sup>	p value
	Clinical	Instrumental			MD [95% CI]		
	bedside	assessment					
	assessment						
Mortality	10.5%	7.3%	135	1(440)	1.49 [0.76, 2.90]	NA	0.24
Pneumonia	12.3%	6.4%	135	1(440)	2.06 [1.05, 4.04]	NA	0.04
Discharge,			135				
home	43.6%	46.4%		1(440)	0.90 [0.62, 1.30]	NA	0.57
Discharge, on			135				
standard diet	51.1%	65.6%		1(378)	0.47 [0.31, 0.71]	NA	0.004
LOS [days]	17.3±15.2	23.7±20.2	135	1(440)	-6.33 [-9.67, -2.99]	NA	0.0002

CI: Confidence intervals; I<sup>2</sup>: Heterogeneity; LOS: Length of stay in hospital; n: Number of studies; N: Number of patients; NA: Not applicable; p: Statistical significance value; OR: Odds Ratio

**Table 6.** Effect of instrumental assessment with FEES compared to instrumental assessment with VFSS on key outcomes.

Outcome	Incidend	ce (%)	Studies	n (N)	OR [95% CI]/	l <sup>2</sup>	P value
	VFSS	FEES			MD [95% CI]		
Pneumonia	29.2%	4.8%	140	1(45)	8.24 [0.92, 73.79]	NA	0.06
PEG	2.6%	23.8%	140	1(99)	0.08 [0.01, 0.47]	NA	0.005

CI: Confidence intervals; FEES: fiberoptic endoscopic evaluation of swallowing; I<sup>2</sup>: Heterogeneity; n: Number of studies; N: Number of patients; NA: Not applicable; p: Statistical significance value; PEG: Percutaneous endoscopic gastrostomy; OR: Odds Ratio

**Table 7.** Effect of complementary and standard assessment in patients with acute or subacute stroke

Outcome	Incidence (%)/	Mean±SD	Studies	n (N)	OR [95% CI]/	l <sup>2</sup>	p value
	Complementary	Standard			MD [95% CI]		
	and standard	assessment					
	assessment						
Mortality	13.5%	19.6%	141	1(311)	0.64 [0.35, 1.18]	NA	0.15
Pneumonia	25.7%	21.5%	141	1(311)	1.26 [0.75, 2.14]	NA	0.38
Independence							
At home	48.6%	44.8%	141	1(311)	1.17 [0.75, 1.83]	NA	0.50
At residential care	43.2%	45.4%	141	1(311)	0.92 [0.59, 1.43]	NA	0.70
At public hospital	8.1%	9.8%	141	1(311)	0.81 [0.37, 1.78]	NA	0.60
Length of stay	7±5.2	6±5.2	141	1(311)	1.00 [-0.16, 2.16]	NA	0.09
FOIS	6.2±1.2	6±1.3	141	1(311)	0.20 [-0.08, 0.48]	NA	0.16

CI: Confidence intervals; I<sup>2</sup>: Heterogeneity; MD: Mean difference; n: Number of studies; N: Number of patients; NA: Not applicable; p: Statistical significance value; OR: Odds Ratio; SD: Standard deviation; FOIS: Functional oral intake scale

Table 8. Effect of consistency modification on key outcomes

Outcome	Inciden	ce %	Studies	n (N)	RR [95% CI]/	l <sup>2,</sup>	p value
	Consistency modification	Control			MD [95% CI]		
Pneumonia							
• RCT	0.0%	20.0%	154, 156, 158	4(100)	0.19 [0.03, 1.40]	0%	0.1
Penetration							
• RCT	0.0%	13.1%	153	1(122)	0.06 [0.00, 1.00]	NA	0.05
Aspiration							
• RCT	21.3%	45.7%	153-155	3(188)	0.51 [0.14, 1.77]	90%	0.29
LOS in hospital (days)							
• RCT	24±9	34±12	158	1(64)	-9.58 [-15.41, - 3.76]	19%	0.001
Fluid intake (ml)							
Overall	1179±235	1612±455	156, 157, 160	3(77)	-133.22 [-541.90, 275.46]	94%	0.52
• RCT	745±164	649±172	156, 157	2(38)	140.48 [-41.56, 322.51]	68%	0.13
• NRCT	1589±302	2575±737	160	1(39)	-986.00 [-1330.71, -641.29]	NA	<0.0001
• Energy intake, Kcal/kg/day							
• NRCT	19.4±6.2	22.3±9.0	161	1(52)	-2.90 [-7.09, 1.29]	NA	0.18
Protein     intake,     g/kg/day							
• NRCT	0.71±0.29	0.90±0.31	161	1(68)	-0.19 [-0.34, - 0.04]	NA	0.02

CI: Confidence intervals; I<sup>2</sup>: Heterogeneity; MD: Mean difference; n: Number of studies; N: Number of patients; p: Statistical significance value; RR: Risk Ratio; SD: Standard deviation; RCT: Randomized controlled trial; NRCT: Non-Randomized Controlled Trial

**Table 9.** Effect of behavioural therapy on key outcomes and dysphagia scores

Outcome	Mean±SD/	Incidence (%)	Studies	n (N)	RR [95% CI]/	l <sup>2</sup>	P value
	Behaviour	Control	]		MD [95% CI]		
Mortality							
• RCT	15.1%	10.7%	25, 170, 171	3(505)	1.47 [0.32 <i>,</i> 6.78]	71%	0.62
mRS, RCT							
• mRS ≥3	50.5%	48.0%	171	1(306)	1.05 [0.82, 1.34]	NA	0.69
Pneumonia							
Overall	18.4%	24.5%	25, 170, 171, 173, 183, 184	6(677)	0.57 [0.43 <i>,</i> 0.75]	0%	< 0.0001
EMST, RCT	11.6%	19.0%	173, 183, 184	3(196)	0.58 [0.24, 1.41]	22%	0.23
Swallowing exercises, RCT	21.3%	26.6%	25, 170, 171	3(481)	0.56 [0.41, 0.76]	0%	0.0002
LOS							
Swallowing exercise, RCT	19.2±1.2	21.4±12.4	171	1(306)	-2.20 [-4.61, 0.21]	NA	0.07
Tube feeding							
Tube removal	63.6%	28.6%	193, 194	2(43)	2.16 [0.75, 6.17]	43%	0.15
Improvement in							
dysphagia scores							
Overall	6.4±3.6	4.1±3.5	101, 165, 172, 173, 175-177, 181, 185-190, 192-194	18(510)	1.18 [0.78, 1.57]	70%	<0.00001
• RCT	5.0±2.9	3.0±2.8	101, 165, 172, 173, 175-177, 181, 185-190, 192	16(440)	0.97 [0.64, 1.30]	68%	<0.00001
EMST, RCT	1.4±1.3	0.7±1.4	165, 172, 173, 185	4(108)	0.99 [0.51, 1.47]	16%	< 0.0001
Swallowing exercises, overall	7.6±4.2	5.1±4.1	101, 175-177, 181, 186-190, 192-194	14(402)	1.01 [0.67, 1.34]	73%	<0.00001
Swallowing exercises, RCT	6.1±3.4	3.9±3.3	101, 175-177, 181, 186-190, 192	12(332)	1.19 [0.68, 1.69]	73%	<0.00001
Swallowing exercises, NRCT	15.5±8.4	10.5±7.3	193, 194	2(70)	3.11 [-0.12, 6.34]	40%	0.06

CI: Confidence intervals; I<sup>2</sup>, p: Heterogeneity; n: Number of studies; N: Number of patients; NA: Not applicable; NRCT: Non-randomized controlled trial; p: Statistical significance value; SD: Standard Deviation; MD: Mean Difference; RR: Risk Ratio; EMST: Expiratory muscle strength training; RCT: Randomized controlled trial; NRCT: Non-Randomized Controlled Trial

Table 10. Effect of acupuncture on key outcomes

Outcome	Mean±SD/ Inci	dence (%)	Studies	n (N)	RR [95% CI]/	l <sup>2</sup>	p value
	Acupuncture	Control			(S)MD [95% CI]		
Dysphagia	20.0%	39.6%	196 198-208,	23(2177)	0.51 [0.41, 0.63]	58%	< 0.00001
at end of			210-214, 216,				
trial			218-222				
Dysphagia							
score, overall*							
• Improve- ment	4.0±0.8	2.8±0.9	197, 199, 217	3(292)	1.05 [0.45, 1.65]	81%	0.0006
• Post	1.5±0.7	2.1±0.9	197, 199, 208,	5(443)	-0.63 [-1.12, -0.14]	84%	0.01
inter-			212, 217				
vention							
Pneumonia	3.3%	8.3%	200	1(120)	0.40 [0.08, 1.98]	NA	0.26
SQoL	197±19	165±20	200	1(120)	32.0 [24.99, 39.01]	NA	<0.00001
Nasal	89.5%	50.0%	198	1(74)	1.79 [1.27, 2.53]	NA	0.0009
feeding							
tube							
removal							
ВІ	78±11	63±12	209, 217	2(140)	7.40 [-12.39, 27.19]	95%	0.46
Adverse effects							
• Pain	1.7%	0.0%	217	1(120)	3.00 [0.12, 72.20]	NA	0.5
• Hema- toma	3.3%	0.0%	217	1(120)	5.00 [0.25, 102.00]	NA	0.3
• Discom- fort	11.7%	8.3%	217	1(120)	1.40 [0.47, 4.17]	NA	0.55

<sup>\*:</sup> Standard Mean Difference; CI: Confidence intervals; I<sup>2</sup>: Heterogeneity; n: Number of studies; N: Number of patients; NA: Not applicable; p: Statistical significance value; SD: Standard Deviation; MD: Mean Difference; SQoL: Swallowing quality of life; RR: Risk ratio; BI: Barthel Index; RCT: Randomized controlled trial; NRCT: Non-Randomized Controlled Trial

**Table 11.** Effect of early compared to late initiation of oral nutritional therapy on key outcomes

Outcome	Incidence (%)	Studies	n (N)	RR [95% CI]/	l <sup>2</sup>	p value			

	Early	Late			MD [95% CI]		
	nutrition	nutrition			1010 [3370 61]		
Mortality	Hatrition	Hacifelon					
• RCT	11.7%	12.6%	223-226	4(4337)	0.88 [0.57, 1.37]	26%	0.57
Pneumonia							
• RCT	6.4%	5.8%	223	1(4023)	1.12 [0.88, 1.42]	NA	0.38
mRS, RCT							
mRS, 0, 1	23.4%	23.5%	223	1(4023)	1.00 [0.89, 1.11]	NA	0.94
mRS, 0-2	40.4%	41.1%	223	1(4023)	0.98 [0.91, 1.06]	NA	0.68
Recurrent stroke							
• RCT	2.5%	2.1%	223	1(4023)	1.16 [0.77, 1.73]	NA	0.48
Infections							
• RCT	8.5%	10.0%	223	1(4023)	0.86 [0.71, 1.04]	NA	0.12
Pressure sores							
• RCT	0.7%	1.3%	223	1(4023)	0.57 [0.31, 1.08]	NA	0.09
GIT haemorrhage							
• RCT	1.4%	0.9%	223	1(4023)	1.55 [0.86, 2.79]	NA	0.15
Length of stay, days							
• RCT	31.1±46.5	31.4±43.2	223-226	4(4289)	0.93 [-1.05, 2.91]	0%	0.36
Weight, change, kg							
• RCT	0.0±1.7	-1.1±2.1	225-227	4(315)	1.03 [0.17, 1.89]	91%	0.02
Energy, kJ/kg							
• RCT	61.6±20.8	49.7±15.0	225, 227	5(264)	8.25 [1.97, 14.53]	81%	0.01
Protein intake, g/kg							_
• RCT	0.9±0.3	0.7±0.3	225, 227	5(264)	0.21 [0.01, 0.41]	88%	0.04

CI: Confidence intervals; I<sup>2</sup>, p: Heterogeneity; n: Number of studies; N: Number of patients; MD: Mean differecne; NA: Not applicable; p: Statistical significance value; RR: Risk Ratio; GIT: Gastrointestinal tract; RR: Risk ratio; RCT: Randomized controlled trial; NRCT: Non-Randomized Controlled Trial

**Table 12.** Effect of early compared to late or restrictive enteral or parenteral nutrition therapy on key outcomes

on key outcome			ı	ı		2	Γ
Outcome		nce (%)	Studies	n (N)	RR [95% CI]/	l <sup>2</sup>	p value
	Early	Late/			MD [95% CI]		
	Enteral or	Restrictive					
	Parenteral	Enteral or					
		Parenteral					
Mortality			220				
• RCT	42.4%	48.1%	229	1(859)	0.88 [0.76, 1.02]	NA	0.09
Pneumonia							
RCT	28.4%	29.5%	229, 230	2(1005)	0.97 [0.80, 1.17]	0%	0.75
MRS (RCT)							
• mRS, 0, 1	5.7%	7.0%	229, 230	2(981)	0.84 [0.36, 1.94]	65%	0.68
• mRS, 0-2	9.3%	10.2%	229	1(859)	0.91 [0.61, 1.37]	NA	0.65
Recurrent stroke							
• RCT	3.5%	5.3%	229	1(859)	0.65 [0.35, 1.24]	NA	0.19
Infections							
• RCT	23.8%	27.3%	229, 230	2(1005)	0.80 [0.55, 1.18]	65%	0.27
Pressure sores							
• RCT	2.8%	2.3%	229	1(859)	1.20 [0.53, 2.75]	NA	0.66
Malnutrition							
• RCT	27.1%	48.3%	230	1(128)	0.56 [0.35, 0.90]	NA	0.02
GIT haemorrhage							
• RCT	5.1%	2.6%	229	1(859)	2.00 [0.98, 4.08]	NA	0.06
Length of stay, days							
• RCT	45±58	44±50	229	1(859)	1.00 [-6.24, 8.24]	NA	0.79
BI							
• RCT	46.7±8.8	44.4±9.3	230	1(146)	2.30 [-0.64, 5.24]	NA	0.13
Living at home							
• RCT	35.7%	31.6%	229	1(859)	1.13 [0.93, 1.36]	NA	0.21
Living in Rehabilitation/							
institution							
• RCT	21.9%	20.0%	229	1(859)	1.10 [0.84, 1.42]	NA	0.49
Nasogastric tube							
• RCT	7.0%	5.3%	229	1(859)	1.31 [0.77, 2.21]	NA	0.32
PEG							
• RCT	3.3%	2.3%	229	1(859)	1.40 [0.63, 3.12]	NA	0.41

CI: Confidence intervals; I<sup>2</sup>, p: Heterogeneity; n: Number of studies; N: Number of patients; MD: Mean difference; NA: Not applicable; p: Statistical significance value; RR: Risk Ratio; BI: Barthel Index; RCT: Randomized controlled trial; NRCT: Non-Randomized Controlled Trial

**Table 13.** Effects of oral health interventions on key outcomes

Outcome		dence %	Studies	n (N)	RR [95% CI]/	l <sup>2</sup>	p value
	Oral	Control			(S)MD [95% CI]		
	health						
Mortality							
<ul> <li>Overall</li> </ul>	17.4%	29.8%	84, 238	3(349)	0.66 [0.45, 0.96]	0%	0.03
• RCT	8.7%	14.0%	238	1(203)	0.62 [0.28, 1.38]	NA	0.24
• NRCT	32.8%	47.7%	84	2(146)	0.67 [0.44, 1.03]	0%	0.07
In-patients							
• RCT	8.7%	11.0%	238	1(203)	0.79 [0.34, 1.83]	NA	0.59
1 month							
• RCT	NR	NR		NR	NR	NR	NR
• NRCT	12.1%	25.0%	84	2(146)	0.48 [0.22, 1.05]	0%	0.07
3 months							
• RCT	8.7%	14.0%	238	1(203)	0.62 [0.28, 1.38]	NA	0.24
6 months							
• RCT	NR	NR		NR	NR	NR	NR
• NRCT	32.8%	47.7%	84	2(146)	0.67 [0.44, 1.03]	0%	0.07
Pneumonia							
• Overall	8.7%	13.9%	84, 238-242	7(2110)	0.39 [0.17, 0.91]	53%	0.03
• RCT	0.6%	5.6%	238-240	3(284)	0.14 [0.02, 1.11]	NA	0.06
• NRCT	10.0%	15.2%	84, 241, 242	4(1826)	0.47 [0.21, 1.06]	51%	0.07
Tube feeding							
<ul> <li>Overall</li> </ul>	18.1%	29.1%	84, 237, 242	4(1853)	0.62 [0.48, 0.79]	36%	0.0001
• RCT	41.4%	100.0%	84, 237, 242	1 (51)	0.43 [0.28, 0.65]	NA	< 0.0001
• NRCT	17.5%	27.2%	84, 242	3 (1802)	0.68 [0.57, 0.81]	0%	< 0.0001
Length of stay							
• RCT	NR	NR		NR	NR	NR	NR
• NRCT	11.7±9.7	16.8±7.6	84, 243	2(200)	-3.21 [-5.26, -1.16]	0%	0.002
Oral Health							
Overall*	NA	NA	237, 239-241	6(235)	-1.27 [-2.26, -0.28]	93%	0.01
Plaque index							
• RCT	1.4±1.5	7.4±2.6	239, 240	3(175)	-2.98 [-4.98, -0.98]	98%	0.003
Gingival	_						
bleeding							
index							
• RCT	8.7±9.3	17.7±21.9	240	2(81)	-8.85 [-17.77,	27%	0.05
					0.07]		

l<sup>2</sup>: Heterogeneity; MD: Mean difference; n: Number of studies; N: Number of patients; RR: Risk ratio; RCT: Randomized controlled trial; NRCT: Non-Randomized Controlled Trial

**Table 14:** Effect of different pharmaceutical agents on key outcomes

Outcome	Incide	ence %	Studies	n (N)	RR [95% CI],	l <sup>2</sup>	P value
	Drugs	Control			MD [95% CI]		
Mortality							
ACE inhibitors							
Overall	10.3%	10.5%	257, 258, 268, 275	4(6733)	0.96 [0.54 <i>,</i> 1.69]	75%	0.88
RCTs: vs Control	10.6%	11.0%	257, 258, 268	3(6244)	0.97 [0.46, 2.04]	83%	0.93
NRCT: vs Control	4.8%	5.6%	275	1(489)	0.86 [0.37, 1.99]	NA	0.72
TRPV-agonists: RCT	0.0%	2.9%	254	1(70)	0.33 [0.01, 7.91]	NA	0.5
Dopaminergic drugs: RCT	15.2%	42.9%	257	1(68)	0.35 [0.14, 0.86]	NA	0.02
Antibiotics: RCTs	16.1%	15.3%	250, 252, 255, 256, 263, 264, 266	7(4301)	1.05 [0.87, 1.26]	16%	0.61
Metoclopramide: RCT	26.7%	40.0%	265	1(60)	0.67 [0.32, 1.39]	NA	0.28
Pneumonia							
ACE inhibitors							
Overall	4.1%	7.6%	258, 260, 271-275, 278, 279	12(106 11)	0.60 [0.51, 0.70]	61%	< 0.00001
RCTs vs control (fatal)	4.4% (2.2%)	5.2% (2.2%)	258, 260	2(6176) 2(6176)	0.86 [0.69, 1.06] (1.02 [0.74, 1.42])	61% (79%)	0.16 (0.89)
NRCTs vs control	3.6%	11.4%	271, 274, 275, 278	4(1491)	0.41 [0.26, 0.64]	0%	< 0.0001
<ul> <li>NRCTs: vs other antihypertensive drugs</li> </ul>	3.9%	10.6%	271-274, 279	6(2944)	0.38 [0.28, 0.52]	0%	< 0.00001
TRPV-agonists							
Overall	9.6%	32.7%	254, 277	2(104)	0.31 [0.15, 0.66]	0%	0.002
RCT: Vs Control	0.0%	2.9%	254	1(70)	0.33 [0.01, 7.91]	NA	0.50
NRCT: Vs Control	29.4%	94.1%	277	1(34)	0.31 [0.15, 0.66]	NA	0.002

Outcome	Incide	ence %	Studies	n (N)	RR [95% CI],	l <sup>2</sup>	P value
	Drugs	Control			MD [95% CI]		
Dopaminergic drugs: RCT	6.0%	27.5%	259	1(163)	0.22 [0.09, 0.55]	NA	0.001
Antibiotics: RCTs	256, 263, 264, 266 1.10]		17%	0.40			
Metoclopramide: RCT	26.7%	86.7%	265	1(60)	0.31 [0.17, 0.57]	NA	0.0002
mRS							
Antibiotics: RCTs							
• mRS 0-2	46.0%	45.4%	250, 256, 264, 266	3(3946)	1.02 [0.83, 1.25]	56%	0.85
• mRS 3-6	43.3%	45.4%	263, 264, 266	3(2825)	0.97 [0.91, 1.02]	31%	0.25
Length of stay in hospital, days							
ACE inhibitor: RCT	37±22	51±36	257	1(68)	-14.00 [- 28.09, 0.09]	NA	0.05
Dopaminergic: RCT	37±22	51±36	257	1(68)	-14.00 [- 28.09, 0.09]	NA	0.05
Antibiotics: RCT	12.5±5.9	10.2±5.8	256, 266	2(3755)	3.49 [-3.37, 10.35]	100%	0.32
Aspiration							
ACE inhibitors: RCT	26.2%	91.7%	269	1(54)	0.29 [0.17, 0.49]	NA	<0.00001
<ul> <li>Dopaminergic drugs: RCT</li> </ul>	25.9%	91.7%	269	1(39)	0.30 [0.16, 0.58]	0%	0.0003
Latency of swallowing reflex							
<ul> <li>TRPV agonist</li> </ul>							
<ul> <li>Change</li> </ul>			252 254 276				
Overall	-7.4±1.2	-0.5±7.2	253, 254, 276	3(174)	-5.14 [-7.86, -2.41]	100%	0.80
• RCT	-7.9±1.5	-0.6±9.4	253, 254	2(134)	-6.68 [- 15.75, 2.39]	90%	0.15
• NRCT	-5.5±0.0	0.0±0.01	276	1(40)	-5.50 [-5.50, -5.50]	NA	<0.00001
Upper oesophageal sphincter opening time, sec							

Outcome	Incide	ence %	Studies	n (N)	RR [95% CI],	l <sup>2</sup>	P value
	Drugs	Control			MD [95% CI]		
TRPV agonist	0.9±0.1	1.0±0.0	262	2(50)	-0.08 [-0.13,	41%	0.0002
					-0.04]		
Laryngeal vestibule							
closure time, sec							
<ul> <li>TRPV agonist</li> </ul>	0.3±0.0	0.4±0.0	121, 262	3(116)	-0.10 [-0.12,	70%	<0.00001
					-0.08]		
Hyoid bone maximum							
anterior extension							
time, sec							
<ul> <li>TRPV agonist</li> </ul>	0.5±0.0	0.6±0.1	121, 262	3(146)	-0.15 [-0.16,	0%	<0.00001
					-0.13]		
Latency of Swallowing							
reflex							
<ul> <li>Dopaminergic</li> </ul>	2.9±0.8	8.3±1.2	270	1(54)	-5.40 [-5.94,	NA	<0.00001
drugs: RCT					-4.86]		
Swallows/min							
TRPV agonist							
Change: RCT	3.3±2.5	0.0±0.05	254	1(70)	3.30 [2.47,	NA	<0.00001
					4.13]		

ACE: Angiotensin converting enzyme; CI: Confidence intervals; I<sup>2</sup>, p: Heterogeneity; n: Number of studies; N: Number of patients; MD: Mean difference; NA: Not applicable; NRCT: Non-Randomized Controlled Trial; p: Statistical significance value; RCT: Randomized Controlled Trial; RR: Risk ratio; TRPV: transient receptor potential vanilloid

**Table 15:** Effect of different neurostimulation modalities on key outcomes

Oı	ıtcome	Mear	n±SD	Studies	n (N)	RR [95% CI]/	l <sup>2</sup>	p value
		Stimulation	Control			(S)MD [95% CI]		
Im	prevement in							
dy	sphagia score							
TE	S							
•	Overall	5.8±2.7	3.5±2.6	173, 282, 284, 287,	22(868)		69%	<0.00001
				294-296, 299, 301, 304, 307, 308, 312-		_		
				317, 319		0.90 [0.62,		
				173, 282, 284, 287,	40(=46)	1.18]	700/	0.00004
•	RCT	6.2±2.8	3.7±2.7	294-296, 299, 301,	19(746)		70%	<0.00001
				304, 307, 308, 312-		0.90 [0.60,		
				315		0.90 [0.80, 1.19]		
•	NRCT	3.7±1.9	1.8±1.9	316, 317, 319	3(122)	1.14 [-0.13,	78%	0.08
	MICI	3.7±1.5	1.0±1.5		3(122)	2.41]	7070	0.00
rT	MS					27.72		
•	Overall	9.6±6.1	4.7±5.1		11(236)	1.33 [0.51,	85%	0.002
						2.16]		
•	RCT	10.5±6.4	5.3±5.5	285, 289-291, 295,	10(212)	1.51 [0.60,	85%	0.001
				297, 298, 300		2.42]		
•	NRCT	0.8±2.6	0.7±2.5	318	1(24)	0.04 [-0.76,	NA	0.93
						0.84]		
tD				201 202 202 202				
•	Overall	2.8±2.3	2.0±1.8	281, 292, 293, 303, 306, 310	8(196)	0.75 [0.38,	26%	<0.0001
				281, 292, 293, 303,	0(100)	1.12]	2001	2 2224
•	RCT	2.8±2.3	2.0±1.8	306, 310	8(196)	0.75 [0.38,	26%	<0.0001
БЕ	C. Non			,		1.12]		
	S, Non- acheostomised							
-	Overall	2.3±1.9	1.6±2.2	283, 288, 297, 302,	5(204)	0.77 [-0.06,	80%	0.07
	Overall	2.5_1.9	1.0±2.2	309	3(204)	1.60]	3070	0.07
		2.3±1.9	1.6±2.2	283, 288, 297, 302,	5(204)	0.77 [-0.06,	80%	0.07
•	RCT	2.5_2.5	1.0_2.2	309	(== : /	1.60]		
PE	S, tracheostomised					-		
•	Overall	5.6±3.9	5.2±4.3	286, 305	2(83)	0.25 [-0.19,	0%	0.27
						0.69]		
		5.6±3.9	5.2±4.3	286, 305	2(83)	0.25 [-0.19,	0%	0.27
•	RCT					0.69]		
М	ortality, RCT							
•	2 weeks, PES	3.5%	1.5%	283, 288	2(154)	1.66 [0.22,	0%	0.62
						12.37]		

• 3 months, PES	13.8%	12.0%	283, 288, 309	3(231)	1.10 [0.55,	0%	0.78
					2.18]		
mRS, RCT			285	4			
• rTMS	1.0±0.7	2.5±1.3		1(38)	-1.50 [-2.29, - 0.71]	0%	0.0002
• PES	3.8±1.1	4.2±1.0	283, 286	2(177)	-0.33 [-0.63, - 0.02]	0%	0.04
Pneumonia, RCT					_		
• TES			173, 314		0.75 [0.19,		
	5.8%	8.5%		2(99)	2.95]	NA	0.68
<ul><li>tDCS</li></ul>			306		0.71 [0.40,		
	37.9%	53.3%	202 205	1(59)	1.26]	NA	0.24
<ul><li>PES</li></ul>			283, 286		0.66 [0.29,		
	7.6%	11.5%		2(209)	1.52]	0%	0.33
BI			205 200 200 240				
• rTMS, Overall	76.8±7.9	52.8±14.5	285, 289, 290, 318	5(110)	29.54 [25.82, 33.26]	87%	< 0.00001
• rTMS, RCT	79.8±5.1	46.9±12.7	285, 289, 290	4(86)	31.57 [27.75, 35.39]	73%	< 0.00001
• rTMS, NRCT	64.0±20.0	70.0±20.0	318	1(24)	-6.00 [-22.00, 10.00]	NA	0.46
PES, RCT	36.1±30.5	27.0±25.7	283, 288	2(154)	-0.34 [-1.19, 0.51]	74%	0.43
LOS, Hospital (d), RCT							
• tDCS	16.2±6.8	13.4±5.1	306	1(59)	2.80 [-0.28, 5.88]	NA	0.07
• PES	32.4±20.7	35.3±22.1	283, 305	3(192)	-4.23 [-12.11, 3.66]	33%	0.29
LOS, ICU (d), RCT					,		
• tDCS	6.7±4.4	7.0±3.3	306	1(59)	-0.30 [-2.29, 1.69]	NA	0.77
• PES	38.2±14.9	38.8±19.7	306	1(59)	-0.60 [-14.45, 13.25]	NA	0.93
Decannulation					-		
Tracheotomised patients, PES,  Overall	59.0%	7.5%	286, 305, 320	3(145)	5.43 [2.42, 12.16]	0%	< 0.0001
Overall     Tracheotomised	58.2%	11.4%	286, 305	2(99)	4.64 [2.00,	0%	0.004
<ul><li>patients, PES, RCT</li><li>Tracheotomised</li></ul>	60.9%	0.0%	320	1(46)	10.79] 29.00 [1.83,	NA	0.02
patients, PES, NRCT					459.04]		
Feeding Tube removal			294	_			
• TES, RCT	50.0%	14.3%	Z3 <del>4</del>	1(19)	3.50 [0.52,	NA	0.2

					23.42]		
PES, RCT	50.0%	28.6%	309	1(30)	1.75 [0.67,	NA	0.25
					4.58]		
Quality of Life, change							
from baseline, RCT							
Swallowing QoL, TES	26.2±18.2	7.2±17.1	304, 312	3(106)	18.02 [11.41,	37%	<0.00001
					24.63]		

CI: Confidence intervals; tDCS: transcranial Direct Current Stimulation; I<sup>2</sup>: Heterogeneity; n: Number of studies; N: Number of patients; TES: Transcutaneous Electrical Stimulation; NRCT: RCT: Non-randomized controlled trial (Cohort, before after, case-control studies); p: Statistical significance value; PES: Pharyngeal Electrical Stimulation; RCT: Randomized controlled trial; RR: Risk ratio SD: Standard Deviation; SMD: Standard Mean Difference; rTMS: repetitive Transcranial Magnetic Stimulation; BI: Barthel Index; LOS: Length of stay; ICU: Intensive care unit; NRCT: Non-Randomized Controlled Trial; RCT: Randomized Controlled Trial;

Table 16. Summary table of PICO-questions and recommendations

PICO-question	Recommendations/Expert Opinions
•	
Dysphagia Screening  1. In patients with acute stroke does screening compared to no screening for dysphagia improve functional outcome and/or survival, reduce aspiration risk, reduce length of hospital stay, reduce adverse events and complications, have an effect on nutritional status, and have an effect on quality-of-life?  2. In patients with acute stroke, does early dysphagia screening compared to no screening or late screening, improve functional outcome and/or survival, reduce aspiration risk, length of hospital stay, adverse events and complications and have an effect on nutritional status and on quality of life?  3. In patients with acute stroke does dysphagia screening with multiple consistencies compared to screening with single consistencies improve functional outcome and/or survival, reduce aspiration risk, length of hospital stay, adverse	Recommendation 1: In all patients with acute stroke, we recommend a formal dysphagia screening test to prevent post-stroke pneumonia and decrease risk of early mortality. We recommend to screen the patients as fast as possible after admission. For screening, either waterswallow-tests or multiple consistency tests may be used. Quality of evidence: Moderate $\bigoplus \bigoplus$ Strength of recommendation: Strong for intervention $\uparrow \uparrow$ Recommendation 2: In patients with acute stroke, we recommend no administration of any food or liquid items, including oral medication, until a dysphagia screening has been done and swallowing was judged to be safe. Quality of evidence: Moderate $\bigoplus \bigoplus$ Strength of recommendation: Strong for intervention $\uparrow \uparrow$
events and complications, and have an effect on	
nutritional status and/or quality of life?	
Nutritional Screening	
1. In patients with post-stroke dysphagia does nutritional screening/assessment compared to no nutritional screening/assessment improve functional outcome and/or survival, reduce aspiration risk, reduce length of hospital stay, reduce adverse events and complications, improve swallowing status/function, have an effect on nutritional status, and have an effect on quality of life?	Expert opinion: There is consensus among the guideline group (15/15) that patients with acute stroke should be screened for nutritional risk within the first days after hospital admission using validated screening tools.
Dysphagia Assessment	
1. In patients with acute and/or subacute stroke does full clinical and instrumental assessment compared to no assessment improve functional outcome and/or survival, reduce aspiration risk, reduce length of hospital stay, reduce adverse events and complications, have an effect on nutritional status, and/or have an effect on quality	Recommendation 3: We suggest a dysphagia assessment in all stroke patients failing a dysphagia screening and/or showing other clinical predictors of post-stroke dysphagia, in particular a severe facial palsy, severe dysarthria, severe aphasia or an overall severe neurological deficit (NIH-SS ≥ 10 points). Dysphagia assessment should be done as soon as possible. In addition to the clinical swallow examination,

of life?

- 2. In patients with acute and /or subacute stroke does early assessment for dysphagia compared to late assessment improve functional outcome and/or survival, reduce aspiration risk, reduce length of hospital stay, reduce adverse events and complications, have an effect on nutritional status, and/or have an effect on quality of life?
- 3. In patients with acute and /or subacute stroke do repeated assessments compared to single assessments improve functional outcome and/or survival, reduce aspiration risk, reduce length of hospital stay, reduce adverse events and complications, have an effect on nutritional status, and/or have an effect on quality of life?
- 4. In patients with stroke does clinical bedside assessment compared to instrumental assessment improve functional outcome and/or survival, reduce aspiration risk, reduce length of hospital stay, reduce adverse events and complications, have an effect on nutritional status, and/or have an effect on quality of life?
- 5. In patients with acute and/or subacute stroke does instrumental assessment with VFSS compared to FEES improve functional outcome and/or survival, reduce aspiration risk, reduce length of hospital stay, reduce adverse events and complications, have an effect on nutritional status, and/or have an effect on quality of life?
- 6. In patients with acute and / or subacute stroke do complementary assessments to clinical assessments (i.e. spirometry, EMG) compared to standard clinical assessment improve functional outcome and/or survival, reduce aspiration risk, reduce length of hospital stay, reduce adverse events and complications, have an effect on nutritional status, and/or have an effect on quality of life?

VFSS, or, preferentially, FEES should be available.

Quality of evidence: Low  $\bigoplus \bigoplus$ 

Strength of recommendation: Weak for intervention  $\uparrow$ ?4

Recommendation 4: We suggest that in acute stroke patients swallowing of tablets should routinely be evaluated as part of dysphagia assessment in addition to assessing the swallowing of liquid and different food consistencies and quantities.

Quality of evidence: Low  $\bigoplus$ 

Strength of recommendation: Weak for intervention  $\uparrow$ ?

## **Dysphagia Treatment**

## a. Dietary Interventions

1. In patients with post-stroke dysphagia does texture diet modification compared to no texture

Recommendations 5: In patients with post-stroke dysphagia, we suggest that texture modified diets and/or

diet modification improve functional outcome and/or survival, reduce aspiration risk, reduce length of hospital stay, reduce adverse events and complications, improve swallowing status/ability, have an effect on nutritional status, and have an effect on quality of life?

2. In patients with post-stroke dysphagia, does fluid thickening compared to no fluid thickening, improve functional outcome and/or survival, reduce aspiration risk, reduce length of hospital stay, reduce adverse events and complications, improve swallowing status/ ability, have an effect on nutritional status, and have an effect on quality of life?

thickened liquids may be used to reduce the risk of pneumonia. Quality of evidence: Low  $\bigoplus$ 

Strength of recommendation: Weak for intervention ↑?

Recommendation 6: In patients with post-stroke dysphagia we recommend that texture modified diets and/or thickened liquids are prescribed only based on an appropriate assessment of swallowing.

Quality of evidence: Low  $\bigoplus \bigoplus$ 

Strength of recommendation: Strong for intervention  $\uparrow \uparrow$ 

Recommendation 7: In stroke patients put on texture modified diet and/or thickened liquids we recommend to monitor fluid balance and nutritional intake.

Quality of evidence: Moderate  $\oplus \oplus \oplus$ 

Strength of recommendation: Strong for intervention ↑↑

#### b. Behavioural interventions

1. In patients with post-stroke dysphagia do behavioural swallowing exercises compared to no treatment improve functional outcome and/or survival, reduce aspiration risk, reduce length of hospital stay, reduce adverse events and complications, improve swallowing status/ability, have an effect on nutritional status, and have an effect on quality of life?

Recommendation 8: In patients with post-stroke dysphagia, we suggest behavioural swallowing exercises to rehabilitate swallowing function.

Quality of evidence: Moderate  $\oplus \oplus \oplus$ 

Strength of recommendation: Weak for intervention ↑?

Recommendation 9: In patients with post-stroke dysphagia, we suggest that behavioural interventions should not be limited to one specific manoeuvre or training, but the treatment should be tailored to the specific swallowing impairment of the individual patient based on a careful assessment of dysphagia.

Quality of evidence: Moderate  $\oplus \oplus \oplus$ 

Strength of recommendation: Weak for intervention  $\uparrow$ ?

Recommendation 10: In patients with post-stroke dysphagia, we suggest that acupuncture may be used to rehabilitate swallowing function.

Quality of evidence: Moderate  $\oplus \oplus \oplus$ 

Strength of recommendation: Weak for intervention  $\uparrow$ ?

## c. Nutritional Interventions

1. In patients with post-stroke dysphagia does early initiation of oral nutritional therapy compared to late initiation of nutritional therapy improve functional outcome and/or survival, reduce

Recommendation 11: In unselected stroke patients, we suggest to avoid routine use of oral nutritional supplementation.

Quality of evidence: Moderate  $\oplus \oplus \oplus$ 

aspiration risk, reduce length of hospital stay, reduce adverse events and complications, improve swallowing status/function, have an effect on nutritional status, and have an effect on quality of life?

2. In patients with post-stroke dysphagia does early enteral or parenteral feeding compared to late or restrictive enteral or parenteral feeding improve functional outcome and/or survival, reduce aspiration risk, reduce length of hospital stay, reduce adverse events and complications, improve swallowing status/ability, have an effect on nutritional status, and have an effect on quality of life?

Strength of recommendation: Weak against intervention  $\downarrow$ ?

Recommendation 12: In stroke patients who tolerate an oral diet and present with a risk of malnutrition or with manifest malnutrition, we suggest to consider the use of oral nutritional supplementation.

Quality of evidence: Low ⊕⊕

Strength of recommendation: Weak for intervention  $\uparrow$ ?

Recommendation 13: In patients with post-stroke dysphagia and insufficient oral intake we suggest an early enteral nutrition via a nasogastric tube.

Quality of evidence: Moderate  $\bigoplus \bigoplus$ 

Strength of recommendation: Weak for intervention ↑?

## d. Interventions to improve oral health

1. In patients with post-stroke dysphagia does specific oral health care compared to standard care improve functional outcome and/or survival, reduce aspiration risk, reduce length of hospital stay, reduce adverse events and complications, improve swallowing status/ ability, have an effect on nutritional status, and have an effect on quality of life?

Recommendation 14: In stroke patients we suggest to implement oral health care interventions to reduce the risk of pneumonia.

Quality of evidence: Low  $\bigoplus \bigoplus$ 

Strength of recommendation: Weak for intervention  $\uparrow$ ?

## e. Pharmacological treatment

1. In patients with post-stroke dysphagia, does pharmacological treatment compared to no treatment improve functional outcome and/or survival, reduce aspiration risk, reduce length of hospital stay, reduce adverse events and complications, improve swallowing status/ ability, have an effect on nutritional status, and have an effect on quality of life?

Recommendation 15: We recommend that due to the limited evidence available with regards to clinical endpoints, pharmacological treatment of post-stroke dysphagia should be preferably used within clinical trial settings.

Quality of evidence: Low  $\bigoplus \bigoplus$ 

Strength of recommendation: Strong for intervention ↑↑

Recommendation 16: We recommend that preventive antimicrobial treatment is not used in stroke patients.

Quality of evidence: High  $\bigoplus \bigoplus \bigoplus$ 

Strength of recommendation: Strong against intervention

 $\downarrow \downarrow$ 

Recommendation 17: In stroke patients with post-stroke dysphagia and an impaired swallow response, we suggest to consider TRPV1 agonists and dopaminergic agents to improve swallowing safety. Quality of evidence: Low  $\bigoplus \bigoplus$  Strength of recommendation: Weak for intervention  $\uparrow$ ?

	Recommendation 18: In stroke patients fed via a nasogastric tube, we suggest to use metoclopramide to promote gastric emptying and reduce the risk of esophagopharyngeal regurgitation with subsequent aspiration.  Quality of evidence: Low $\bigoplus \bigoplus$ Strength of recommendation: Weak for intervention $\uparrow$ ?
f. Neurostimulation treatment	
1. In patients with post-stroke dysphagia, do neurostimulation techniques compared to no treatment, improve functional outcome and/or survival, reduce aspiration risk, reduce length of hospital stay, reduce adverse events and complications, improve swallowing status/ ability, have an effect on nutritional status, and have an effect on quality of life?  2. In patients with post-stroke dysphagia, do neurostimulation techniques compared to behavioural treatments improve functional outcome and/or survival, reduce aspiration risk, reduce length of hospital stay, reduce adverse events and complications, improve swallowing status/ ability, have an effect on nutritional status, and have an effect on quality of life?	Recommendation 19: In patients with post-stroke dysphagia, we recommend that treatment with neurostimulation techniques should preferably be conducted within a clinical trial setting.  Quality of evidence: Low \(\oplus\)  Strength of recommendation: Strong for intervention \(\bar\)  Recommendation 20: In patients with post-stroke dysphagia, we suggest treatment with rTMS, TES, tDCS and PES as adjunct to conventional dysphagia treatments.  Quality of evidence: Moderate \(\oplus\)  Strength of recommendation: Weak for intervention \(\bar\)?  Recommendation 21: In tracheotomized stroke patients with severe dysphagia, we suggest treatment with pharyngeal electrical stimulation to accelerate
	decannulation.  Quality of evidence: High ⊕⊕⊕⊕

Strength of recommendation: Weak for intervention  $\uparrow$ ?

## **Supplement 2: Search Strategies**

## **Epidemiology**

- ((stroke) OR (transient ischemic attack\*) OR (TIA) OR (mild stroke) OR (minimal stroke) OR (brain hypoxia) OR (brain infarct\*) OR (brain haemorrhage) OR (brain ischemia) OR (basal ganglia cerebrovascular disease) OR (cardioembolic stroke) OR (cerebral embolism) OR (cerebral haemorrhage) OR (cerebral infarct\*) OR (cerebrovascular accident\*) OR (CVA) OR (cerebrovascular apoplexy) OR (cerebrovascular infarct\*) OR (cerebrovascular embolism) OR (cerebrovascular disorder) OR (acute isch?emi\* stroke) OR (Ischemic stroke) OR (Ischemic apoplexy) OR (intracranial embolism) OR (Intracranial thrombosis) OR (hemiparesis) OR (hemiplegia)).tw,ti,ab.
- 2. ((anterior cerebral artery infarction) OR (middle cerebral artery infarction) OR (posterior cerebral artery infarction) OR (lacunar stroke) OR (wind stroke) OR (anterior circulation occlusion) OR (Post-stroke) OR (Apoplexy)).tw,ti,ab.
- 3. #1 OR #2
- 4. ((dysphagia) OR (deglutition) OR Swallowing OR (swallowing disorders) OR (deglutition disorders) OR (impaired swallowing) OR (pneumonia OR aspiration) OR (respiratory aspiration) OR (inhalation) OR (cough) OR (gastric motility) OR (odynophagia)).tw,ti,ab.
- 5. oropharynx\$ or trachea\$ or lung\$ or pulmon\$ adj5 aspirat\$
- 6. #4 OR #5
- 7. (Outcomes OR complication OR (quality of life) OR hospitalization OR (Length of stay) OR mortality OR morbidity OR (adverse events) OR (adverse effects) OR (nutritional status) OR nutrition OR survival)
- 8. #3 AND #6 AND #7

## **Dysphagia Screening**

- ((stroke) OR (transient ischemic attack\*) OR (TIA) OR (mild stroke) OR (minimal stroke) OR (brain hypoxia) OR (brain infarct\*) OR (brain haemorrhage) OR (brain ischemia) OR (brain isch?emi\*) OR (basal ganglia cerebrovascular disease) OR (cardioembolic stroke) OR (cerebral embolism) OR (cerebral haemorrhage) OR (cerebral infarct\*) OR (cerebrovascular accident\*) OR (CVA) OR (cerebrovascular apoplexy) OR (cerebrovascular infarct\*) OR (cerebrovascular embolism) OR (cerebrovascular disorder) OR (acute isch?emi\* stroke) OR (Ischemic stroke) OR (Ischemic apoplexy) OR (intracranial embolism) OR (Intracranial thrombosis) OR (hemiparesis) OR (hemiplegia)).tw,ti,ab.
- 2. ((anterior cerebral artery infarction) OR (middle cerebral artery infarction) OR (posterior cerebral artery infarction) OR (lacunar stroke) OR (wind stroke) OR (anterior circulation occlusion) OR (Post-stroke) OR (Apoplexy)).tw,ti,ab.
- 3. #1 OR #2
- 4. ((dysphagia) OR (deglutition) OR Swallowing OR (swallowing disorders) OR (deglutition disorders) OR (impaired swallowing) OR (pneumonia OR aspiration) OR (respiratory aspiration) OR (inhalation) OR (cough) OR (gastric motility) OR (odynophagia)).tw,ti,ab.
- 5. oropharynx\$ or trachea\$ or lung\$ or pulmon\$ adj5 aspirat\$
- 6. #4 OR #5
- 7. (Screening OR Diagnosis OR Sensitivity OR Specificity OR Questionnaire OR test OR Evaluation OR tool OR appraisal OR (predictive value)).tw,ti,ab.
- 8. #3 AND #6 AND #7

## **Dysphagia Assessment**

- ((stroke) OR (transient ischemic attack\*) OR (TIA) OR (mild stroke) OR (minimal stroke) OR (brain hypoxia) OR (brain infarct\*) OR (brain haemorrhage) OR (brain ischemia) OR (basal ganglia cerebrovascular disease) OR (cardioembolic stroke) OR (cerebral embolism) OR (cerebral haemorrhage) OR (cerebral infarct\*) OR (cerebrovascular accident\*) OR (CVA) OR (cerebrovascular apoplexy) OR (cerebrovascular infarct\*) OR (cerebrovascular embolism) OR (cerebrovascular disorder) OR (acute isch?emi\* stroke) OR (Ischemic stroke) OR (Ischemic apoplexy) OR (intracranial embolism) OR (Intracranial thrombosis) OR (hemiparesis) OR (hemiplegia)).tw,ti,ab.
- 2. ((anterior cerebral artery infarction) OR (middle cerebral artery infarction) OR (posterior cerebral artery infarction) OR (lacunar stroke) OR (wind stroke) OR (anterior circulation occlusion) OR (Post-stroke) OR (Apoplexy)).tw,ti,ab.
- 3. #1 OR #2
- 4. ((dysphagia) OR (deglutition) OR Swallowing OR (swallowing disorders) OR (deglutition disorders) OR (impaired swallowing) OR (pneumonia OR aspiration) OR (respiratory aspiration) OR (inhalation) OR (cough) OR (gastric motility) OR (odynophagia)).tw,ti,ab.
- 5. oropharynx\$ or trachea\$ or lung\$ or pulmon\$ adj5 aspirat\$
- 6. #4 OR #5
- 7. ((clinical assessment) OR (medical history taking) OR (symptoms assessment) OR (physical examination) OR (clinical swallowing Evaluation) OR (CSE) OR (Questionnaire) OR (auscultation methods) OR (respiratory sounds) OR (diagnostic self-evaluation) OR (Clinical medicine) OR (mass screening) OR (Bedside screening tests) OR (Toronto Bedside Swallowing Screening Test) OR (Nursing Bedside Swallowing Screen tool) OR (NBSS tool) OR (TOR-BSST) OR (TOR-BSST) OR (fluoroscopy) OR (videofluoroscopy) OR (VFS) OR (VFSS) OR (Videofluoroscopic swallow study) OR (instrumental assessment) OR (instrument assessment) OR (fibreoptic endoscopic evaluation) OR (Fiberoptic endoscopic evaluation of swallowing) OR (FEES) OR (Swallowing accelerometry) OR (TOR-BSST) OR (RADAVE) OR (Watian Swallowing Test) OR (Swallowing Functional Assessment) OR (Swallowing Disorder Integral) OR (Gugging Swallowing Screen) OR (Swallowing screening) OR (Royal Brisbane and Women's Hospital dysphagia screening tool) OR (RBWH) OR (I-RBWH) OR (Mann assessment of swallowing ability) OR (MASA) OR (Acoustic analysis) OR (Acoustic\*) OR (Burks Dysphagia Screening Test) OR (BDST) OR (modified barium swallow) OR (MBS) OR (flexible endoscopic evaluation of swallowing) OR (FEES)).tw,ti,ab.
- 8. ((electromyography) OR (Surface electromyography) OR (EMG) OR (Neuromuscular Disease Swallowing Status Scale) OR (NdSSS) OR (Sydney Swallow Questionnaire) OR (SSQ) OR (spirometry) OR (Lung function test)).tw,ti,ab.
- 9. (Dysphagia assessment) adj5 instrument
- 10. #7 OR #8 OR #9
- 11. #3 AND #6 AND #12

## **Dysphagia Treatment**

- ((stroke) OR (transient ischemic attack\*) OR (TIA) OR (mild stroke) OR (minimal stroke) OR (brain hypoxia) OR (brain infarct\*) OR (brain haemorrhage) OR (brain ischemia) OR (carebrovascular disease) OR (cardioembolic stroke) OR (cerebral embolism) OR (cerebral haemorrhage) OR (cerebral infarct\*) OR (cerebrovascular accident\*) OR (CVA) OR (cerebrovascular apoplexy) OR (cerebrovascular infarct\*) OR (cerebrovascular embolism) OR (cerebrovascular disorder) OR (acute isch?emi\* stroke) OR (Ischemic stroke) OR (Ischemic apoplexy) OR (intracranial embolism) OR (Intracranial thrombosis) OR (hemiparesis) OR (hemiplegia)).tw,ti,ab.
- 2. ((anterior cerebral artery infarction) OR (middle cerebral artery infarction) OR (posterior cerebral artery infarction) OR (lacunar stroke) OR (wind stroke) OR (anterior circulation occlusion) OR (Post-stroke) OR (Apoplexy)).tw,ti,ab.
- 3. #1 OR #2
- 4. ((dysphagia) OR (deglutition) OR Swallowing OR (swallowing disorders) OR (deglutition disorders) OR (impaired swallowing) OR (pneumonia OR aspiration) OR (respiratory aspiration) OR (inhalation) OR (cough) OR (gastric motility) OR (odynophagia)).tw,ti,ab.
- 5. oropharynx\$ or trachea\$ or lung\$ or pulmon\$ adj5 aspirat\$
- 6. #4 OR #5
- 7. (Stimulation OR Electrical OR Vitalstim OR vocastim OR stimulation OR neurostimulation OR (neuromuscular stimulation) OR (Electrical stimulation) OR (Neuromuscular electrical stimulation) OR (NMES) OR (Pharyngeal electrical stimulation) OR (PES) OR (Physical stimulation) OR (Transcranial Direct Current Stimulation) OR (TDCS) OR (transcranial magnetic stimulation) OR (brain stimulation) OR (cortical stimulation) OR (non-invasive brain stimulation) OR (repetitive transcranial magnetic stimulation) OR RTMS OR (Evoked potential) OR (motor cortex stimulation) OR (cortex stimulation) OR (alternate therapy) OR (Physical stimulation) OR (thermal OR tactile)).tw,ti,ab.
- 8. ((acupuncture) OR (Acupressure) OR (needle therapy) OR (acupuncture therapy) OR (acupuncture treatment) OR (acupuncture methods)).tw,ti,ab.
- 9. ((Behaviour treatment) OR (Swallowing exercises) OR (Behavior change techniques) OR rehabilitation OR exercise OR behavio\* OR (swallowing training) OR (swallowing exercise\*) OR (Neuromuscular exercises) OR (Myofunctional Therapy) OR intervention OR exercise OR (therapeutic exercise\*) OR (Tongue resistance Effortful swallow) OR gargling OR (Jaw exercise) OR (Therabite stretch) OR (terabite swallow) OR (Effortful swallow) OR (Mendelsohn Masako) OR Positioning OR posture).tw,ti,ab.
- 10. ((Oral nutrition) OR diet OR nutrition OR (fortified food) OR (diet therapy) OR (diet modification) OR (texture modified) OR (pureed diet) OR (thickened drinks) OR dysphagia diet OR consistency OR mashed OR chopped OR liquid OR fork OR (Liquidized diet) OR (modified diet) OR (Nutritional supplement) OR (oral supplement) OR (nutrition support) OR (artificial feeding) OR (Enteral nutrition) OR (Enteral feeding) OR (Tube feeding) OR (Gastric tube feeding) OR (Nasoenteric feeding) OR (Nasogastric feeding) OR (Nasojejunal feeding) OR (Nasoduodenal feeding) OR (Artificial feeding) OR (Gastrostomy) OR (Percutaneous endoscopic gastrostomy) OR (sip feeding) OR (feeding route) OR (nasogastric tube) OR Nasogastric OR (nasojejunal tube) OR NJT OR (gastrointestinal intubation) OR (oral intake)

- OR (tube feeding) OR sham OR (sham feeding) OR (sham stimulation) OR (restrictive enteral) OR (late enteral)).tw,ti,ab.
- 11. (Liquids) OR (thin liquid) OR (thickened liquid) OR (thickened drinks) OR (viscosity) OR (pureed diet) OR (puree consistency) OR (mashed) OR (chopped) OR (soft solid food) OR (solid diet) OR (dysphagia diet) OR (consistency) OR (varibar) OR (Minimal Eating Observation Form) OR (Minimal Eating Form) OR (diet modification) OR (non-thickened liquid) OR (Texture modified diet) OR (texture diet) OR (dietary protein) OR (oral nutrition) OR (solid regular-texture diet)).tw,ti,ab.
- 12. (Medication OR Therapy OR therapeutics OR Treatment OR Drugs OR (pharmacological agents) OR nifedipine OR (Calcium antagonist) OR (Calcium channel blocker) OR (antibacterial oral gel) OR (drug treatment) OR (angiotensin converting enzyme inhibitor) OR (angiotensin converting enzyme) OR (Levodopa)).tw,ti,ab.
- 13. ((Malnutrition) OR (under nutrition) OR (poor nutrition) OR (Nutrition Disorders) OR (Nutritional Deficiency) OR (Subnutrition OR Sub-nutrition) OR (Nutritional status) OR (health status) OR nutrition).tw,ti,ab.
- 14. ((Nutrition therapy) OR (Diet therapy) OR (treatment OR management OR intervention OR supplementation) OR (feeding or nutrition) OR (nutritional supplementation) OR (swallowing therapy) OR (tube feeding) OR fluid OR (fluid supplementation) OR (sip feeding) OR (feeding route) OR timing OR diet OR hydration).tw,ti,ab.
- 15. ((Parenteral nutrition) OR (Parenteral feeding) OR (parenteral feed) OR (parenteral food) OR (parenteral nutrition) OR (total parenteral nutrition) OR TPN OR (total nutrient admixture) OR (partial parenteral nutrition) OR (peripheral parenteral nutrition) OR (central venous nutrition) OR (intravenous nutrition) OR (IV nutrition) OR (subcutaneous nutrition) OR (SC nutrition) OR (SC feed)).tw,ti,ab.
- 16. (Consistency OR (Liquids) OR (thin liquid) OR (thickened liquid) OR (thickened drinks) OR (viscosity) OR (pureed diet) OR (puree consistency) OR (mashed) OR (chopped) OR (soft solid food) OR (solid diet) OR (dysphagia diet) OR (consistency) OR (varibar) OR (E-Z-EM's Varibar) OR (Minimal Eating Observation Form) OR (Minimal Eating Form) OR (MEOF) OR (Oral nutrition) OR (texture modified diet) OR (diet modification)).tw,ti,ab.
- 17. ((Oral health) OR (oral mucositis) OR (oral candidiasis) OR (dental health) OR (oral dental care) OR (dental caries) OR (oral care) OR (gum)).tw,ti,ab.
- 18. #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17
- 19. #3 AND #6 AND #18

## **Supplement 3: PRISMA Diagrams**

Figure 1: Epidemiology

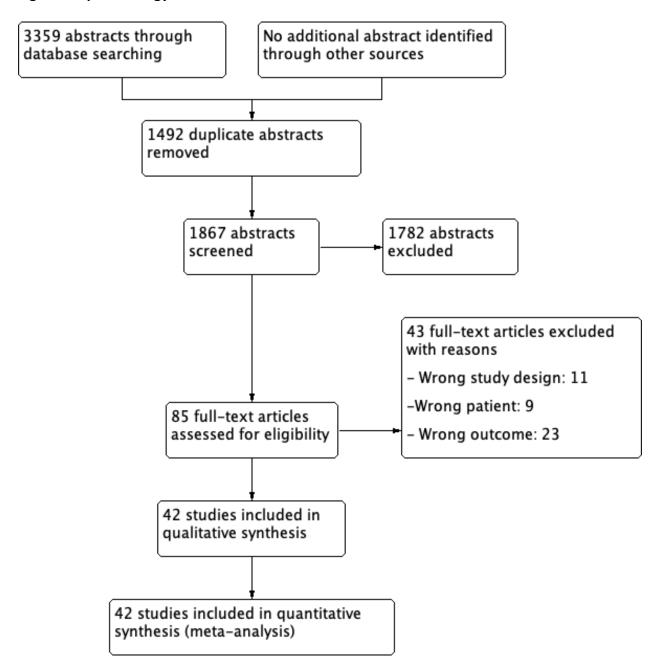


Figure 2: Screening

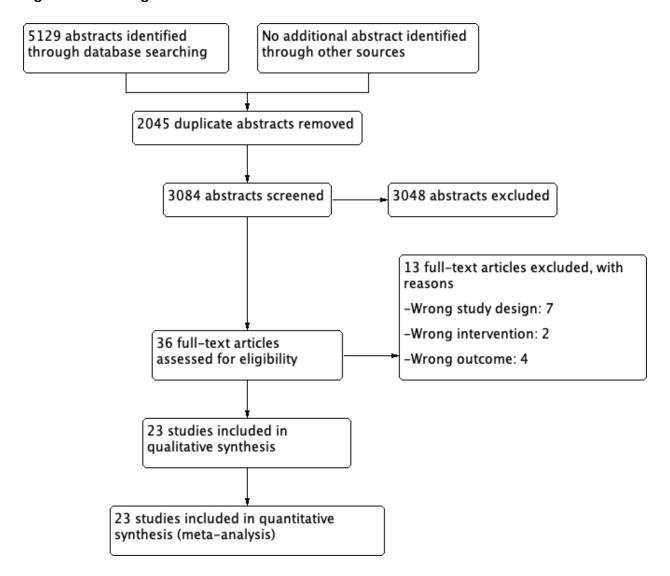
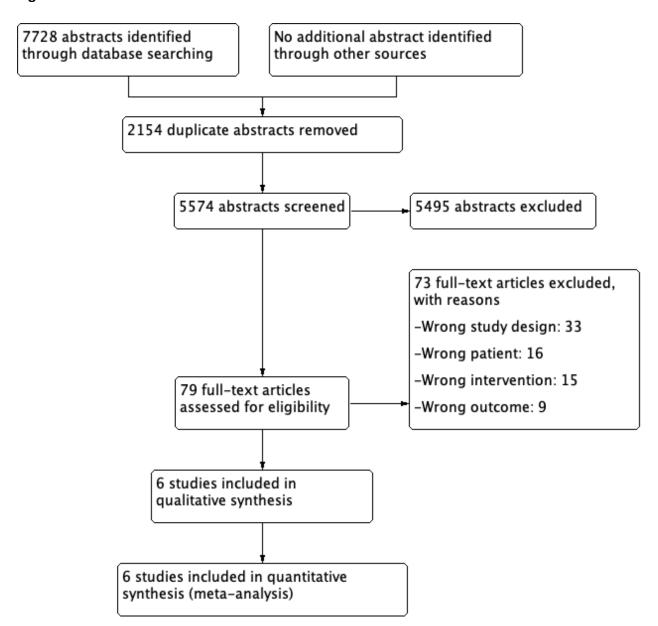
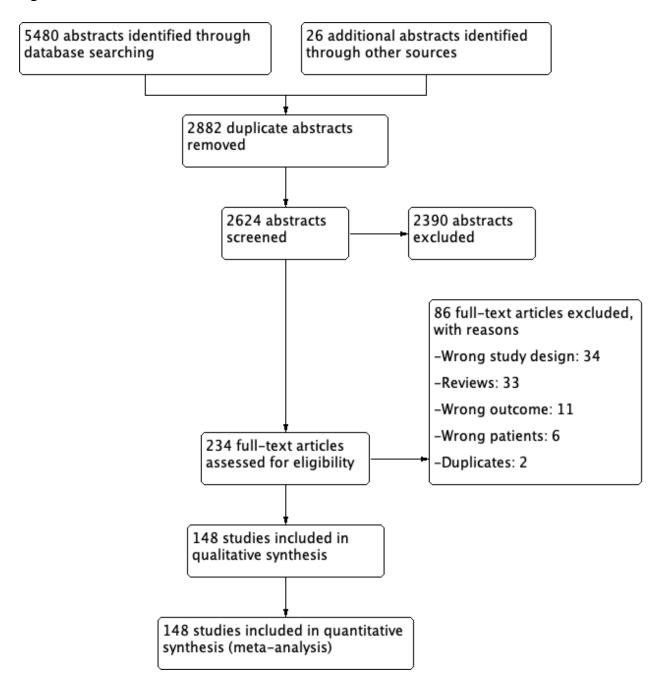


Figure 3: Assessment



**Figure 4: Treatments** 



## **Supplement 4: Meta-Analyses**

## **Epidemiology**

PICO 1

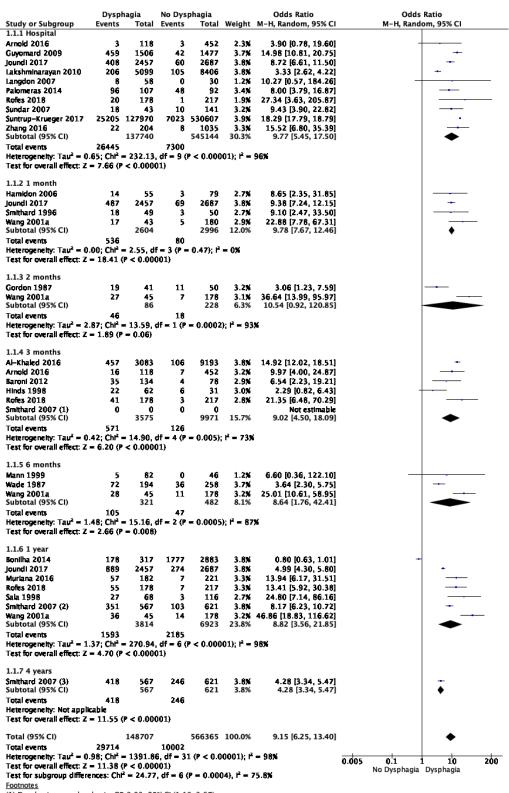
Table 1: Effect of dysphagia compared to no dysphagia on mortality, pneumonia, aspiration risk, and length of stay in hospital in patients with stroke

Outcome	Incidence (%)	/ Mean±SD	n (N)	OR [95% CI]/	l <sup>2</sup>	P value
	Dysphagia	No dysphagia		MD [95% CI]		
Mortality						
Mortality,						
hospital	19%	1%	10(682884)	9.77 [5.45, 17.50]	96%	< 0.00001
Mortality, 1			. (=)			
month	21%	3%	4(5600)	9.78 [7.67, 12.46]	0%	< 0.00001
Mortality, 2	<b>530</b> /	00/	2/24.4)	40.54[0.02.420.05]	020/	0.06
months	53%	8%	2(314)	10.54 [0.92, 120.85]	93%	0.06
<ul> <li>Mortality, 3 months</li> </ul>	16%	1%	5(13546)	9.02 [4.50, 18.09]	73%	< 0.00001
<ul> <li>Mortality, 6</li> </ul>						
months	33%	10%	3(803)	8.64 [1.76, 42.41]	87%	0.008
<ul> <li>Mortality, 1 year</li> </ul>	42%	32%	7(10737)	8.82 [3.56, 21.85]	98%	< 0.00001
<ul> <li>Mortality, 4</li> </ul>						
years	74%	40%	1(1188)	4.28 [3.34, 5.47]	NA	< 0.00001
Pneumonia	22%	3%	31(767179)	7.45 [6.01, 9.24]	94%	< 0.00001
Tubing						
<ul> <li>Nasogastric tube</li> </ul>	41%	1%	2(8171)	93.74 [24.33, 361.14]	35%	< 0.00001
<ul> <li>Percutaneous</li> </ul>						
feeding tube	9%	0.1%	4(8446)	71.60 [34.38, 149.11]	0%	< 0.00001
mRS						
• mRS 0, 1	6%	30%	2(5582)	0.20 [0.11, 0.35]	83%	< 0.00001
• mRS ≥2	76%	55%	3(17858)	2.34 [1.24, 4.40]	98%	0.08
• mRS 4,5	52%	18%	1(5012)	5.03 [4.43, 5.72]	NA	< 0.00001
LOS						
• LOS, days	12.1±9.7	8.4±6.2	14(697614)	4.72 [3.53, 5.91]	99%	< 0.00001
<ul> <li>LOS, stroke unit</li> </ul>	4.4±3.0	2.7±2.4	1(570)	1.70 [1.12, 2.28]	NAs	< 0.00001
Swallowing						
Mann Score	135.3	193.6	2(130)	-57.35 [-77.04, -37.67]	97%	< 0.0001
• FOIS	3.2	6.8	2(172)	-3.63 [-4.23, -3.03]	97%	< 0.0001
Discharge status			-	_		
Discharged home	17%	67%	8(678519)	0.17 [0.09, 0.35]	100%	< 0.00001
<ul> <li>Discharged to</li> </ul>	49%	26%	7(665094)	3.90 [2.93, 5.21]	81%	< 0.00001

	Institution/Pallia						
	tive						
•	Discharged to						
	long term care	15%	5%	2(663721)	1.95 [0.71, 5.32]	100%	0.19
•	Readmission, 1						
	year	42%	54%	1(395)	0.62 [0.42, 0.93]	NA	0.02

CI: Confidence intervals; FOIS: Functional oral intake scale; I<sup>2</sup>: Heterogeneity; LOS, Length of stay in hospital; MD: Mean difference; n: Number of studies; N: Number of patients; NIHSS: National Institute of Health Stroke Scale; p: Statistical significance value; OR: Odds Ratio; SD: Standard deviation

Figure: Effect of dysphagia compared to no dysphagia on mortality in patients with stroke



<sup>(1)</sup> Dysphagia vs no dysphagia, OR 2.03, 95% CI (1.12-3.67)

<sup>(2)</sup> Dysphagia vs no dyaphagia, OR 1.60, 95% CI (0.98-2.63)

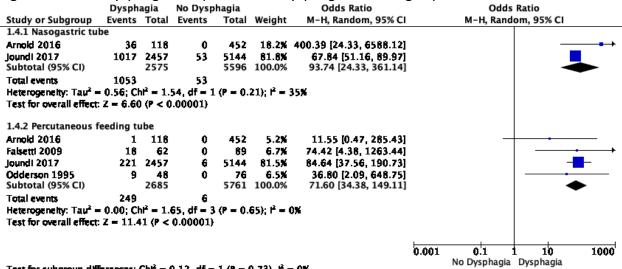
<sup>(3)</sup> Dysphagia vs no dyaphagia, OR 1.60, 95% CI (0.98-2.63)

Figure: Effect of dysphagia compared to no dysphagia on pneumonia in patients with stroke

	Dysp	hagia	No Dys	phagia		Odds Ratio	Odds Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% CI	M-H, Random, 95% CI
Al-Khaled 2016	917	3083	337	9193	6.0%	11.13 [9.74, 12.71]	+
Alsumrain 2013	20	68	19	212	3.7%	4.23 [2.10, 8.55]	
Arnold 2016	27	118	5	452	2.7%	26.53 [9.95, 70.71]	
Babi 2014	8	58	2	200	1.4%	15.84 [3.26, 76.92]	
Brogan 2014	57	328	8	205	3.5%	5.18 [2.42, 11.10]	
Chua 1996	6	21	2	32	1.2%	6.00 [1.08, 33.38]	
De Castillo 2017 (1)	0	0	0	0		Not estimable	
De Pippo 1994	10	82	1	57	0.9%	7.78 [0.97, 62.57]	-
Falsetti 2009	8	62	1	89	0.9%	13.04 [1.59, 107.13]	
Finlayson 2011	119	829	468	7422	5.7%	2.49 [2.01, 3.09]	-
Gordon 1987	7	41	4	50	1.9%	2.37 [0.64, 8.74]	<del> </del>
Cottleb 1996	9	50	9	130	2.7%	2.95 [1.10, 7.94]	
Hoffman 2012a	740	3507	367	11828	6.0%	8.35 [7.32, 9.53]	•
Hoffman 2012b	2396	10465	969	34620	6.1%	10.31 [9.53, 11.15]	•
Hoffman 2016	18	111	7	368	2.9%	9.98 [4.05, 24.61]	
Holas 1994	21	127	6	215	2.8%	6.90 [2.70, 17.61]	
oundi 2017	322	2457	52	2687	5.5%	7.64 [5.67, 10.30]	-
Kidd 1995	19	25	2	35	1.3%	52.25 [9.57, 285.14]	
Kumar 2016	107	450	37	1194	5.1%	9.75 [6.59, 14.45]	-
Lakshminarayan 2010	348	5099	172	8406	5.8%	3.51 [2.91, 4.22]	+
Langdon 2007	11	58	2	30	1.4%	3.28 [0.68, 15.87]	<del>                                     </del>
⊔m 2001	4	28	1	22	0.8%	3.50 [0.36, 33.82]	<del> </del>
Lord 2014	62	303	72	809	5.2%	2.63 [1.82, 3.81]	-
Mann 1999	24	82	2	46	1.5%	9.10 [2.04, 40.59]	
Murlana 2016	21	182	3	221	2.0%	9.48 [2.78, 32.32]	
Odderson 1995	0	48	0	76		Not estimable	
Palomeras 2014	98	107	47	92	3.3%	10.43 [4.70, 23.10]	
Rofes 2018	21	178	3	217	2.0%	9.54 [2.80, 32.55]	
Sala 1998	11	68	2	119	1.5%	11.29 [2.42, 52.64]	
Smithard 1996	20	60	9	57	3.0%	2.67 [1.09, 6.50]	
Sundar 2007	29	43	6	141	2.5%	46.61 [16.52, 131.48]	
Suntrup-Krueger 2017	29634	127970	12703	530607	6.1%	12.29 [12.02, 12.56]	
Zhang 2016	63	204	27	1035	4.7%	16.68 [10.28, 27.07]	
Total (95% CI)		156312		610867	100.0%	7.45 [6.01, 9.24]	•
Total events	35157		15345				
Heterogeneity: $Tau^2 = 0$	.20; Chl2	<b>=</b> 541.14.	df = 30	(P < 0.00)	001); ř •	- 94%	0.005 0.1 1 10 20
est for overall effect: Z							0.005 0.1 1 10 20 No Dysphagia Dysphagia

 $\frac{Footnotes}{(1)\ Multivariate\ logistic\ regression\ analysis:\ Association\ of\ pneumonia\ with\ dysphagia\ OR\ =\ 5.20$ 

Figure: Effect of dysphagia compared to no dysphagia on tubing in patients with stroke



Test for subgroup differences:  $Chi^2 = 0.12$ , df = 1 (P = 0.73),  $i^2 = 0\%$ 

Figure: Effect of dysphagia compared to no dysphagia on mRS in patients with stroke

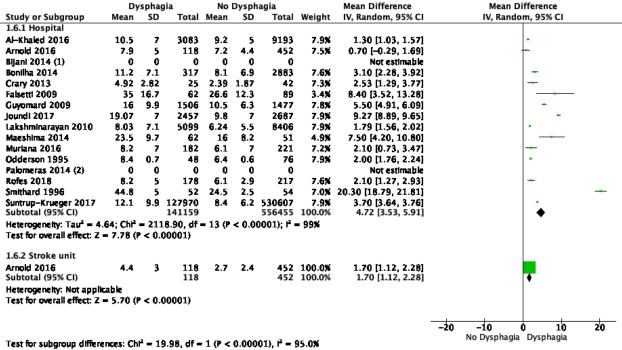
	Dysph	agia	No Dys	phagia		Odds Ratio	Odd	ls Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M–H, Random, 95% CI	M-H, Ran	dom, 95% CI
1.8.1 mRS 0-1								
Arnold 2016	42	118	303	452	45.0%	0.27 [0.18, 0.42]		
Joundi 2017	108	2396	624	2616	55.0%	0.15 [0.12, 0.19]	<b>←</b>	
Subtotal (95% CI)		2514		3068	100.0%	0.20 [0.11, 0.35]		
Total events	150		927					
Heterogeneity: Tau <sup>2</sup> =	• 0.15; Ch	$h^2 = 5.9$	7, df = 1	1 (P = 0.	$(01); t^2 = 1$	83 <b>%</b>		
Test for overall effect:	Z = 5.52	(P < 0	.00001)	-				
1.8.6 mRS ≥2								
Al-Khaled 2016	2291	3083	4628	9193	35.0%	2.85 [2.61, 3.12]		_
Arnold 2016	76	118	149	452	30.4%	3.68 [2.41, 5.63]		
Joundi 2017	1880	2396	1932	2616	34.7%	1.29 [1.13, 1.47]		
Palomeras 2014 (1)	1000	2350	1552	2010	J7.7/a	Not estimable		<del>-</del>
Subtotal (95% CI)	v	5597	v	-	100.0%	2.34 [1.24, 4.40]		
Total events	4247	3337	6709	12201	100.070	2.51 [2.21, 4.10]		
Heterogeneity: Tau <sup>2</sup> =		.e _ 10		- 2/0 -	0.00001	). P _ 084		
Test for overall effect:				- 2 (F C	0.00001	), 1 = 90M		
rest for overall effect.	1 - 2.97	, (r – <b>v</b>	.000)					
1.8.8 mRS 4,5								_
Joundi 2017	1256	2396	470		100.0X	5.03 [4.43, 5.72]		
Subtotal (95% CI)		2396		2616	100.0%	5.03 [4.43, 5.72]		•
Total events	1256		470					
Heterogeneity: Not ap	plicable							
Test for overall effect:	Z = 24.7	73 (P <	0.00001	)				
							-11	<del>                                     </del>
							0.2 0.5	1 2 6

Test for subgroup differences:  $Chi^2 = 116.63$ , df = 2 (P < 0.00001),  $i^2 = 96.3\%$ 

Footnotes

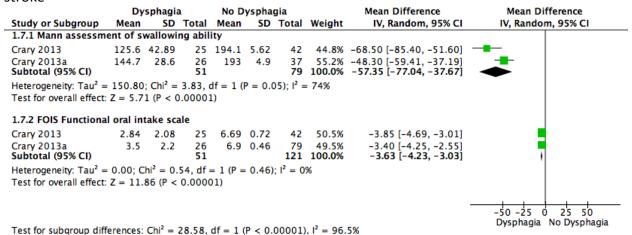
<sup>(1)</sup> Dysphagia vs dysphagia, p < 0.001

Figure: Effect of dysphagia compared to no dysphagia on length of stay in hospital or stroke unit in patients with stroke



Footnotes

Figure: Effect of dysphagia compared to no dysphagia on swallowing functions in patients with stroke



<sup>(1)</sup> Prolonged LOS and swallowing disorders: OR 6.69, 95% CI (3.73-12.01); p < 0.001

<sup>(2)</sup> Dysphagia vs dysphagia, longer stay in hospial, p = 0.016

Figure: Effect of dysphagia compared to no dysphagia on discharge status in patients with stroke

Sticke								
	Dysp	hagia	No Dys	phagia		Odds Ratio		Odds Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% CI		M-H, Random, 95% CI
1.11.1 Discharged hom	ie							
Arnold 2016	23	118	288	452	13.3%	0.14 [0.08, 0.23]		
Gordon 1987	4	41	20	50	10.2%	0.16 [0.05, 0.53]		<del></del>
Joundi 2017	423	2457	1439	2687	14.1%	0.18 [0.16, 0.21]		+
Lakshminarayan 2010	979	5099	2862	8406	14.2%	0.46 [0.42, 0.50]		•
Maeshima 2014	2	62	17	51	8.5%	0.07 [0.01, 0.31]		<del></del>
Odderson 1995	13	48	42	76	12.1%	0.30 [0.14, 0.66]		<del></del>
Rofes 2016	76	178	176	217	13.4%	0.17 [0.11, 0.27]		
Suntrup-Krueger 2017		127970			14.2%	0.09 [0.09, 0.09]		
Subtotal (95% CI)		135973			100.0%	0.17 [0.09, 0.35]		•
Total events	22651		365594			(,,		
Heterogeneity: $Tau^2 = 0$ .		= 1472 3		(P < 0.00)	001): P =	100%		
Test for overall effect: Z				1. ~ 0.00	VVI), 1 —	100%		
rest ior overall effect. 2	- 4.03 (1	~ 0.000	V-,					
1.11.2 Palliative/ Instit	ution							
Arnold 2016	92	118	160	451	14.3%	6.44 [4.00, 10.36]		
Joundi 2017	345	2457	116	2687	20.8%	3.62 [2.91, 4.50]		-
Muriana 2016	102		36	221	14.7%	6.55 [4.13, 10.40]		
Odderson 1995	22	48	17	76	8.6%	2.94 [1.34, 6.43]		
Palomeras 2014	77	107	39	92	11.8%	3.49 [1.93, 6.30]		
Smithard 1996	14	31	10	47	6.2%	3.05 [1.13, 8.23]		<u> </u>
Smithard 2007 (1)	17	0	10	7,	4.2/4	Not estimable		
Suntrup-Krueger 2017	•	127970	•	•	23.6%	2.79 [2.75, 2.82]		_
Subtotal (95% CI)	030/9	130913	139090		100.0%	3.90 [2.93, 5.21]		•
Total events	64331		139468					
Heterogeneity: $Tau^2 = 0$ .				< 0.0001)	$ ; ^2 = 61$	K .		
Test for overall effect: Z	= 9.26 (I	P < 0.0000	01)					
1.11.3 Discharged to lo								
-	-		825	200-	40.00	1 10 11 04 1 201		
Joundi 2017	941	2457		2687		1.16 [1.04, 1.30]		<b>.</b> _
Suntrup-Krueger 2017	18345	127970	26037	530607		3.24 [3.18, 3.31]		
Subtotal (95% CI)		130427		533294	100.0%	1.95 [0.71, 5.32]		
Total events	19286		26972					
Heterogeneity: $Tau^2 = 0$ .			, df = 1 (f	· < 0.0000	)1);	100%		
Test for overall effect: Z	= 1.30 (	P = 0.19						
1.11.5 Readmission, 1	vear							
Rofes 2018	75	178	117	217	100.0%	0.62 [0.42, 0.93]		
Subtotal (95% CI)	,,	178	117		100.0%	0.62 [0.42, 0.93]		<b>=</b>
Total events	75		117		200,0	0.02 [0.12] 0.00]		<b>~</b>
Heterogeneity: Not applic	-		117					
Test for overall effect: Z		- 0.02						
rest for overall effect; Z	- 2.33 (1	- 0.02)						
							0.02	0.1 1 10
								Dysphagia No Dysphagia
_								

Footnotes (1) Dysphagia vs no dysphagia, OR 1.73, 95% CI (1.02-2.95)

**Table 2**: Effect of dysphagia compared to no dysphagia on adverse effects and quality of life in patients with stroke

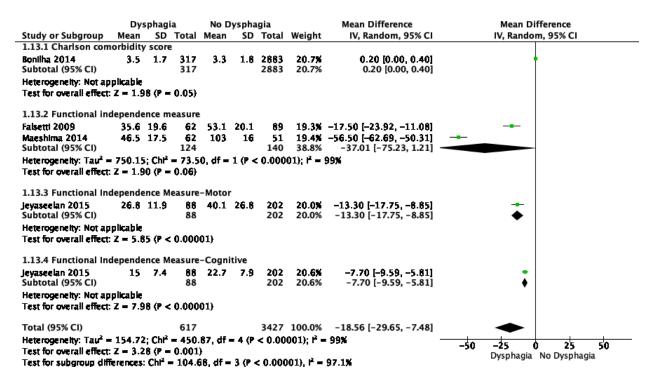
Outcome	Incidence (	%)/ Mean± SD	n (N)	OR [95% CI]/	l <sup>2</sup>	P value
	Dysphagia	No dysphagia		MD [95% CI]		
Neurological worsening	25%	7.0%	2(5774)	4.81 [2.94, 7.87]	51%	<0.00001
Seizure	2.9%	0.9%	1(5144)	3.45 [2.15, 5.53]	NA	<0.00001
Depression	3.3%	1.2%	1(5144)	2.86 [1.90, 4.33]	NA	<0.00001
Deep vein thrombosis	1.5%	0.4%	1(5144)	3.62 [1.84, 7.12]	NA	0.0002
Myocardial infarction	2.6%	1.0%	1(5144)	2.54 [1.62, 3.97]	NA	<0.00001
Cardiac arrest	4.4%	0.7%	1(5144)	6.75 [4.09, 11.16]	NA	<0.00001
Decubitus ulcer	1.9%	0.2%	1(5144)	8.53 [3.63, 20.00]	NA	<0.00001
UTI	6.7%	0.9%	1(395)	7.77 [1.72, 35.20]	NA	0.008
Gastrointestinal						
bleeding	2.4%	0.6%	1(5144)	4.46 [2.53, 7.87]	NA	<0.00001
Ambulation, 2 days	24%	38%	1(13505)	0.53 [0.49, 0.57]	NA	< 0.00001
Ambulation, discharge	27%	46%	1(13505)	0.43 [0.40, 0.46]	NA	< 0.00001
Charlson comorbidity						
score	3.5±1.7	3.3±1.8	1(3200)	0.20 [0.00, 0.40]	NA	0.05
Functional					99%	
independence measure	41.1±18.6	71.3±18.6	2(264)	-37.01 [-75.23, 1.21]		0.06
Functional					NA	
independence measure-						
motor	26.8±11.9	40.1±26.8	1(290)	-13.30 [-17.75, -8.85]		<0.00001
Functional					NA	
independence measure-						
cognitive	15±7.4	22.7±7.9	1(290)	-7.70 [-9.59, -5.81]		<0.00001

CI: Confidence intervals; I<sup>2</sup>: Heterogeneity; MD: Mean difference; n: Number of studies; N: Number of patients; p: Statistical significance value; OR: Odds Ratio; SD: Standard deviation; UTI: Urinary tract infections

Figure: Effect of dysphagia compared to no dysphagia on adverse events in patients with stroke

rigure: Effect o	-		_	-	eu to		on au			auen
Study or Subgroup	Dysph Events		No Dysp Events		Weight N	Odds Ratio 4-H, Random, 95% CI		Odds M-H, Rand	Ratio om, 95% Cl	
1.12.1 Neurological wo						,,			_	
Joundi 2017		2457	211	2687	72.4%	4.12 [3.48, 4.86]				
Rofes 2018 Subtotal (95% CI)	25	178 2635	10	452 3139	27.6% 100.0%	7.22 [3.39, 15.38] 4.81 [2.94, 7.87]				
Total events	663		221	5255	100.070	1101 [215 1, 7107]			•	
Heterogeneity: $Tau^2 = 0$ .				= 0.15	s); r² = 51%					
Test for overall effect: Z	= 6.24 (	P < 0.0	0001)							
1.12.2 Seizure										
Joundi 2017	71	2457	23		100.0%	3.45 [2.15, 5.53]			-	
Subtotal (95% CI) Total events		2457	22	2687	100.0%	3.45 [2.15, 5.53]			•	
Heterogeneity: Not apple	71 cable		23							
Test for overall effect: Z		P < 0.0	0001)							
1.12.3 Depression										
Joundi 2017	82	2457	32	2687	100.0%	2.86 [1.90, 4.33]			-	
Subtotal (95% CI)		2457			100.0%	2.86 [1.90, 4.33]			•	
Total events	B2		32							
Heterogeneity: Not applicate Test for overall effect: Z		P < 0.0	0001}							
			,							
1.12.4 DVT	35	2457		200-	100 00	2 62 [1 64 7 12]				
Joundi 2017 Subtotal (95% CI)	30	2457 2457	11		100.0% 100.0%	3.62 [1.84, 7.12] 3.62 [1.84, 7.12]			-	
Total events	36		11						_	
Heterogeneity: Not appli										
Test for overall effect: Z	= 3.72 (	r = v.v	UU2)							
1.12.5 MI									_	
Joundi 2017	64	2457	28		100.0%	2.54 [1.62, 3.97]			<b>T</b>	
Subtotal (95% CI) Total events	64	2457	28	2007	100.0%	2.54 [1.62, 3.97]			•	
Heterogeneity: Not appli										
Test for overall effect: Z	<b>-</b> 4.08 (	P < 0.0	001)							
1.12.6 Cardiac arrest										
Joundi 2017	107	2457	18		100.0%	6.75 [4.09, 11.16]			-	
Subtotal (95% CI)		2457		2687	100.0%	6.75 [4.09, 11.16]			•	
Total events Heterogeneity: Not appli	107 cable		16							
Test for overall effect: Z		P < 0.0	0001)							
1.12.7 Decubitus ulcer										
Joundi 2017	46	2457	6	26R7	100.0%	8.53 [3.63, 20.00]				
Subtotal (95% CI)		2457	•		100.0%	8.53 [3.63, 20.00]			•	
Total events	46		6							
Heterogeneity: Not applicate Test for overall effect: Z		P < 0.0	0001)							
1.12.8 UTI	12	170	•	217	100.00	7 77 17 72 25 201				
Rofes 2018 Subtotal (95% CI)	12	178 178	2		100.0% 100.0%	7.77 [1.72, 35.20] 7.77 [1.72, 35.20]				_
Total events	12		2							
Heterogeneity: Not appli		n – A A	A0\							
Test for overall effect: Z	- 2.00 (	r = 0.0	v0)							
1.12.9 GI bleed										
Joundi 2017 Subtotal (95% CI)	60	2457 2457	15		100.0% 100.0%	4.46 [2.53, 7.87] 4.46 [2.53, 7.87]				
Total events	60	2437	15	2007	100.0/0	7.70 [2.33, 7.07]				
Heterogeneity: Not appli	cable		-							
Test for overall effect: Z	<b>-</b> 5.15 (	P < 0.0	0001)							
1.12.10 Ambulation at	day 2									
Lakshminarayan 2010	1233	5099	3176		100.0%	0.53 [0.49, 0.57]				
Subtotal (95% CI) Total events	1233	5099	3176	8406	100.0%	0.53 [0.49, 0.57]		•		
Heterogeneity: Not appli			31/4							
Test for overall effect: Z		(P < 0.	00001)							
1.12.11 Ambulation at	dischare	ie								
Lakshminarayan 2010		5099	3884	8406	100.0%	0.43 [0.40, 0.46]				
Subtotal (95% CI)		5099			100.0%	0.43 [0.40, 0.46]		•		
Total events Heterogeneity: Not appli	1375 cable		3884							
Test for overall effect: Z		(P < 0.	00001)							
			•							
								0.1	10	100
Test for subgroup differe	ences: Ch	n² = 50	9.19, df =	10 (P ·	< 0.00001)	, r² = 98.0%	N	lo Dysphagia	Dysphagia	

Figure: Effect of dysphagia compared to no dysphagia on Charlson comorbidity and quality of life in patients with stroke



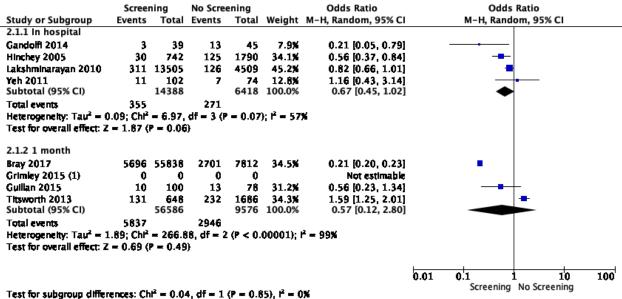
# Screening

Table 1: Effect of screening compared to no screening on mortality, pneumonia, length of stay in hospital and discharge in patients with stroke

Outcome	· · · · · ·	%)/ Mean±SD	n (N)	OR [95% CI]/	<b>I</b> <sup>2</sup>	P value
	Screening	No Screening	(,	MD [95% CI]	-	
Mortality	30.008					
Mortality, hospital	2%	4%	4(20806)	0.67 [0.45, 1.02]	57%	0.06
Mortality, 1 month	10%	31%	3(66162)	0.57 [0.12, 2.80]	99%	0.49
Pneumonia	7%	10%	11(536650)	0.55 [0.36, 0.83]	99%	0.004
Nasogastric tube,			, ,	- , -		
insertion	44%	53%	3(459)	0.86 [0.51, 1.45]	0%	0.58
Endotracheal tube						
insertion	7%	9%	2(260)	0.66 [0.27, 1.63]	0%	0.37
LOS, days	7.2±6.4	6.2±5.3	5(21005)	0.02 [-2.22, 2.26]	99%	0.99
Barthel Index Score	19.74±29.9	12.89±23.6	1(84)	6.85 [-4.79, 18.49]	NA	0.25
Adverse effects						
• UTI	5%	6%	1(67672)	0.79 [0.60, 1.05]	NA	0.10
• Temperature ≥ 38	43%	41%	1(176)	1.11 [0.61, 2.04]	NA	0.73
Discharge						
<ul> <li>Discharged home</li> </ul>						<
	29%	33%	2(20348)	0.84 [0.79, 0.90]	0%	0.00001
<ul> <li>Discharged to</li> </ul>						
Institution	20%	19%	1(2334)	1.08 [0.86, 1.35]	NA	0.53
Skilled nursing						
facility	14%	11%	1(2334)	1.27 [0.97, 1.66]	NA	0.09
• Hospice	2%	3%	1(2334)	0.78 [0.43, 1.39]	NA	0.39
Other hospitals	6%	5%	1(2334)	1.28 [0.86, 1.92]	NA	0.23
<ul> <li>Ambulation, 2 days</li> </ul>						<
	33%	44%	1(18014)	0.61 [0.57, 0.66]	NA	0.00001
<ul> <li>Ambulation, at</li> </ul>						
discharge	39%	42%	1(18014)	0.88 [0.82, 0.94]	NA	0.0002

CI: Confidence intervals; I<sup>2</sup>: Heterogeneity; LOS, Length of stay in hospital; MD: Mean difference; n: Number of studies; N: Number of patients; p: Statistical significance value; OR: Odds Ratio; SD: Standard deviation

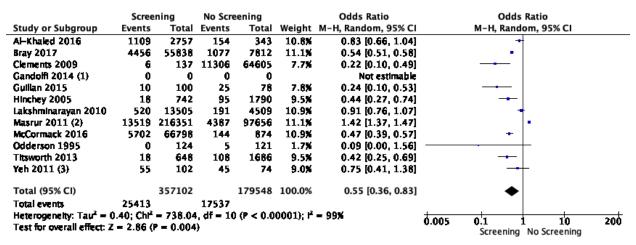
Figure 1: Effect of screening compared to no screening on mortality in patients with stroke



Footnotes

(1) Significantly less with screening p < 0.001 and more alive, OR 4.8; 95% CI 3.5-6.6

Figure 2: Effect of screening compared to no screening on pneumonia in patients with stroke



### Footnotes

- (1) OR 0.33, 95% CI 0.10-1.03
- (2) Patients on NPO were not considered
- (3) Adjusted data, dysphagia screening decreased pneumonia; OR 0.42, 95% CI, 0.18-1.00; p=0.05

Figure 3: Effect of screening compared to no screening on intubation and requirement of oxygen in patients with stroke

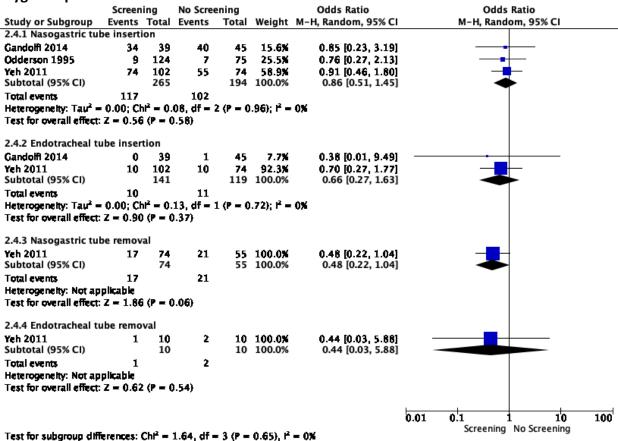


Figure 4: Effect of screening compared to no screening on length of stay in hospital in patients with stroke

	S	creenin	g	No :	Screeni	ng		Mean Difference	Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI	IV, Random, 95% CI
Gandolfi 2014	33.41	20.27	39	28.04	23.51	45	4.6%	5.37 [-3.99, 14.73]	
Hinchey 2005	5	4.5	742	4	4	1790	29.5X	1.00 [0.63, 1.37]	
Lakshminarayan 2010	7.1	6.3	13505	6.41	5.4	4509	29.7%	0.69 [0.50, 0.88]	•
Odderson 1995	7.2	0.5	124	9.8	0.9	75	29.7%	-2.60 [-2.82, -2.38]	•
Yeh 2011	32.4	28.4	102	31.9	25.1	74	6.3%	0.50 [-7.44, 8.44]	
Total (95% CI)			14512			6493	100.0%	0.02 [-2.22, 2.26]	•
Heterogeneity: $Tau^2 = 4$ Test for overall effect: Z				4 (P <	0.0000	11); l² =	99%	-	-10 -5 0 5 10 Screening No Screening

Figure 5: Screening vs no screening and intubation and Barthel index and Rankin score in patients with stroke

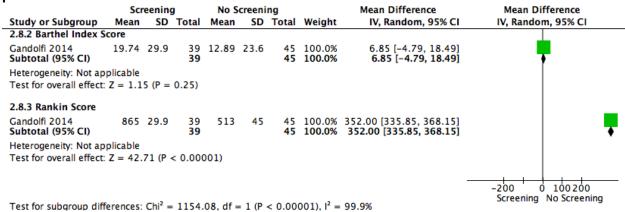


Figure 6: Effect of screening compared to no screening on urinary tract infection and temperature in patients with stroke

	Screer	ning	No Scree	ening		Odds Ratio	Odds Ratio
Study or Subgroup	Events	Total	<b>Events</b>	Total	Weight	M-H, Random, 95% CI	M-H, Random, 95% CI
2.9.3 UTI							
McCormack 2016 Subtotal (95% CI)	3311	66798 <b>66798</b>	54		100.0% 100.0%	0.79 [0.60, 1.05] <b>0.79 [0.60, 1.05</b> ]	-
Total events Heterogeneity: Not ap Test for overall effect:		i (P = 0.	54 10)				
2.9.4 Temperature ≥	38						
Gandolfi 2014 Subtotal (95% CI)	44	102 <b>102</b>	30	74 <b>74</b>	100.0% 100.0%	1.11 [0.61, 2.04] 1.11 [0.61, 2.04]	-
Total events Heterogeneity: Not ap Test for overall effect:		(P = 0.	30 73)				
							0.2 0.5 1 2

Figure 7: Effect of screening compared to no screening on discharge and ambulation in patients with stroke

	Scree	_	No Scre	_		Odds Ratio	Odds Ratio
tudy or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% CI	M-H, Random, 95% CI
2.7.1 Home							_
akshminarayan 2010 —	3841	13505	1435	4509	87.4%	0.85 [0.79, 0.92]	<b>-</b>
Fitsworth 2013	209	648	637	1686	12.6X	0.78 [0.65, 0.95]	<del></del>
Subtotal (95% CI)		14153		6195	100.0%	0.84 [0.79, 0.90]	<b>•</b>
Fotal events Heterogeneity: Tau² = 0. Fest for overall effect: Z				= 0.43	);		
2.7.2 Institution							
Fitsworth 2013 Subtotal (95% CI)	128	648 648	314		100.0% 100.0%	1.08 [0.86, 1.35]	
Fotal events	128	040	314	1000	100.0%	1.08 [0.86, 1.35]	
Heterogeneity: Not applic Fest for overall effect: Z	cable	P = 0.53	-				
2.7.3 Skilled nursing fa	cility						
Fitsworth 2013	66	648	186		100.0%	1.27 [0.97, 1.66]	
Subtotal (95% CI)		648		1086	100.0%	1.27 [0.97, 1.66]	
Fotal events Heterogeneity: Not appli Fest for overall effect: Z		P = 0.09	186				
2.7.4 Hospice							
Fitsworth 2013 Subtotal (95% CI)	15	648 648	50		100.0% 100.0%	0.78 [0.43, 1.39] 0.78 [0.43, 1.39]	
Fotal events	15		50				
Heterogeneity: Not applic Fest for overall effect: Z		P = 0.39	)				
2.7.5 Other hospital							<u> </u>
Fitsworth 2013 Subtotal (95% CI)	37	648 648	76		100.0% 100.0%	1.28 [0.86, 1.92] 1.28 [0.86, 1.92]	
Total events	37		76				
Heterogeneity: Not applik Fest for overall effect: Z		P = 0.23	)				
2.7.6 Ambulation at da	v 2						
akshminarayan 2010 Subtotal (95% CI)		13505 13505	1992		100.0% 100.0%	0.61 [0.57, 0.66] 0.61 [0.57, 0.66]	
Fotal events	4409	25505	1992	.505	100.070	0.02 [0.07, 0.00]	<b>~</b>
Heterogeneity: Not applic Fest for overall effect: Z		(P < 0.0	0001)				
2.7.7 Ambulation at dis	charge						
akshminarayan 2010		13505	1899	4509	100.0%	0.88 [0.82, 0.94]	<b>-</b>
Subtotal (95% CI)		13505			100.0%	0.88 [0.82, 0.94]	₹
Fotal events Heterogeneity: Not applic			1899				
Test for overall effect: Z	= 3.77 (	P = 0.00	(02)				

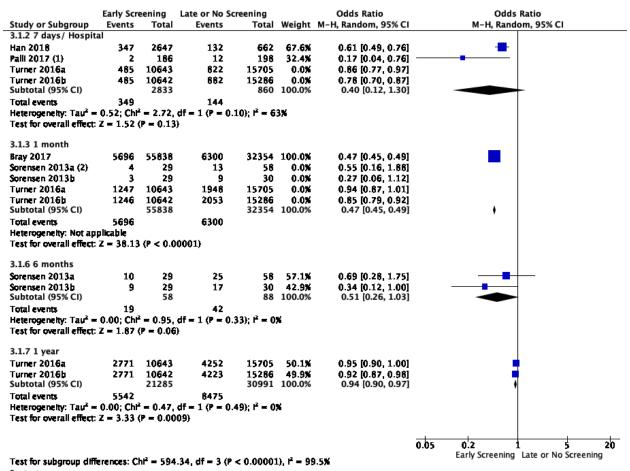
Test for subgroup differences:  $Chi^2 = 88.82$ , df = 6 (P < 0.00001),  $i^2 = 93.2\%$ 

Table 1: Effect of early screening compared to late screening on mortality, pneumonia, length of stay in hospital and discharge in patients with stroke

Outcome	Incidence (	%)/ Mean±SD	n (N)	OR [95% CI]/	l <sup>2</sup>	P value
	Early	Late Screening		MD [95% CI]		
	Screening					
Mortality						
• Overall	15%	23%	7(144307)	0.62 [0.43, 0.91]	99%	0.01
<ul> <li>Mortality,</li> </ul>						
hospital/ 7 days	5%	6%	4(55969)	0.74 [0.61, 0.89]	75%	0.002
<ul> <li>Mortality, 1</li> </ul>						
month	11%	16%	5(140614)	0.66 [0.42, 1.02]	99%	0.06
<ul> <li>Mortality, 6</li> </ul>						
months	33%	48%	1(146)	0.51 [0.26, 1.03]	0%	0.06
Mortality, 1 year	26%	27%	2(52276)	0.94 [0.90, 0.97]	0%	0.0009
Pneumonia	9%	15%	10(96367)	0.45 [0.35, 0.58]	83%	< 0.00001
Feeding tube						
<ul> <li>Nasogastric tube</li> </ul>						
feeding	38%	52%	2(146)	0.52 [0.26, 1.04]	0%	0.07
• PEG	14%	9%	2(146)	1.70 [0.51, 5.74]	8%	0.39
LOS, days	23.8±9.5	27.6±9.2	6(56085)	-2.27 [-3.12, -1.43]	92%	< 0.00001
Barthel Index Score, 1						
week	15±36	7±18	1(116)	8.00 [-2.36, 18.36]	NA	0.13
Barthel Index Score,						
discharge	17±43	12±28	1(116)	5.00 [-8.21, 18.21]	NA	0.46
ADR						
• UTI	0%	0%	1(116)	1.15 [0.55, 2.40]	NA	0.71
Discharge						
Discharged home	57%	53%	2(52276)	1.16 [1.08, 1.26]	79%	< 0.0001
• Readmission	2%	6%	1(138)	0.35 [0.06, 2.19]	NA	0.69
mRS						
• mRS, 4-5	28%	39%	1(3309)	0.59 [0.50, 0.71]	NA	0.00001

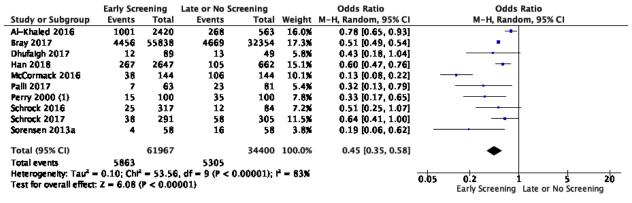
CI: Confidence intervals; I<sup>2</sup>: Heterogeneity; LOS, Length of stay in hospital; MD: Mean difference; n: Number of studies; N: Number of patients; p: Statistical significance value; PEG: Percutaneous endoscopic gastrostomy; OR: Odds Ratio; SD: Standard deviation

Figure 1: Effect of early vs late screening for dysphagia on mortality in patients with stroke



Footnotes

Figure 2: Effect of early vs late screening for dysphagia on pneumonia in patients with stroke



Footnote

<sup>(1)</sup> Gugging Swallowing Screen 24/7 dysphagia screening vs speech-language therapists during regular working hours

<sup>(2)</sup> Dysphagia screeing within 24 hours 98% vs 72%

<sup>(1)</sup> Following the guideline of early screening for dysphagia vs no (3 vs 4 days)

Figure 3: Effect of early vs late screening for dysphagia on nasogastric tubing or percutaneous gastroscopy in patients with stroke

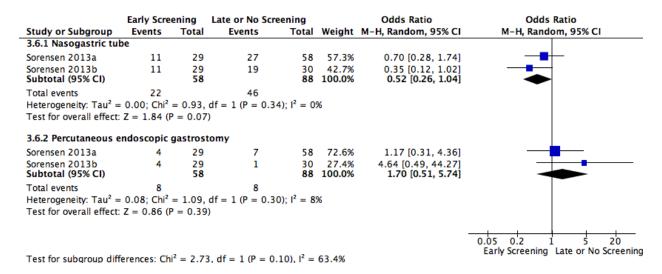


Figure 4: Effect of early vs late screening for dysphagia on length of stay in patients with stroke

	Early	Scree	ning	Late or	No Scre	ening		Mean Difference	Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI	IV, Random, 95% CI
Han 2018	6.2	13	2647	9.8	15.4	662	19.5%	-3.60 [-4.87, -2.33]	
Palli 2017	8	9.5	186	9	15	198	8.7%	-1.00 [-3.50, 1.50]	<del></del>
Sorensen 2013a	16	13	58	21	9	58	3.9%	-5.00 [-9.07, -0.93]	
Svendsen 2009 (1)	0	0	0	0	0	0		Not estimable	
Turner 2016a	26.2	9	10643	27.6	9	15705	34.0%	-1.40 [-1.62, -1.18]	•
Turner 2016b	26.2	9	10642	28.6	9	15286	34.0%	-2.40 [-2.62, -2.18]	•
Total (95% CI)			24176			31909	100.0%	-2.27 [-3.12, -1.43]	•
Heterogeneity: Tau <sup>2</sup> =	• 0.54; C	hi² = 4	48.43, df	= 4 (P <	0.0000	$(1); l^2 = 9$	2%		<u>-4 -2 0 2 4</u>
Test for overall effect									Early Screening Late or No Screening

Footnotes

(1) Higher quality of care (Screening and other interventions) are associated with shorter LOS

Figure 5: Effect of early vs late screening for dysphagia on Barthel score in patients with stroke

	Early S	Screer	ning	Late or l	No Screen	ing		Mean Difference	Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI	IV, Random, 95% CI
3.8.1 1 week									
Sorensen 2013a Subtotal (95% CI)	15	36	58 <b>58</b>	7	18	58 <b>58</b>		8.00 [-2.36, 18.36] 8.00 [-2.36, 18.36]	
Heterogeneity: Not ap	plicable								
Test for overall effect	Z = 1.51	1 (P =	0.13)						
3.8.2 At discharge									
Sorensen 2013a Subtotal (95% CI)	17	43	58 <b>58</b>	12	28	58 <b>58</b>	100.0% 100.0%	5.00 [-8.21, 18.21] 5.00 [-8.21, 18.21]	
Heterogeneity: Not ap	plicable								
Test for overall effect	: Z = 0.74	4 (P =	0.46)						
								•	-10 -5 0 5 10
									Early Screening Late or No Screen

Test for subgroup differences:  $Chi^2 = 0.12$ , df = 1 (P = 0.73),  $I^2 = 0\%$ 

Figure 6: Effect of early vs late screening for dysphagia on urinary tract infectors in patients with stroke

	Early Scre	ening	Late or No Scr	eening		Odds Ratio	Odds Ratio	
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% CI	M–H, Random, 95% CI	
3.7.1 UTI								
Sorensen 2013a Subtotal (95% CI)	26	58 58	24		100.0% 100.0%	1.15 [0.55, 2.40] 1.15 [0.55, 2.40]		
Total events Heterogeneity: Not ap Test for overall effect		P = 0.71	24					
Test for subgroup dif	forences: No	et annile:	.hla				0.2 0.5 1 2 Late or no Screening Early Screening	5

Figure 7: Effect of early vs late screening for dysphagia on discharge and readmission in patients with stroke

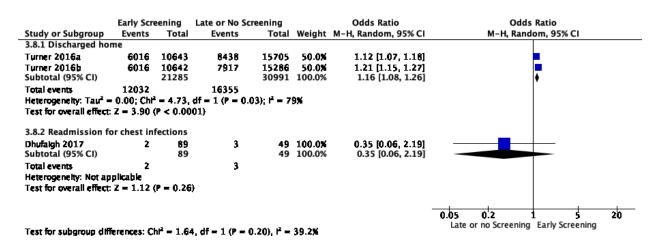
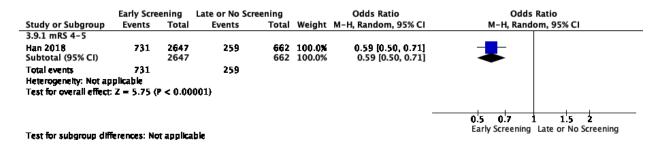


Figure 8: Effect of early vs late screening for dysphagia on mRS in patients with stroke



### Assessment

Table 1: Effect of early assessment compared to late assessment on pneumonia and discharge in patients with stroke

Outcome	Incidence (%)/ Mean±SD		n (N)	OR [95% CI]/	l <sup>2</sup>	P value
	Early	Late		MD [95% CI]		
	assessment	assessment				
Pneumonia	NR*	40%-100%	1(24542)	0.60 (0.40-0.78) at		<0.0001
		more		< 6 hr vs 2-24 hr		
		compared		0.40 (0.16-0.59) at	NA	<0.0001
		to early		< 6 hr vs 24-48 hr		
	12.8%**	26.5%	1(135)	0.41 [0.17, 0.99]	NA	0.05
Improvement of						
dysphagia	1.5	0.6	1(135)	Not reported	NA	NA

<sup>\*:</sup> Bray 2017; \*\*: Dhufaigh 2017; CI: Confidence intervals; I<sup>2</sup>: Heterogeneity; MD: Mean difference; n: Number of studies; N: Number of patients; NA: Not applicable; p: Statistical significance value; OR: Odds Ratio; SD: Standard deviation

Figure 1: Pneumonia with early or late assessment of dysphagia in patients with acute or subacute stroke

	Early Assess	ment	Late Assess	sment		Odds Ratio	Odds Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% CI	M-H, Random, 95% CI
Bray 2017 (1)	0	0	0	0		Not estimable	<u> </u>
Dhufaigh 2017	11	86	13	49	100.0%	0.41 [0.17, 0.99]	- <b></b>
Total (95% CI)		86		49	100.0%	0.41 [0.17, 0.99]	•
Total events	11		13				
Heterogenelty: Not ap	plicable						0.01 0.1 1 10 100
Test for overall effect:	Z = 1.97 (P =	0.05)					Early Assessment Late Assessment

Footnotes

(1) Early vs late: OR: 0.60 (0.40-0.78) at < 6 hr vs 6-24 hr; OR: 0.40 (0.16-0.59) at < 6 hr vs 24-48 hr

Figure 2: Improvement in Dysphagia with early or late assessment of dysphagia in patients with acute or subacute stroke

	Early As	sessn	nent	Late A	ssessn	ient		Mean Difference		Mean D	ifference	
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI		IV, Rando	om, 95% CI	
Dhufaigh 2017	1.5	0	86	0.6	0	49		Not estimable				
Total (95% CI)			86			49		Not estimable				
Heterogeneity: Not ap Test for overall effect:		cable							-100		0 50 Late Assessment	100

Table 2: Effect of clinical bedside assessment compared to instrumental assessment on mortality, pneumonia tube removal, discharge and LOS in patients with stroke

			0			
Outcome	Incide	nce (%)	n (N)	OR [95% CI]	$I^2$	P value
	Clinical	Instrumental				
	bedside	assessment				
	assessment					
Mortality	10.5%	7.3%	1(440)	1.49 [0.76, 2.90]	NA	0.24
Pneumonia	12.3%	6.4%	1(440)	2.06 [1.05, 4.04]	NA	0.04
Correct						
judgement in						
Tube removal	62.5.0%	100%	1(32)	0.05 [0.00, 0.96]	NA	0.05
Discharge,						
home	43.6%	46.4%	1(440)	0.90 [0.62, 1.30]	NA	0.57
Discharge, on						
standard diet	51.1%	65.6%	1(378)	0.47 [0.31, 0.71]	NA	0.004
LOS, days	17.3±15.2	23.7±20.2	1(440)	-6.33 [-9.67, -2.99]	NA	0.0002

Cl: Confidence intervals; I<sup>2</sup>: Heterogeneity; n: Number of studies; N: Number of patients; NA: Not applicable; p: Statistical significance value; OR: Odds Ratio

Figure 3: Effect of clinical bedside assessment compared to instrumental assessment on mortality in patients with stroke

	Clinical be	dside	Instrur	nent		Odds Ratio	Odds Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% CI	M-H, Random, 95% CI
Bax 2014	23	220	16	220	100.0%	1.49 [0.76, 2.90]	
Total (95% CI)		220		220	100.0%	1.49 [0.76, 2.90]	-
Total events	23		16				
Heterogeneity: Not ap Test for overall effect		= 0.24)	•				0.2 0.5 1 2 5 Instrument Clinical bedside

Figure 4: Effect of clinical bedside assessment compared to instrumental assessment on pneumonia in patients with stroke

	Clinical be	dside	Instrur	nent		Odds Ratio		Odds	Ratio	
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% CI		M-H, Rand	om, 95% CI	
Bax 2014	27	220	14	220	100.0%	2.06 [1.05, 4.04]				
Total (95% CI)		220		220	100.0%	2.06 [1.05, 4.04]			-	_
Total events	27		14							
Heterogeneity: Not ap Test for overall effect		- 0.04)	•				0.2	0.5 Instrument	1 2 Clinical bedside	5

Figure 5: Effect of clinical bedside assessment compared to instrumental assessment on discharge in patients with stroke

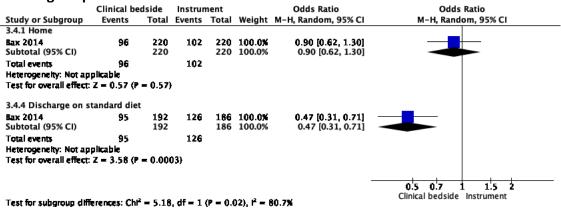


Figure 6: Effect of clinical bedside assessment compared to instrumental assessment on length of stay in hospital in patients with stroke

	Clinic	al bed	side	Ins	trume	nt		Mean Difference		Mea	n Differe	nce	
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI		IV, Ra	ndom, 9	5% CI	
Bax 2014	17.34	15.2	220	23.67	20.2	220	100.0%	-6.33 [-9.67, -2.99]					
Total (95% CI)			220			220	100.0%	-6.33 [-9.67, -2.99]	-				
Heterogeneity: Not ap Test for overall effect		1 (P = (	0.0002	)					-10 CI	-5	ide Insti	5 rument	10

Table 3: Effect of clinical bedside assessment compared to instrumental assessment in patients with stroke

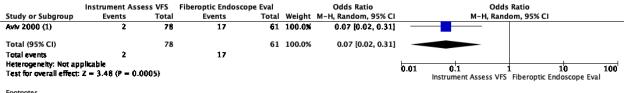
Outcome	Incidend	ce (%)	n (N)	OR [95% CI]	l <sup>2</sup>	P value
	Instrumental FEES					
	assessment					
	with VFSS					
Pneumonia	29.2%	4.8%	1(45)	8.24 [0.92, 73.79]	NA	0.06
PEG	2.6%	23.8%	1(99)	0.08 [0.01, 0.47]	NA	0.005

CI: Confidence intervals; Diet: Non-oral feeding: 1-3; FEES: fiberoptic endoscopic evaluation of swallowing; Oral diets: 4-7; I<sup>2</sup>: Heterogeneity; n: Number of studies; N: Number of patients; NA: Not applicable; p: Statistical significance value; PEG: Percutaneous endoscopic gastrostomy; OR: Odds Ratio

Figure 8: Pneumonia with videofluoroscopy (VFSS) compared to fiberoptic endoscopic evaluation of swallowing (FEES) in patients with stroke

	Instrument Asse	ess VFS	Fiberoptic Endos	cope Eval		Odds Ratio	Odds Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% CI	M-H, Random, 95% CI
Aviv 2000	7	24	1	21	100.0%	8.24 [0.92, 73.79]	
Total (95% CI)		24		21	100.0%	8.24 [0.92, 73.79]	
Total events	7		1				
Heterogeneity: Not ap Test for overall effect		(6)					0.01 0.1 1 10 100 Instrument Assess VFS Fiberoptic Endoscope Eval

Figure 9: Percutaneous endoscopic gastrostomy with videofluoroscopy (VFSS) compared to fiberoptic endoscopic evaluation of swallowing (FEES) in patients with stroke



Footnotes (1) Intrument group was all patients

Table 4: Effect of Complementary and standard assessment in patients with acute or subacute stroke

Outcome	Incidence (%)/	Mean±SD	n (N)	OR [95% CI]/	l <sup>2</sup>	P value
	Complementary	Standard		MD [95% CI]		
	and standard	assessment				
	assessment					
Mortality	13.5%	19.6%	1(311)	0.64 [0.35, 1.18]	NA	0.15
Pneumonia	25.7%	21.5%	1(311)	1.26 [0.75, 2.14]	NA	0.38
Independence						
At home	48.6%	44.8%	1(311)	1.17 [0.75, 1.83]	NA	0.50
At residential care	43.2%	45.4%	1(311)	0.92 [0.59, 1.43]	NA	0.70
At public hospital	8.1%	9.8%	1(311)	0.81 [0.37, 1.78]	NA	0.60
Length of stay	7±5.2	6±5.2	1(311)	1.00 [-0.16, 2.16]	NA	0.09
FOIS	6.2±1.2	6±1.3	1(311)	0.20 [-0.08, 0.48]	NA	0.16

CI: Confidence intervals; Diet: Non-oral feeding: 1-3; Oral diets: 4-7; I<sup>2</sup>: Heterogeneity; MD: Mean difference; n: Number of studies; N: Number of patients; NA: Not applicable; p: Statistical significance value; OR: Odds Ratio; SD: Standard deviation

Figure 10: Mortality with full clinical and instrumental assessment compared to no assessment in patients with acute or subacute stroke

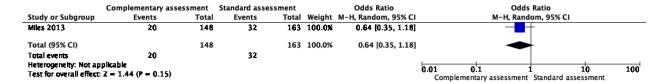


Figure 11: Pneumonia with full clinical and instrumental assessment compared to no assessment in patients with acute or subacute stroke

	Complementary asse	ssment	Standard asse	ssment		Odds Ratio	Odds Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% CI	M–H, Random, 95% CI
Miles 2013	38	146	35	163	100.0%	1.26 [0.75, 2.14]	-
Total (95% CI)		148		163	100.0%	1.26 [0.75, 2.14]	•
Total events	36		35				
Heterogeneity: Not ap Test for overall effect	pplicable t Z = 0.87 (P = 0.38)						0.01 0.1 1 10 100 Standard assessment Complementary assessment

Figure 12: Independence at home, residential or hospital with full clinical and instrumental assessment compared to no assessment in patients with acute or subacute stroke

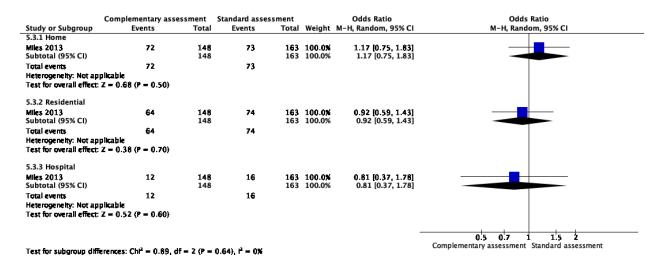
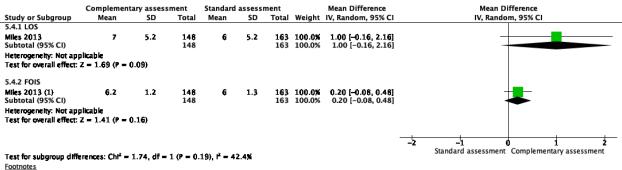


Figure 13: Length of stay and diet with full clinical and instrumental assessment compared to no assessment in patients with acute or subacute stroke



Footnotes
(1) Non-oral feeding: 1-3; Oral diets: 4-7

## Treatment 1 – Dietary Interventions

Table 1: Effect of consistency modification on pneumonia, dysphagia at end, penetration, UTI and satisfaction in patients with dysphagia after stroke

Outcome	Inciden	ce %	n (N)	RR [95% CI]/	l <sup>2</sup>	P value
	Consistency modification	Control				
Pneumonia						
• RCT	0.0%	20.0%	4(100)	0.19 [0.03, 1.40]	0%	0.1
Dysphagia at end						
• RCT	33.3%	84.8%	64	0.40 [0.20, 0.77]	0%	0.006
Penetration						
• RCT	0.0%	13.1%	1(122)	0.06 [0.00, 1.00]	NA	0.05
UTI*						
• RCT	NR	NR	NR	NR	NR	.024
Aspiration						
• RCT	21.3%	45.7%	188	0.51 [0.14, 1.77]	90%	0.29
Satisfaction**						
• RCT	NR	NR	NR	NR	NR	0.414

<sup>\*:</sup> Higher proportion in thickened compared to water protocol; \*\*: Water protocol vs thickened; CI: Confidence intervals; I<sup>2</sup>, p: Heterogeneity; n: Number of studies; N: Number of patients; p: Statistical significance value

Figure 1: Pneumonia (Data from RCTs)

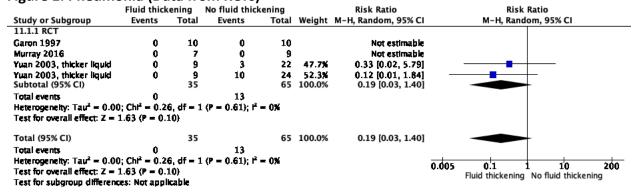
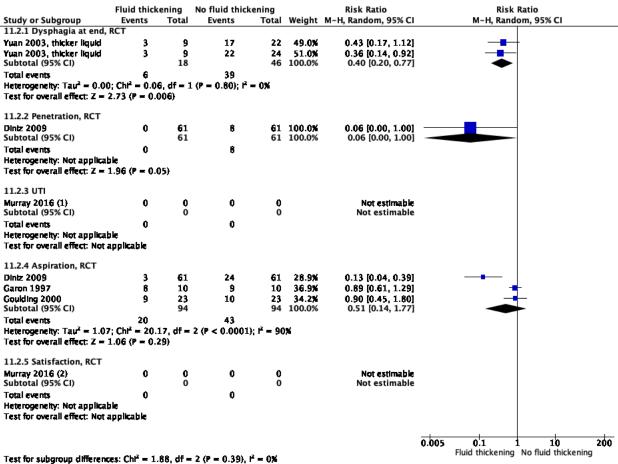


Figure 2: Dysphagia and penetration with thick fluid in patients with stroke and dysphagia (Data from RCTs)



Footnotes  $\overline{\text{(1) Higher proportion thickened compared to water protocol, p} = 0.024$ 

<sup>(2)</sup> Water protocol vs thickened vs , p = 1.0 at 7 days, 0.414 at 14 days

Table 2: Length of stay in hospital, time to resolution of dysphagia and length of days of no aspiration with thick fluid in patients with stroke and dysphagia

Outcome	Mear	n±SD	n (N)	MD [95% CI]	l <sup>2</sup>	P value
	Fluid	Control				
	thickening					
LOS in hospital,						
days						
• RCT	24±9	34±12	1(64)	-9.58 [-15.41, -3.76]	19%	0.001
Time to resolution						
of dysphagia						
	38±29	27±13	1(14)	11.00 [-13.89, 35.89]	NA	0.39
Days of no						
aspiration						
• RCT	39±19	33±11	1(20)	6.10 [-7.17, 19.37]	NA	0.37

CI: Confidence intervals; I<sup>2</sup>, p: Heterogeneity; LOS: Length of stay; MD: Mean difference; n: Number of studies; N: Number of patients; p: Statistical significance value; SD: Standard Deviation

Figure 3: Length of stay in hospital, time to resolution of dysphagia and length of days of no aspiration with thick fluid in patients with stroke and dysphagia

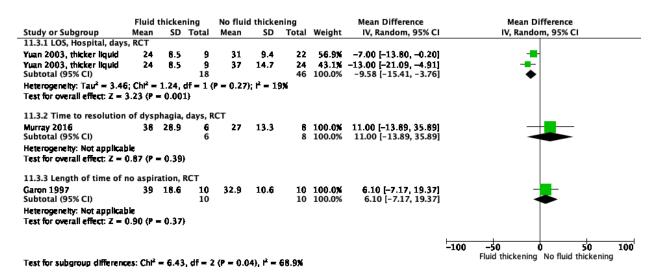


Table 3: Effect of fluid thickening on albumin in patients with dysphagia after stroke

Outcome	Mear	n±SD	n (N)	MD [95% CI]	l <sup>2</sup>	P value
	Fluid	Control				
	thickening					
Albumin						
• RCT	37.0±6.7	36.7±10.0	1(64)	0.30 [-3.94, 4.55]	0%	0.89
BUN/Cr ratio						
RCT	25±13	20±4	1(14)	5.00 [-5.76, 15.76]	NA	0.36
Fluid intake						
Oral thickened fluid						
• Overall	10041496	705   162	2(27)	225.22 [-52.84,	0%	0.11
- DCT	1004±486	785±162	1(14)	503.28] 221.00 [-183.75,	NA	0.11
• RCT	1028±486	807±162	1(14)	625.75]	NA	0.28
NRCT	10281480	8071102	1(13)	229.00 [-153.65,	NA	0.28
• INKCI	984±486	755±162	1(13)	611.65]	INA	0.24
• Enteral + oral	9641460	7331102		011.05]		0.24
fluid						
NRCT			1(13)	3387.00 [3004.35,	NA	
• MICI	4142±486	755±162	1(13)	3769.65]	IVA	<0.00001
Water/ thin liquid				5.05.051		0.0000
Overall				-324.95 [-578.81, -		
	698±255	1100±602	2(53)	71.08]	44%	0.01
• RCT			1(14)	-228.00 [-425.96, -	NA	
	71±70	299±274		30.04]		0.02
• NRCT			1(39)	-498.00 [-841.70, -	NA	
	907±317	1405±727		154.30]		0.005
Fluid intake						
<ul> <li>Overall</li> </ul>			3(77)	-133.22 [-541.90,	94%	
	1179±235	1612±455		275.46]		0.52
• RCT			2(38)	140.48 [-41.56,	68%	
	745±164	649±172		322.51]		0.13
• NRCT			1(39)	-986.00 [-1330.71, -	NA	
	1589±302	2575±737		641.29]		<0.0001

CI: Confidence intervals; I<sup>2</sup>, p: Heterogeneity; LOS: Length of stay; MD: Mean difference; n: Number of studies; N: Number of patients; p: Statistical significance value; SD: Standard Deviation

Figure 4: Effect of thickened fluid on albumin and BUN/Cr ratio in patients with stroke and dysphagia

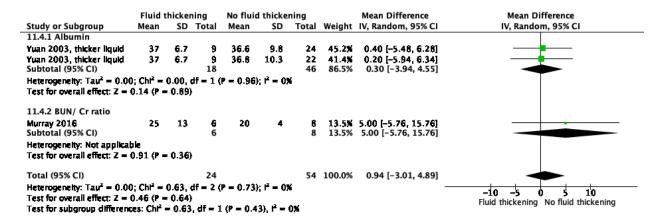
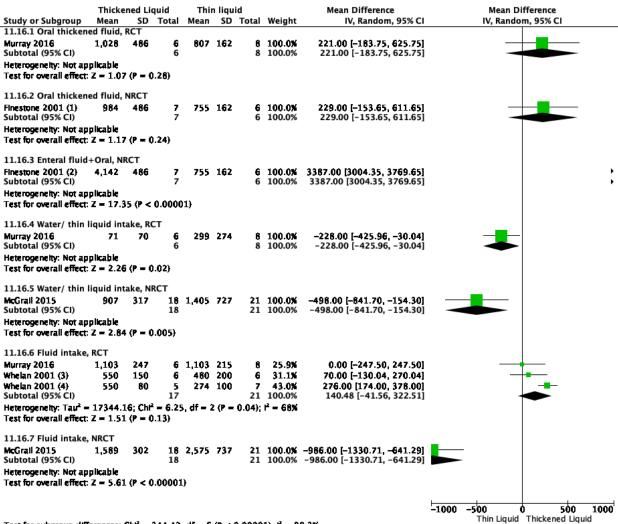


Figure 5: Effect of thickened fluid on fluid intake in patients with stroke and dysphagia



Test for subgroup differences:  $Chi^2 = 344.42$ , df = 6 (P < 0.00001),  $i^2 = 96.3\%$ 

<u>Footnotes</u>

<sup>(1)</sup> Intervention group also received 3158 mL of enteral fluid

<sup>(2)</sup> Intervention group also received 3158 mL of enteral fluid

<sup>(3)</sup> Stroke unit, Prethickened vs powdered thickened

<sup>(4)</sup> Non-specialist ward, Prethickened vs powdered thickened

Table 4: Effect of Dysphagia/texture modified diet on energy and protein intake in patients with post-stroke dysphagia

Outcome	Mear	t ± SD	n (N)	MD [95% CI]	l <sup>2</sup>	P value
	Dysphagia diet/Texture modification	Regular diet/No Texture modification				
Energy intake, Kcl/kg/day						
• NRCT	19.4±6.2	22.3±9.0	1(52)	-2.90 [-7.09, 1.29]	NA	0.18
Protein intake, g/kg/day						
NRCT	0.71±0.29	0.90±0.31	1(68)	-0.19 [-0.34, -0.04]	NA	0.02

CI: Confidence intervals; I<sup>2</sup>, p: Heterogeneity; MD: Mean differences; n: Number of studies; N: Number of patients; NA: Not applicable; p: Statistical significance value; RR: Risk Ratio; SD: Standard deviation

Figure 6: Energy intake (Kcl/kg/day) with texture modified diet in patients with post-stroke dysphagia

	Dysphagia diet			Reg	ular d	iet		Mean Difference	Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI	IV, Random, 95% CI
Foley 2006	19.4	6.2	17	19.2	5.1	11	100.0%	0.20 [-4.02, 4.42]	
Total (95% CI)			17			11	100.0%	0.20 [-4.02, 4.42]	
Heterogeneity: Not ap Test for overall effect		) (P =	0.93)						-4 -2 0 2 4 Regular diet Dysphagia diet

Figure 7: Protein intake (g/kg/day), with texture modified diet in patients with post-stroke dysphagia

	Dysphagia diet			Regular diet				Mean Difference	Mean Difference		
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI		IV, Random, 95% CI	
Foley 2006	0.71	0.29	20	0.69	0.17	12	100.0%	0.02 [-0.14, 0.18]			
Total (95% CI)			20			12	100.0%	0.02 [-0.14, 0.18]			
Heterogeneity: Not ap Test for overall effect:						-0.2	-0.1 0 0.1 0.2 Regular diet Dysphagia diet	-			

# **Treatment 2a – Behavioural Interventions**

Table 1: Effect of behavioural therapy on dysphagia scores in patients with dysphagia after stroke

Outcome	Mea	n±SD	n (N)	MD [95% CI]	l <sup>2</sup>	P value
	Behavior	Control				
Improvement in						
dysphagia scores						
<ul> <li>Overall</li> </ul>	6.4±3.6	4.1±3.5	18(510)	1.18 [0.78, 1.57]	70%	<0.00001
• RCT	5.0±2.9	3.0±2.8	16(440)	0.97 [0.64, 1.30]	68%	<0.00001
• EMST, RCT	1.4±1.3	0.7±1.4	4(108)	0.99 [0.51, 1.47]	16%	< 0.0001
<ul> <li>Swallowing</li> </ul>	7.6±4.2	5.1±4.1	14(402)		73%	<0.00001
exercises,						
overall				1.01 [0.67, 1.34]		
<ul> <li>Swallowing</li> </ul>	6.1±3.4	3.9±3.3	12(332)		73%	<0.00001
exercises, RCT				1.19 [0.68, 1.69]		
<ul> <li>Swallowing</li> </ul>	15.5±8.4	10.5±7.3	2(70)		40%	0.06
exercises, NRCT				3.11 [-0.12, 6.34]		
Post intervention,						
dysphagia scores						
Overall	11.3±4.1	14.2±4.2	19(555)	-1.44 [-2.28, -0.60]	90%	0.0008
• RCT	8.8±3.5	11.1±3.7	17(485)	-0.82 [-1.05, -0.59]	0%	<0.00001
• EMST, RCT	3.8±1.3	4.6±1.4	4(109)	-0.81 [-1.22, -0.39]	14%	0.0001
<ul> <li>Swallowing</li> </ul>	13.0±4.7	16.7±4.9	15(485)		92%	0.007
exercises,						
overall				-1.66 [-2.87, -0.45]		
<ul> <li>Swallowing</li> </ul>	10.2±4.1	13.2±4.4	13(376)		0%	<0.00001
exercises, RCT				-0.84 [-1.14, -0.54]		
<ul> <li>Swallowing</li> </ul>	29.4±8.2	34.1±7.2	2(70)		14%	<0.00001
exercises, NRCT				-6.71 [-8.51, -4.91]		

CI: Confidence intervals; I<sup>2</sup>, p: Heterogeneity; n: Number of studies; N: Number of patients; NA: Not applicable; NRCT: Non-randomized controlled trial; p: Statistical significance value; SD: Standard Deviation; MD: Mean Difference; RCT: Randomized controlled trial

Figure 1: Improvement in dysphagia scores with behavior therapy in patients with dysphagia after stroke

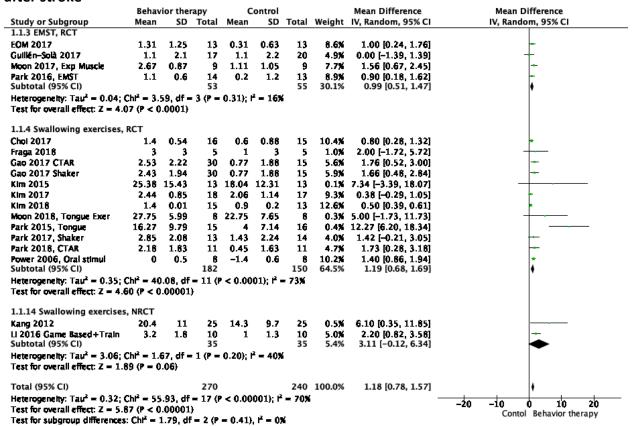


Figure 2: Improvement in dysphagia scores with different kinds of behavior therapy in patients with dysphagia after stroke

	benav	ior thera	ιру		Control			Mean Difference	Mean Difference
tudy or Subgroup	Mean	SD	Total	Mean		Total	Weight	IV, Random, 95% CI	IV, Random, 95% CI
.3.3 EMST, RCT									
OM 2017	1.31	1.25	13	0.31	0.63	13	8.6%	1.00 [0.24, 1.76]	<u>+</u>
uillén-Solà 2017	1.1	2.1	17	1.1	2.2	20	4.9%	0.00 [-1.39, 1.39]	+
loon 2017, Exp Muscle	2.67	0.87	9	1.11	1.05	9	7.7%	1.56 [0.67, 2.45]	-
ark 2016, EMST	1.1	0.6	14	0.2	1.2	13	8.9%	0.90 [0.18, 1.62]	_
ubtotal (95% CI)	1.1	0.0	53	V.E	1.2	55	30.1%	0.99 [0.51, 1.47]	•
eterogeneity: $Tau^2 = 0.04$ ; (est for overall effect: $Z = 4.0$				0.31);	r² = 16%			,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	ľ
.3.4 Shaker, RCT									
hoi 2017	1.4	0.54	16	0.6	0.88	15	10.4%	0.80 [0.28, 1.32]	-
ao 2017 Shaker	2.43	1.94	30	0.77	1.88	15	5.9X	1.66 [0.48, 2.84]	-
ark 2017, Shaker	2.85	2.08	13	1.43	2.24	14	4.0%	1.42 [-0.21, 3.05]	<del>  - </del>
ubtotal (95% CI)			59			44	20.3%	0.98 [0.52, 1.45]	<b>*</b>
eterogeneity: $Tau^2 = 0.00$ ; (est for overall effect: $Z = 4.1$			2 (P =	0.36);	r² = 1%				
.3.5 CTAR, RCT									
ao 2017 CTAR	2.53	2.22	30	0.77	1.66	15	5.6%	1.76 [0.52, 3.00]	
Im 2018	1.4	0.01	15	0.9	0.2	13	12.6%	0.50 [0.39, 0.61]	<b>.</b>
ark 2018, CTAR	2.18	1.83	11	0.45	1.63	11	4.7%	1.73 [0.28, 3.18]	
ubtotal (95% CI)	2.10	1.00	56	V.73	1.43	39	22.8%	1.15 [0.14, 2.15]	•
eterogeneity: $Tau^2 = 0.54$ ; (est for overall effect: $Z = 2.2$				0.04);	r² = 70%			( 1, =)	•
	,								
.3.6 Tongue exercise, RCT		A 0F		2.00			A 2-2	A 20 L A 20 1 AC1	L
lm 2017	2.44	0.85	18	2.06	1.14	17	9.3%		<u>†</u>
loon 2018, Tongue Exer	27.75	5.99	. 6	22.75	7.65	- 6		5.00 [-1.73, 11.73]	<del>                                     </del>
ark 2015, Tongue ubtotal (95% CI)	16.27	9.79	15 41	4	7.14	16 41		12.27 [6.20, 18.34] 5.47 [-2.11, 13.05]	
eterogeneity: Tau <sup>2</sup> = 38.33;	Ch# - 1	16 27 45		_ 0 00	M31- 12 -		10.0/6	J. 17 [ L.11, 13.03]	
est for overall effect: $Z = 1.4$			- 2 (1	- 0.00	1037, 1 -	- 00%			
.3.8 Voice therapy, RCT raga 2018	3	3	5	1	3	5	1.0%	2.00 [-1.72, 5.72]	
ubtotal (95% CI)	•	•	5	-	•	5	1.0%	2.00 [-1.72, 5.72]	-
eterogeneity: Not applicable est for overall effect: $Z=1.6$		).29)							
.3.9 Oral stimulation, RCT									
ower 2006, Oral stimul	0	0.5	8	-1.4	0.6	8	10.2%	1.40 [0.86, 1.94]	+
ubtotal (95% CI)			8			8	10.2%	1.40 [0.86, 1.94]	♦
eterogeneity: Not applicable est for overall effect: Z = 5.0		0.00001)							
.3.10 Game based, NRCT									
2016 Game Based+Train   ubtotal (95% CI)	3.2	1.6	10 10	1	1.3	10 10	5.0% 5.0%	2.20 [0.82, 3.58] 2.20 [0.82, 3.58]	<del>-</del>
eterogeneity: Not applicable est for overall effect: Z = 3.1		).002)							
.3.11 Neck exercise, NRCT									
lm 2015	25.38	15.43	13	18.04	12.31	13	0.1%	7.34 [-3.39, 18.07]	<del>-  </del>
ubtotal (95% CI)		-	13			13		7.34 [-3.39, 18.07]	
eterogeneity: Not applicable est for overall effect: $Z=1.3$		).18)							
.3.14 Behavior, NRCT									
ang 2012	20.4	11	25	14.3	9.7	25	0.5%	6.10 [0.35, 11.85]	
ubtotal (95% CI)	-		25		-	25	0.5%	6.10 [0.35, 11.85]	
eterogeneity: Not applicable est for overall effect: $Z = 2.0$		1.04)							
	1.	,	270			240	100.0%	1.18 [0.78, 1.57]	
			2/0			240	100.0%	1.10 [0./8, 1.5/]	1.
otal (95% CI) eterogenelty: Tau² = 0.32; (	AL12	- 62 -15							I'

Figure 3: Dysphagia scores after different behavior therapies in patients with dysphagia after stroke

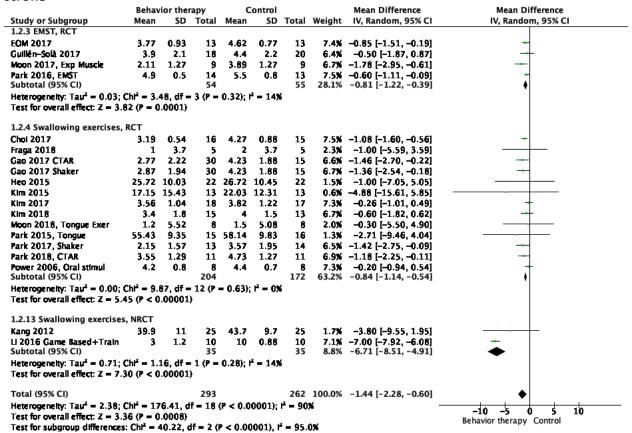


Figure 4: Dysphagia scores after different kinds of behavior therapies in patients with dysphagia after stroke

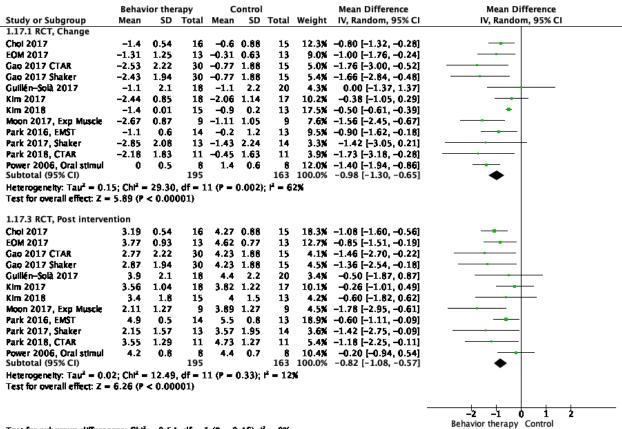
ysphagia after str				_				Mann D'11	Maria Differen
Study or Subgroup		ior thera	ipy Total		Control	Total	Weight	Mean Difference IV, Random, 95% CI	Mean Difference IV, Random, 95% CI
Study or Subgroup 1.4.3 EMST, RCT	Mean	30	rotal	Mean	30	iotai	weight	iv, Random, 95% Cl	iv, Kandom, 95% Ci
EQM 2017	3.77	0.93	13	4.62	0.77	13	7.4%	-0.85 [-1.51, -0.19]	+
Guillén-Solà 2017	3.9	2.1	18	4.4	2.2	20		-0.50 [-1.87, 0.87]	<del> -</del>
Moon 2017, Exp Muscle	2.11	1.27	9	3.89	1.27	9	6.7%	-1.78 [-2.95, -0.61]	<del></del>
Park 2016, EMST	4.9	0.5	14	5.5	0.8	13		-0.60 [-1.11, -0.09]	;
Subtotal (95% CI)	L12 0		54			55	28.1%	-0.81 [-1.22, -0.39]	•
Heterogeneity: Tau <sup>4</sup> = 0.03; C Test for overall effect: Z = 3.63			3 (P =	0.32); 1	r = 14%	i			
1.4.4 Shaker, RCT									
Choi 2017	3.19	0.54	16	4.27	0.88	15	7.5%	-1.08 [-1.60, -0.56]	+
Gao 2017 Shaker	2.87	1.94	30	4.23	1.88	15		-1.36 [-2.54, -0.18]	<del> </del>
Park 2017, Shaker	2.15	1.57	13	3.57	1.95	14		-1.42 [-2.75, -0.09]	<del></del>
Subtotal (95% CI) Heterogenelty: Tau <sup>2</sup> = 0.00; Cl	hP = 0.3	35 AF.	59 2 / P —	0.841-1	2 - NY	44	20.7%	-1.16 [-1.61, -0.71]	<b>*</b>
Test for overall effect: $Z = 5.01$			- \r -	V.04),	- 0/4				
1.4.5 CTAR, RCT									
Gao 2017 CTAR	2.77	2.22	30	4.23	1.88	15		-1.46 [-2.70, -0.22]	<del></del>
Kim 2018	3.4	1.8	15	4	1.5	13		-0.60 [-1.82, 0.62]	<del></del> †
Park 2018, CTAR Subtotal (95% CI)	3.55	1.29	11 56	4.73	1.27	11 39		-1.18 [-2.25, -0.11] -1.09 [-1.76, -0.41]	
Heterogenetty: Tau <sup>2</sup> = 0.00; C Test for overall effect: Z = 3.1!				0.61);	r² = 0%	39	20.2%	-1.09 [-1.76, -0.41]	•
1.4.6 Tongue exercise, RCT									
Kim 2017	3.56	1.04	18	3.82	1.22	17	7.3%	-0.26 [-1.01, 0.49]	+
Moon 2018, Tongue Exer	1.2	5.52	8	1.5	5.08	8	2.0%	-0.30 [-5.50, 4.90]	<del></del>
Park 2015, Tongue	55.43	9.35		58.14	9.83	16	1.3%	-2.71 [-9.46, 4.04]	
Subtotal (95% CI)	L12 A -		41			41	10.5%	-0.29 [-1.03, 0.45]	•
Heterogeneity: Tau² = 0.00; Cl Test for overall effect: Z = 0.7:			2 (P =	0.78); 1	r = 0%				
1.4.7 Voice therapy, RCT									
Fraga 2018	1	3.7	5	2	3.7	5	2.3%	-1.00 [-5.59, 3.59]	
Subtotal (95% CI)			5			5	2.3%	-1.00 [-5.59, 3.59]	
Heterogeneity: Not applicable Test for overall effect: Z = 0.4;	3 (P = 0	.67)							
1.4.8 Oral stimulation, RCT									
Power 2006, Oral stimul	4.2	0.8	8	4.4	0.7	8	7.3%	-0.20 [-0.94, 0.54]	+
Subtotal (95% CI)			8			8	7.3%	-0.20 [-0.94, 0.54]	•
Heterogeneity: Not applicable	1 /r -	EA\							
Test for overall effect: $Z = 0.5$	3 (P = 0	.59)							
1.4.9 Game based, RCT									
∐ 2016 Game Based+Train	3	1.2	10	10	0.88	10		-7.00 [-7.92, -6.08]	<del>+</del>
Subtotal (95% CI)			10			10	7.1%	-7.00 [-7.92, -6.08]	•
Heterogeneity: Not applicable Test for overall effect: Z = 14.1	88 (P <	0.00001	)						
			•						
1.4.10 Neck exercise, RCT Klm 2015	17.15	15.42	12	22.03	12 21	13	0.56	-4.88 [-15.61, 5.85]	
Subtotal (95% CI)	17.13	17.73	13	03	16.31	13		-4.88 [-15.61, 5.85]	
Heterogeneity: Not applicable Test for overall effect: Z = 0.6:	9 (P = 0	.37)						,	
1.4.11 Kinesio-Taping, RCT									
Heo 2015	25.72	10.03	22	26.72	10.45	22	1.5%	-1.00 [-7.05, 5.05]	
Subtotal (95% CI)	-9.72	20.03	22	LQ.72	14.73	22	1.5%	-1.00 [-7.05, 5.05]	
Heterogeneity: Not applicable		<b></b> \						- · ·	
Test for overall effect: $Z = 0.37$	2 (P = 0	.75)							
1.4.13 Behavior, NRCT	20.0		25	42 -	^-	35	1 75	_2 PA [ A SE 1 AS1	
Kang 2012 Subtotal (95% CI)	39.9	11	25 25	43.7	9.7	25 25	1.7% 1.7%	-3.80 [-9.55, 1.95] -3.80 [-9.55, 1.95]	
Heterogeneity: Not applicable			-3			23	2.7/0	3.00 ( 3.33) 1.33]	
Test for overall effect: $Z = 1.36$	0 (P = 0	.20)							
T-+-1 (0F9/ CI)			293			262	100.0%	-1.44 [-2.28, -0.60]	•
Total (95% CI)								,	
Heterogeneity: Tau² = 2.38; C Test for overall effect: Z = 3.36			<b>= 18</b> ·	(P < 0.0	0001);	r² = 90	×	-	-10 -5 0 5 10

Table 2: Effect of behavior therapy on different types of dysphagia scores in patients with dysphagia after stroke

Outcome	Mear	n±SD	n (N)	MD [95% CI]	l <sup>2</sup>	P value
	Behavior	Control				
PAS-Change						
• RCT	-1.9±1.4	-0.8±1.4	12(358)	-0.98 [-1.30, -0.65]	62%	<0.00001
PAS-Post intervention						
• RCT	3.3±1.5	4.3±1.4	12(358)	-0.82 [-1.08, -0.57]	12%	<0.00001
VDS-Change						
Overall	-10.9±5.7	-7.1±4.9	8(260)	-4.24 [-6.09, -2.38]	76%	<0.00001
• RCT	-8.9±4.6	-5.0±3.5	7(210)	-4.08 [-6.01, -2.16]	79%	<0.0001
• NRCT	-20.4±11.0	-14.3±9.7	1(50)	-6.10 [-11.85, -0.35]	NA	0.004
VDS-Post intervention						
Overall	31.8±9.4	43.2±8.0	8(241)	-5.31 [-8.20, -2.42]	82%	0.0003
• RCT	29.9±9.0	43.1±7.5	7(191)	-5.60 [-8.75, -2.45]	85%	0.005
• NRCT	39.9±11.0	43.7±9.7	1(50)	-3.80 [-9.55, 1.95]	NA	0.20
FDS-Change						
• RCT	-13.3±6.6	-5.8±5.8	2(40)	-6.37 [-12.05, -0.70]	56%	0.03
FDS-Post intervention						
• RCT	23.3±9.5	25.8±10.5	3(84)	-2.72 [-6.49, 1.05]	0%	0.16
FOIS-Change						
Overall	2.4±1.5	0.8±1.3	5(138)	1.58 [1.15, 2.00]	0%	<0.00001
• RCT	1.9±1.7	0.6±1.4	3(68)	1.19 [0.55, 1.84]	0%	0.0003
• NRCT	2.9±1.2	1.0±1.2	2(70)	1.87 [1.31, 2.43]	0%	<0.00001
FOIS-Post intervention						
Overall	5.0±1.4	3.8±1.4	5(138)	1.20 [0.70, 1.70]	20%	<0.0001
• RCT	5.3±1.7	4.3±1.4	3(68)	1.01 [0.39, 1.63]	0%	0.001
• NRCT	4.7±1.1	3.3±1.4	2(70)	1.69 [0.13, 3.24]	78%	0.03
MASA-Change						
• RCT	27.8±6.0	22.8±7.7	1(16)	5.00 [-1.73, 11.73]	NA	0.15
MASA-Post intervention						
• RCT	173.3±5.5	166.9±5.1	1(16)	6.37 [1.17, 11.57]	NA	0.02
ASHA-Change						
• RCT	2.3±4.5	2.8±1.4	1(26)	-0.53 [-3.09, 2.03]	NA	0.69
ASHA-Post intervention						
• RCT	4.5±4.5	4.8±1.4	1(26)	-0.38 [-2.94, 2.18]	NA	0.77

CI: Confidence intervals; I<sup>2</sup>, p: Heterogeneity; n: Number of studies; N: Number of patients; NA: Not applicable; NRCT: Non-randomized controlled trial; p: Statistical significance value; SD: Standard Deviation; MD: Mean Difference; RCT: Randomized controlled trial

Figure 5: Effect of behavior therapy on PAS scores in patients with dysphagia after stroke



Test for subgroup differences:  $Cht^2 = 0.54$ , df = 1 (P = 0.46),  $t^2 = 0\%$ 

Figure 6: Effect of behavior therapy on VDS scores in patients with dysphagia after stroke

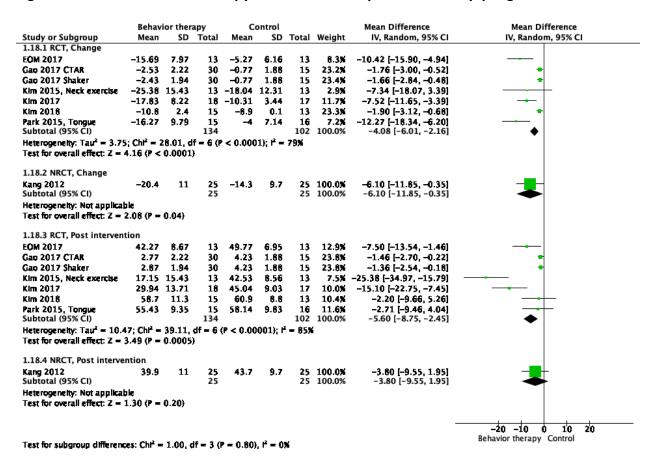


Figure 7: Effect of behavior therapy on FDS scores in patients with dysphagia after stroke

	Behav	ior ther	ару		Control			Mean Difference	Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI	IV, Random, 95% CI
1.21.1 RCT, Change									
Moon 2017, Exp Muscle	-9.78	2.73	9	-5.56	4.22	9	64.4%	-4.22 [-7.50, -0.94]	-
Park 2018, CTAR	-16.27	9.79	11	-6	7.14	11	35.6%	-10.27 [-17.43, -3.11]	<del></del>
Subtotal (95% CI)			20			20	100.0%	-6.37 [-12.05, -0.70]	•
Heterogeneity: $Tau^2 = 10$	.22; Chi <sup>2</sup> •	= 2.27,	df = 1	(P = 0.1)	3); ř =	56%			
Test for overall effect: Z =									
1.21.2 RCT, Post interve	ntion								
Heo 2015	25.72	10.03	22	26.72	10.45	22	38.8%	-1.00 [-7.05, 5.05]	<del>-</del>
Moon 2017, Exp Muscle	18.44	5.64	9	22	6	9	49.1%	-3.56 [-8.94, 1.82]	<del></del>
Park 2018, CTAR	22.36	11.57	11	27.18	14.21	11	12.1%	-4.82 [-15.65, 6.01]	<del></del>
Subtotal (95% CI)			42			42	100.0%	-2.72 [-6.49, 1.05]	•
Heterogeneity: $Tau^2 = 0.0$	00; Cht2 =	0.55, d	f = 2 (F	= 0.76	);	<b>%</b>			
Test for overall effect: Z =	1.41 (P •	= 0.16							
								_	-20 -10 0 10 20
									Behavior therapy Control
Test for subgroup differe	nces: Cht²	= 1.10.	df = 1	(P = 0.2)	29). P =	9.5%			benavior therapy Control

Figure 8: Effect of behavior therapy on FOIS scores in patients with dysphagia after stroke

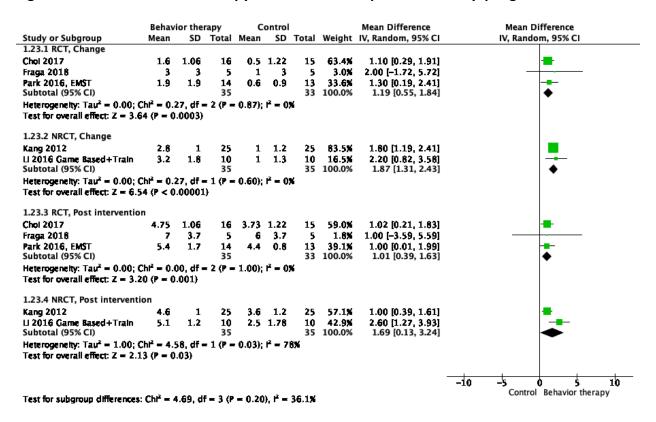
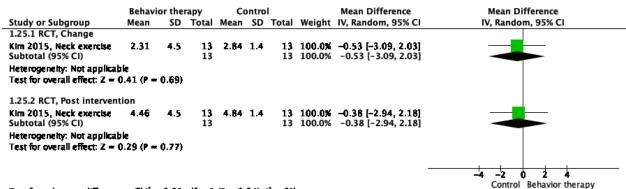


Figure 9: Effect of behavior therapy on MASA scores in patients with dysphagia after stroke

	Behav	ior ther	ару	Co	ontrol			Mean Difference		Mean D	ifference	
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI		IV, Rando	m, 95% CI	
1.24.1 RCT, Change												
Moon 2018, Tongue Exer Subtotal (95% CI)	27.75	5.99	8	22.75	7.65		100.0% 100.0%	5.00 [-1.73, 11.73] 5.00 [-1.73, 11.73]			•	
Heterogeneity: Not applicabl Test for overall effect: Z = 1		0.15)										
1.24.2 RCT, Post interventi	on											
Moon 2018, Tongue Exer Subtotal (95% CI)	173.25	5.52	8	166.88	5.08	8	100.0% 100.0%	6.37 [1.17, 11.57] 6.37 [1.17, 11.57]			<b>•</b>	
Heterogeneity: Not applicable Test for overall effect: $Z = 2$	-	0.02)										
									-100 -	50	0 50	100
Test for subgroup difference	s: Cht² =	0.10, 0	if = 1 (	P = 0.75)	, i² = (	0%				Control	Behavior thera	ру

Figure 10: Effect of behavior therapy on ASHA scores in patients with dysphagia after stroke



Test for subgroup differences:  $Cht^2 = 0.01$ , df = 1 (P = 0.94),  $t^2 = 0\%$ 

Table 3: Effect of behaviour therapy on different outcomes in patients with dysphagia after stroke

Outcome	Mean±SD/ Ir	ncidence (%)	n (N)	MD/ RR [95% CI]	l <sup>2</sup>	P value
	Behavior	Control				
Mortality						
• RCT	15.1%	10.7%	3(505)	1.47 [0.32, 6.78]	71%	0.62
mRS, RCT						
• mRS ≥3	50.5%	48.0%	1(306)	1.05 [0.82, 1.34]	NA	0.69
Pneumonia						
<ul> <li>Overall</li> </ul>	18.4%	24.5%	6(677)	0.57 [0.43, 0.75]	0%	< 0.0001
• EMST, RCT	11.6%	19.0%	3(196)	0.58 [0.24, 1.41]	22%	0.23
<ul> <li>Swallowing</li> </ul>						
exercises, RCT	21.3%	26.6%	3(481)	0.56 [0.41, 0.76]	0%	0.0002
LOS						
<ul> <li>Swallowing</li> </ul>						
exercise, RCT	19.2±1.2	21.4±12.4	1(306)	-2.20 [-4.61, 0.21]	NA	0.07
Tubing						
Tube removal	63.6%	28.6%	2(43)	2.16 [0.75, 6.17]	43%	0.15

CI: Confidence intervals; I<sup>2</sup>, p: Heterogeneity; LOS: Length of Stay; MD: Mean differnence; n: Number of studies; N: Number of patients; NA: Not applicable; NRCT: Non-randomized controlled trial; p: Statistical significance value; RCT: Randomized controlled trial; RR: Risk Ratio; SD: Standard deviation

Figure 11: Effect of behavior therapy on Mortality scores in patients with dysphagia after stroke

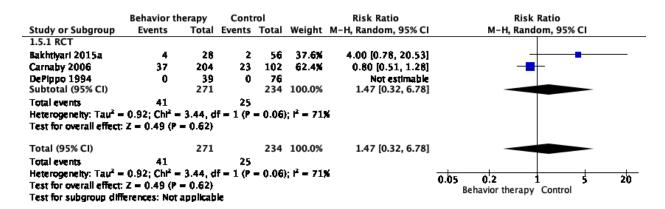


Figure 12: Effect of behavior therapy on mRS scores in patients with dysphagia after stroke

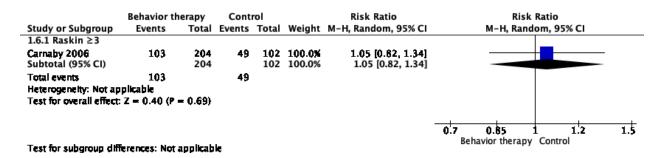


Figure 13: Effect of behavior therapy on Pneumonia scores in patients with dysphagia after stroke

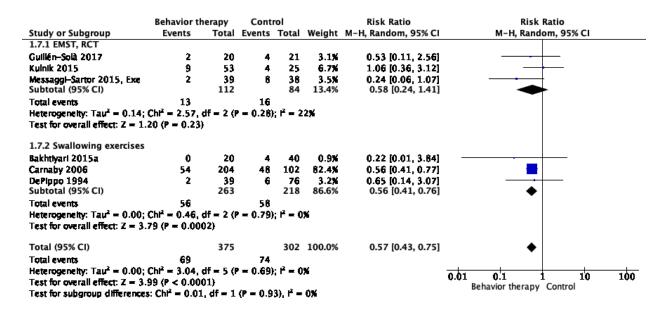
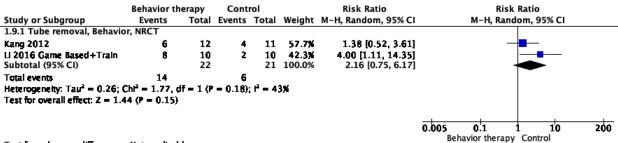


Figure 14: Effect of behavior therapy on Length of study, days scores in patients with dysphagia after stroke

	Behavi	or the	rapy	c	ontrol			Mean Difference		Mea	an Differen	ce	
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI		IV, Ra	andom, 95	% CI	
Carnaby 2006	19.2	1.2	204	21.4	12.4	102	100.0%	-2.20 [-4.61, 0.21]					
Total (95% CI)			204			102	100.0%	-2.20 [-4.61, 0.21]			•		
Heterogeneity: Not ap Test for overall effect:		(P = (	).07)						-100	-50 Behavior the	0 rapy Contr	5 <b>0</b>	100

Figure 15: Effect of behavior therapy on tube removal scores in patients with dysphagia after stroke



Test for subgroup differences: Not applicable

Table 4: Effect of behaviour therapy on different outcomes in patients with dysphagia after stroke

Outcome	Mear	n±SD	n (N)	MD [95% CI]	l <sup>2</sup>	P value
	Behavior	Control				
QoL-Change						
• Overall	25.8±13.1	18.5±7.0	2(66)	0.68 [0.18, 1.17]	0%	0.008
• RCT	36.9±13.3	30.4±7.1	1(16)	0.58 [-0.43, 1.58]	NA	0.26
• NRCT	22.2±13.0	14.7±7.0	1(50)	0.71 [0.13, 1.28]	NA	0.02
QoL-Post intervention						
<ul> <li>Overall</li> </ul>	151.8±18.6	148.1±21.0	2(66)	0.25 [-0.24, 0.74]	0%	0.31
• RCT	164.5±5.3	159.3±9.5	1(16)	0.64 [-0.37, 1.66]	NA	0.21
• NRCT	147±22.9	144.5±24.7	1(50)	0.13 [-0.42, 0.69]	NA	0.64
Depression scale-						
Change						
Overall	-5.3±4.9	-0.7±5.5	3(140)	-0.84 [-1.20, - 0.48]	0%	<0.00001
RCT	-5.6±4.4	-0.7±6.6	2(90)	-0.90 [-1.37, - 0.44]	1%	0.0001
NRCT	-4.7±6.0	-0.8±4.2	1(50)	-0.74 [-1.32, - 0.17]	NA	0.01
Depression scale-Post intervention						
Overall	38.7±4.9	39.6±5.5	3(140)	-0.69 [-1.06, - 0.32]	8%	0.0002
• RCT	43.6±4.4	48.2±6.6	2(90)	-0.85 [-1.32, - 0.38]	4%	0.0004
• NRCT	26.8±6.0	29.2±4.2	1(50)	-0.46 [-1.02, 0.11]	NA	0.11
Functional independence measure-Change						
• NRCT	5.8±7.5	5.2±9.9	1(50)	0.60 [-4.27, 5.47]	NA	0.81
Functional						
independence						
measure-Post						
intervention						
<ul><li>NRCT</li></ul>	74.2±7.5	72.9±9.9	1(50)	1.30 [-3.57, 6.17]	NA	0.60

CI: Confidence intervals; ICU: Intensive care unit; I<sup>2</sup>, p: Heterogeneity; n: Number of studies; N: Number of patients; NA: Not applicable; NRCT: Non-randomized controlled trial; p: Statistical significance value; QoL: Quality of life; SD: Standard Deviation; MD: Mean Difference; RCT: Randomized controlled trial

Figure 16: Effect of behaviour therapy on QoL scores in patients with dysphagia after stroke

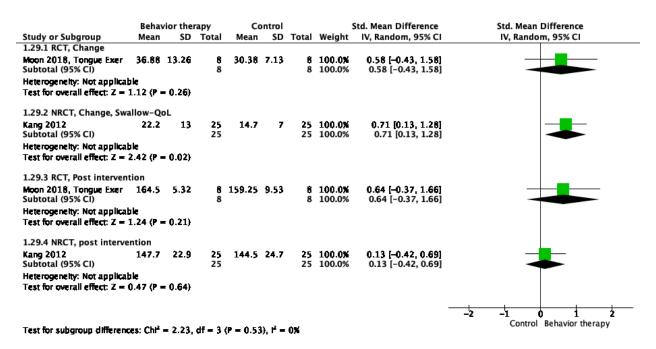


Figure 17: Effect of behavior therapy on Depression scores in patients with dysphagia after stroke

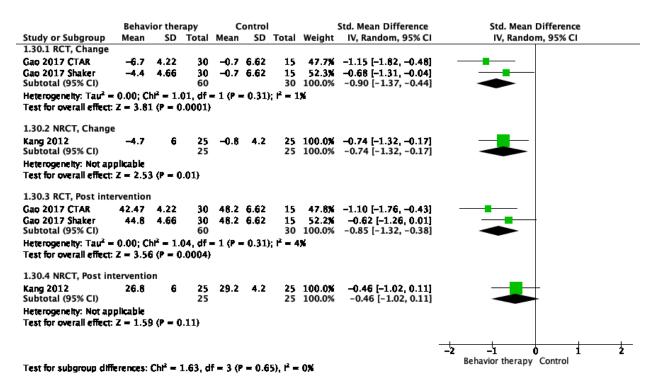
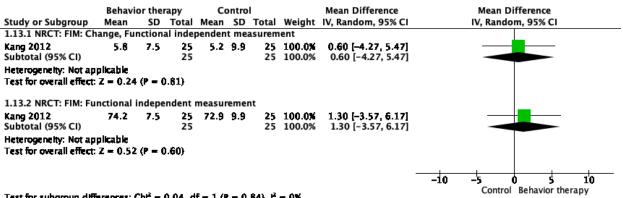


Figure 18: Effect of behaviour therapy on Functional independence measure scores in patients with dysphagia after stroke



Test for subgroup differences:  $Cht^2 = 0.04$ , df = 1 (P = 0.84),  $t^2 = 0\%$ 

Table 5: Effect of behaviour therapy on different outcomes in patients with dysphagia after stroke

Outcome	Inciden	ice (%)	n (N)	RR [95% CI]	l <sup>2</sup>	P value
	Behavior	Control				
Efficacy parameters						
Dysphagia at end	40.1%	57.5%	5(537)	0.72 [0.61, 0.86]	21%	0.0002
Recovery, RCT	41.3%	18.9%	3(178)	2.29 [1.38, 3.82]	0%	0.001
Total effective rate,						
RCT	81.7%	40.0%	2(90)	2.04 [1.30, 3.22]	0%	0.04
Normal diet, RCT	66.7%	55.9%	1(306)	1.19 [0.98, 1.45]	NA	0.08
Functional swallowing,						
RCT	45.6%	32.4%	1(306)	1.41 [1.03, 1.94]	NA	0.03
Adverse effects in						
RCTs						
Stroke, RCT	3.7%	6.4%	1(101)	0.58 [0.10, 3.33]	NA	0.54
<ul> <li>Pulmonary</li> </ul>						
thromboembolism,						
RCT	0.0%	2.1%	1(101)	0.29 [0.01, 6.98]	NA	0.45
<ul> <li>Airway obstruction,</li> </ul>						
RCT	0%	1%	1(115)	0.64 [0.03, 15.40]	NA	0.78
<ul> <li>Depression, RCT</li> </ul>	13.3%	33.3%	1(90)	0.41 [0.18, 0.93]	0%	0.03
Dehydration, RCT	36.3%	47.0%	1(437)	0.57 [0.27, 1.20]	NA	0.7
Hip fracture, RCT	1.9%	2.1%	1(101)	0.87 [0.06, 13.53]	NA	0.92
Complications, RCT	36.3%	47.0%	3(437)	0.57 [0.27, 1.20]	62%	0.14
<ul> <li>Institutionalization</li> </ul>	17.6%	25.5%	1(306)	0.69 [0.44, 1.08]	NA	0.11

Cl: Confidence intervals; I<sup>2</sup>, p: Heterogeneity; n: Number of studies; N: Number of patients; NA: Not applicable; p: Statistical significance value; RR: Risk Ratio

Figure 19: Effect of behavior therapy on Efficacy scores in patients with dysphagia after stroke

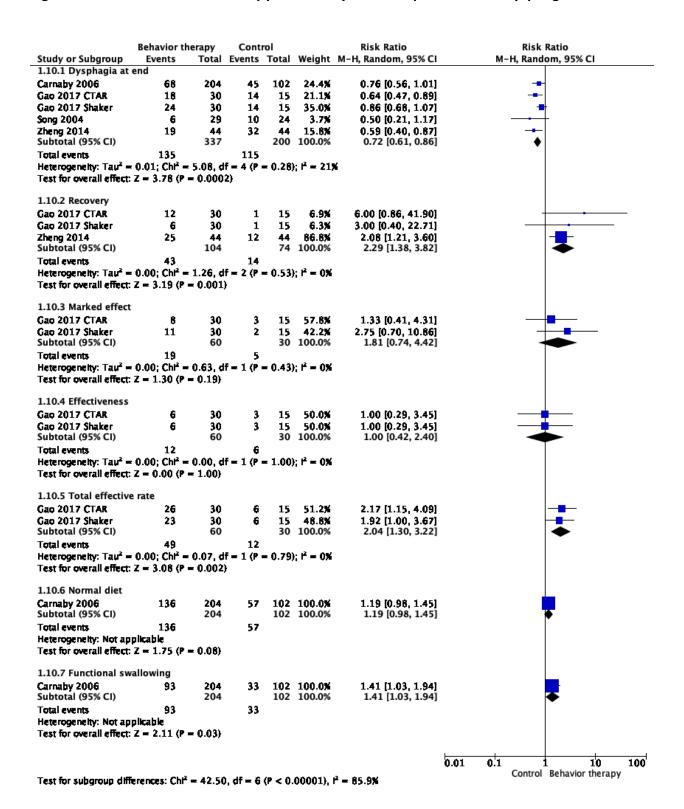


Figure 20: Effect of behaviour therapy on Adverse effects scores in patients with dysphagia after stroke

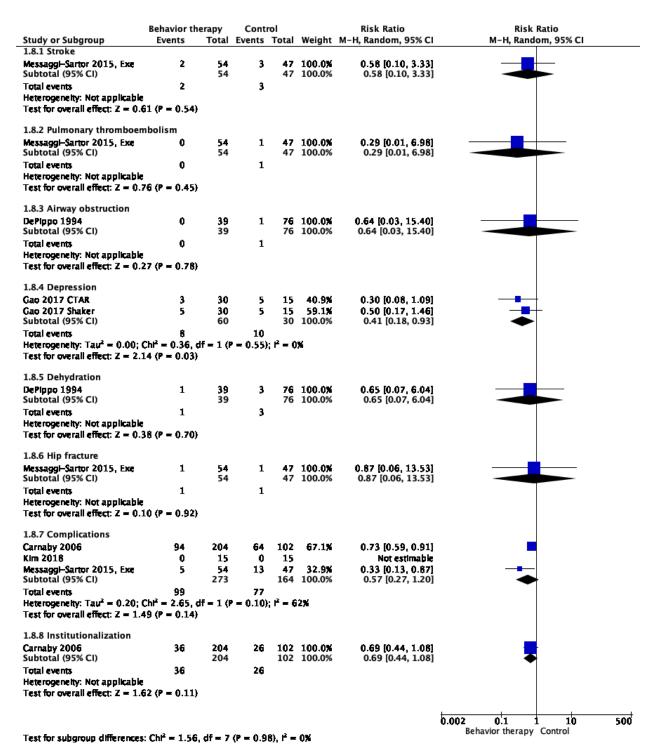
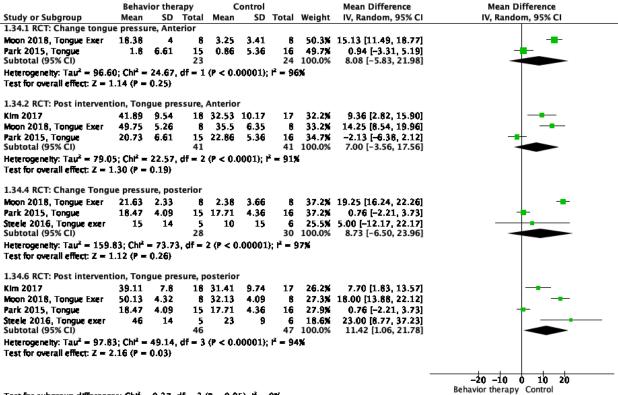


Table 6: Effect of behaviour therapy (tongue exercises) on tongue pressure in patients with dysphagia after stroke

Outcome	Mean±SD		n (N)	MD [95% CI]	l <sup>2</sup>	P value
	Behavior	Control				
Tongue pressures, RCT						
Anterior pressure, RCT						
• Change	7.6±5.7	1.7±4.7	2(47)	8.08 [-5.83, 21.98]	96%	0.25
Post intervention	35.7±7.6	29.3±7.6	3(82)	7.00 [-3.56, 17.56]	91%	0.19
Posterior pressure, RCT						
Change	18.8±5.4	12.1±6.3	3(58)	8.73 [-6.50, 23.96]	97%	0.26
Post intervention	35.0±6.7	25.8±6.9	4(93)	11.42 [1.06, 21.78]	94%	0.03

Cl: Confidence intervals; I<sup>2</sup>, p: Heterogeneity; n: Number of studies; N: Number of patients; NA: Not applicable; p: Statistical significance value; SD: Standard Deviation; MD: Mean Difference

Figure 21: Effect of tongue exercises on tongue pressures scores in patients with dysphagia after stroke



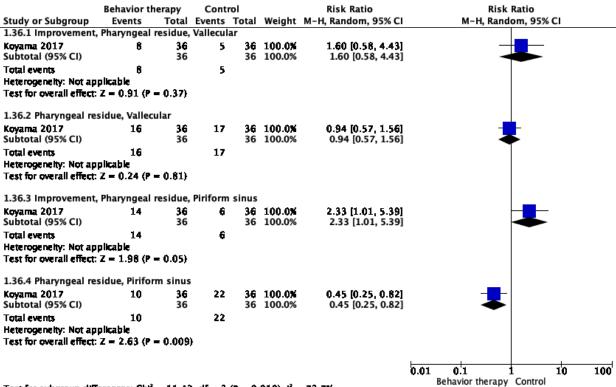
Test for subgroup differences:  $Chi^2 = 0.37$ , df = 3 (P = 0.95),  $i^2 = 0\%$ 

Table 7: Effect of behaviour therapy on pharyngeal outcomes in patients with dysphagia after stroke

Outcome	Mean	±SD/%	n (N)	MD/ RR [95% CI]	l <sup>2</sup>	P value
	Behavior	Control				
Pharyngeal outcomes						
Swallowing exercises						
Pharyngeal residue,						
Vallecular, RCT						
• Change, RCT	22.2%	13.9%	1(72)	1.60 [0.58, 4.43]	NA	0.37
<ul> <li>Post intervention,</li> </ul>						
RCT	44.4%	47.2%	1(72)	0.94 [0.57, 1.56]	NA	0.81
Pharyngeal residue,						
Piriform sinus, RCT						
• Change, RCT	38.9%	16.7%	1(72)	2.33 [1.01, 5.39]	NA	0.05
Post intervention-						
RCT	27.8%	61.1%	1(72)	0.45 [0.25, 0.82]	NA	0.009
Pharyngeal remnant						
<ul> <li>Change, RCT</li> </ul>	-20.9±8.1	-10.4±1.6	1(28)	-10.50 [-14.69, -6.31]	NA	< 0.00001
<ul> <li>Post intervention,</li> </ul>						
RCT	22.4±13.3	33.8±11.6	1(28)	-11.40 [-20.62, -2.18]	NA	0.02
With EMST						
Vesicular residue						
<ul> <li>Change, RCT</li> </ul>	-1.1±0.3	-0.6±0.5	1(18)	-0.55 [-0.96, -0.14]	NA	0.008
<ul> <li>Post intervention,</li> </ul>					NA	
RCT	0.3±0.5	1.1±0.6	1(18)	-0.78 [-1.29, -0.27]		0.003
Piriform sinus residue						
Change, RCT	-0.6±0.5	-0.2±0.4	1(18)	-0.34 [-0.79, 0.11]	NA	0.14
<ul> <li>Post intervention,</li> </ul>			1(18)		NA	
RCT	0.6±0.5	0.9±0.6		-0.33 [-0.85, 0.19]		0.22

CI: Confidence intervals; I<sup>2</sup>, p: Heterogeneity; n: Number of studies; N: Number of patients; NA: Not applicable; p: Statistical significance value; SD: Standard Deviation; MD: Mean Difference; RR: Risk Ratio

Fig 22: Effect of behaviour therapy on Pharyngeal outcomes scores in patients with dysphagia after stroke



Test for subgroup differences:  $Chi^2 = 11.42$ , df = 3 (P = 0.010),  $i^2 = 73.7\%$ 

Fig 23: Effect of behaviour therapy on pharyngeal outcomes scores in patients with dysphagia after stroke

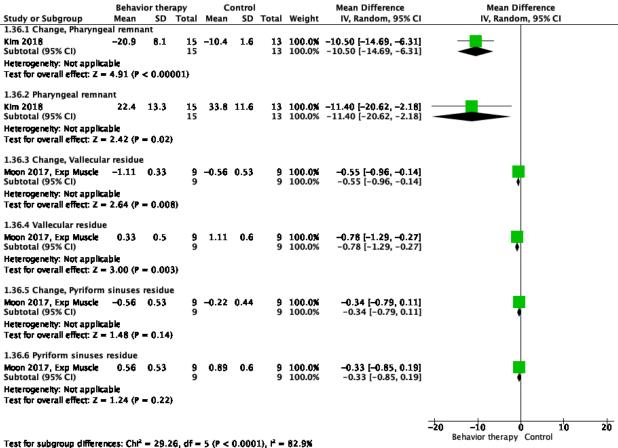


Table 8: Effect of behaviour therapy on pharyngeal timings in patients with dysphagia after stroke

Outcome	Mean	±SD	n (N)	MD [95% CI]	l <sup>2</sup>	P value
	Behavior	Control				
Pharyngeal transit time						
• RCT	3.5±1.3	3.9±2.3	2(44)	-0.19 [-0.24, -0.14]	0%	< 0.0001
Swallow response time						
• RCT	0.8±0.3	0.6±0.2	1(16)	0.27 [-0.00, 0.54]	NA	0.05
Oral transit time						
• RCT	0.4±0.0	0.4±0.1	1(16)	-0.02 [-0.08, 0.04]	NA	0.53
Laryngeal closure time						
• RCT	0.8±0.1	0.9±0.2	1(16)	-0.16 [-0.29, -0.03]	NA	0.02
Cricopharyngeal opening duration						
• RCT	0.6±0.2	0.6±0.0	1(16)	-0.04 [-0.18, 0.10]	NA	0.57
Duration of stage						
transition						
• RCT	0.9±1.2	1.3±1.5	1(20)	-0.36 [-1.55, 0.83]	NA	0.55
Total swallow duration						
• RCT	2.4±1.3	3.0±1.6	1(20)	-0.52 [-1.77, 0.73]	NA	0.42

CI: Confidence intervals; I<sup>2</sup>, p: Heterogeneity; n: Number of studies; N: Number of patients; NA: Not applicable; p: Statistical significance value; SD: Standard Deviation; MD: Mean Difference

Figure 24: Effect of behaviour therapy on Pharyngeal timings scores in patients with dysphagia after stroke

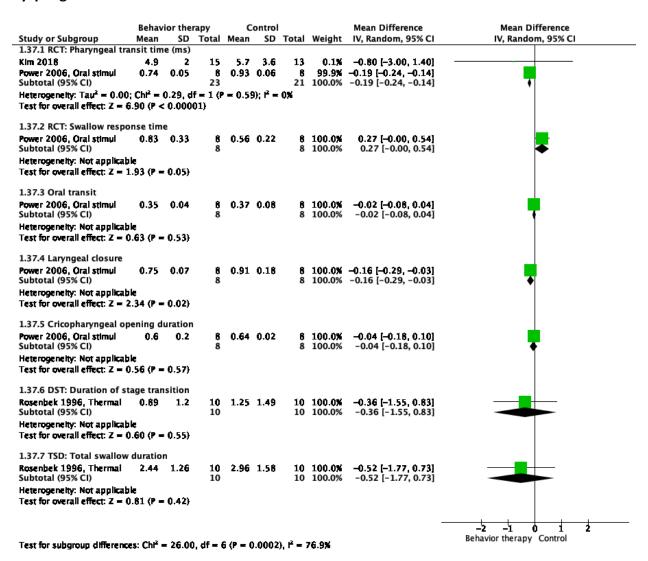


Table 9: Effect of behaviour therapy on hyoid bone, laryngeal and epiglottis movements in patients with dysphagia after stroke

Outcome	Mean		n (N)	MD [95% CI]	l <sup>2</sup>	P value
	Behavior	Control				
Larynx						
Larynx, horizontal						
displacement						
• RCT	0.9±0.4	0.9±0.5	1(27)	0.01 [-0.31, 0.33]	NA	0.95
Larynx, vertical						
displacement						
• RCT	2.1±0.7	2.2±0.6	1(27)	-0.02 [-0.49, 0.45]	NA	0.93
Hyoid bone						
Horizontal excursion						
(cm)						
• RCT	1.9±0.6	1.7±0.5	1(71)	0.13 [-0.12, 0.37]	0%	0.31
Horizontal excursion						
(cm)						
• RCT	2.3±0.7	1.9±0.6	1(71)	0.41 [0.12, 0.70]	0%	0.05
Superior displacement						
• RCT	1.7±0.6	1.2±0.3	1(12)	0.46 [-0.02, 0.94]	NA	0.06
Anterior displacement						
• RCT	1.4±0.2	1.3±0.3	1(12)	0.06 [-0.21, 0.33]	NA	0.66
Epiglottis						
Rotation						
• RCT	51.0±17.8	41.0±20.2	1(24)	10.00 [-1.24, 21.24]	NA	0.08

CI: Confidence intervals; ICU: Intensive care unit; I<sup>2</sup>, p: Heterogeneity; n: Number of studies; N: Number of patients; NA: Not applicable; p: Statistical significance value; SD: Standard Deviation; MD: Mean Difference

Fig 25: Effect of behaviour therapy on Hyoid bone, larynx and epiglottis movements scores in patients with dysphagia after stroke

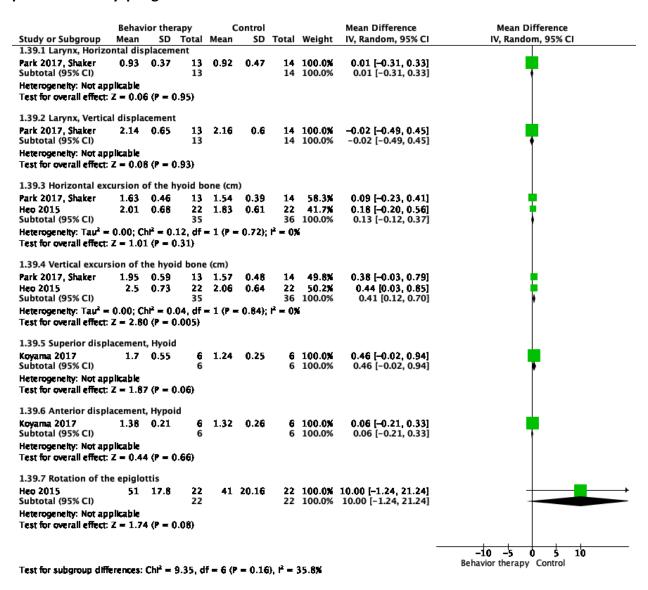


Table 10: Effect of behaviour therapy on hyoid bone, laryngeal and epiglottis movements in patients with dysphagia after stroke

Outcome	Mear	Mean±SD		MD [95% CI]	l <sup>2</sup>	P value
	Behavior	Control				
sEMG with ESMT						
Change						
• RCT	0.9±1.0	-0.1±0.7	1(27)	1.12 [0.30, 1.94]	NA	0.002
Post-intervention						
• RCT	5.6±0.9	4.8±0.8	1(27)	0.91 [0.11, 1.71]	NA	0.01

CI: Confidence intervals; ICU: Intensive care unit; I<sup>2</sup>: Heterogeneity; n: Number of studies; N: Number of patients; NA: Not applicable; p: Statistical significance value; SD: Standard Deviation; SMD: Standard Mean Difference

Figure 26: Effect of behavior therapy on sEMG scores in patients with dysphagia after stroke

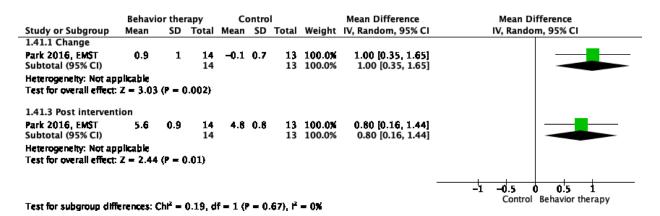
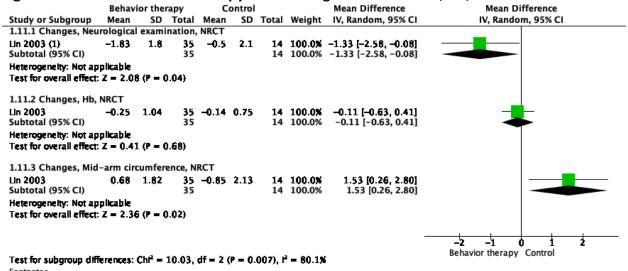


Table 11: Effect of behaviour therapy on neurological examination, Hb, arm circumference scores in patients with dysphagia after stroke

Outcome	Mean	±SD	n (N)	MD [95% CI]	l <sup>2</sup>	P value
	Behavior	Control				
Neurological examination						
Change, NRCT	-1.8±1.8	-0.5±2.1	1(49)	-1.33 [-2.58, -0.08]	NA	0.04
Hb						
Change, NRCT	-0.3±1.0	-0.1±0.8	1(49)	-0.11 [-0.63, 0.41]	NA	0.68
Mid-arm circumference						
Change, NRCT	0.7±1.8	0.9±2.1	1(49)	1.53 [0.26, 2.80]	NA	0.02

CI: Confidence intervals; I<sup>2</sup>, p: Heterogeneity; n: Number of studies; N: Number of patients; NA: Not applicable; p: Statistical significance value; SD: Standard Deviation; MD: Mean Difference

Figure 27: Effect of behavior therapy on Neurological examination, Hb, arm circumference



(1) Higher score shows worse swallowing function

Table 12: Effect of behaviour therapy on swallowing functions scores in patients with dysphagia after stroke

Outcome	Mean	±SD	n (N)	MD [95% CI]	l <sup>2</sup>	P value
	Behavior	Control				
Swallow vol/ sec						
Change, NRCT	1.6±3.8	-1.4±4.3	1(49)	2.97 [0.39, 5.55]	NA	0.02
Volume/swallow						
Change, NRCT	4.2±8.8	-1.6±8.7	1(49)	5.75 [0.34, 11.16]	NA	0.04
Cough/ Choking at timed						
swallow test						
<ul> <li>Change, NRCT</li> </ul>	-0.2±0.6	0.0±0.4	1(49)	-0.24 [-0.53, 0.05]	NA	0.10
Coughing/ Choking at						
meals						
Change, NRCT	-5.3±8.6	2.4±6.8	1(49)	-7.72 [-12.30, -3.14]	NA	0.009
Swallow questionnaire						
Change, NRCT	-0.5±1.6	0.3±0.7	1(49)	-0.80 [-1.46, -0.14]	NA	0.02

CI: Confidence intervals; I<sup>2</sup>, p: Heterogeneity; n: Number of studies; N: Number of patients; NA: Not applicable; p: Statistical significance value; SD: Standard Deviation; MD: Mean Difference

Figure 28: Effect of behaviour therapy on swallowing functions scores in patients with dysphagia after stroke

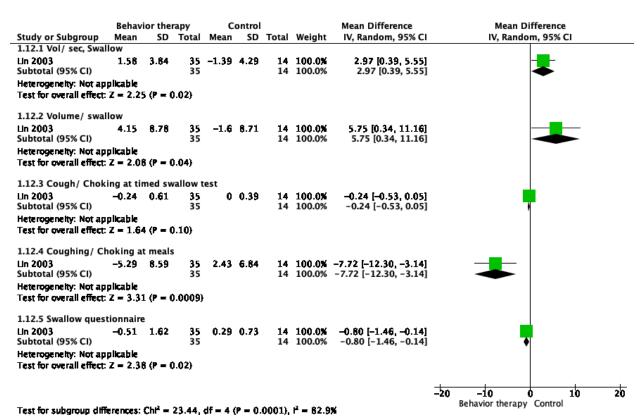
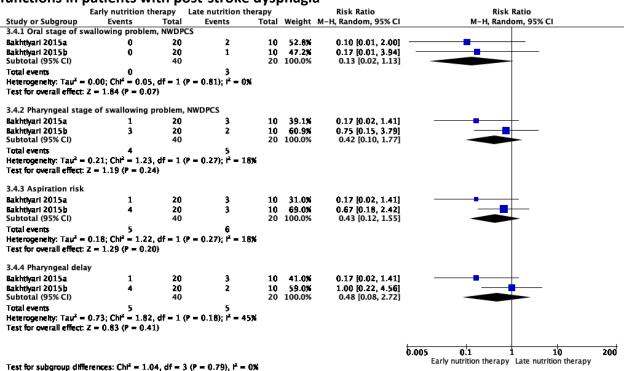


Table 13: Effect of early compared to late initiation of behavioural therapy on mRS and swallowing in patients with post-stroke dysphagia

Outcome	Incider	nce (%)	n (N)	RR [95% CI]	l <sup>2</sup>	P value
	Early	Late				
	nutrition	nutrition				
Oral stage of swallowing						
problem, NWDPCS						
RCT	0.0%	15.0%	1(60)	0.13 [0.02, 1.13]	0%	0.07
Pharyngeal stage of						
swallowing problem,						
NWDPCS						
• RCT	10.0%	25.0%	1(60)	0.42 [0.10, 1.77]	18%	0.24
Aspiration risk, NWDPCS						
• RCT	12.5%	30.0%	1(60)	0.43 [0.12, 1.55]	18%	0.2
Pharyngeal delay						
• RCT	12.5%	25.0%	1(60)	0.48 [0.08, 2.72]	45%	0.41
Infections						
• RCT	33.3%	52.1%	1(146)	0.64 [0.43, 0.94]	NA	0.02
Pressure sores						
• RCT	0.7%	1.3%	1(4023)	0.57 [0.31, 1.08]	NA	0.09
GIT hemorrhage						
• RCT	5.1%	2.6%	1(859)	2.00 [0.98, 4.08]	NA	0.06
Malnutrition						
• RCT	27.1%	48.3%	1(128)	0.56 [0.35, 0.90]	NA	0.02

CI: Confidence intervals; GIT: Gastrointestinal; I<sup>2</sup>,p: Heterogeneity; n: Number of studies; N: Number of patients; NA: Not applicable; NWDPCS: North-Western dysphagia patients check sheet; p: Statistical significance value; RR: Risk Ratio

Figure 29: Effect of early compared to late initiation of behavioural therapy on swallowing functions in patients with post-stroke dysphagia



## **Treatment 2b - Acupuncture**

Table 1: Effect of acupuncture on dysphagia in patients with dysphagia after stroke

Outcome	Mean±SD/ Inc	idence (%)	n (N)	MD/OR [95% CI]	l <sup>2</sup>	P value
	Acupuncture	Control				
Dysphagia at end	20.0%	39.6%	23(2177)	0.51 [0.41, 0.63]	58%	< 0.00001
Dysphagia score, overall*						
<ul> <li>Improvement</li> </ul>	4.0±0.8	2.8±0.9	3(292)	1.05 [0.45, 1.65]	81%	0.0006
<ul> <li>Post intervention</li> </ul>	1.5±0.7	2.1±0.9	5(443)	-0.63 [-1.12, -0.14]	84%	0.01
DOSS						
<ul> <li>Change</li> </ul>	4.0±1.3	2.1±1.1	1(120)	1.90 [1.47, 2.33]	NA	< 0.00001
Post intervention	5.8±1.3	3.7±1.1	1(120)	2.10 [1.67, 2.53]	NA	< 0.00001
VFSS						
<ul> <li>Change</li> </ul>	4.5±0.5	3.8±0.8	1(133)	0.71 [0.49, 0.93]	NA	< 0.00001
Post intervention	9.8±0.5	9.4±0.8	1(133)	0.42 [0.20, 0.64]	NA	< 0.0001
RBHOMS						
<ul> <li>Change</li> </ul>	2.1±0.6	1.9±0.6	1(39)	0.20 [-0.18, 0.58]	NA	0.30
<ul> <li>Post intervention</li> </ul>	7.4±0.6	7.2±0.6	1(39)	0.20 [-0.18, 0.58]	NA	0.30
WST						
<ul> <li>Change</li> </ul>	NR	NR	NA	NA	NA	NA
Post intervention	2.4±0.6	2.9±0.9	2(151)	-0.60 [-0.84, -0.36]	0%	< 0.00001
Latent time in						
swallowing reflux						
Post intervention	1.6±0.3	4.6±1.6	2(52)	-3.43 [-8.32, 1.47]	97%	0.17

<sup>\*:</sup> Standard Mean Difference; CI: Confidence intervals; I<sup>2</sup>: Heterogeneity; n: Number of studies;

N: Number of patients; NA: Not applicable; NR: Not reported; p: Statistical significance value;

SD: Standard Deviation;; WST: Water swallow test

Control Acupuncture Risk Ratio Risk Ratio Events Total Weight IV, Random, 95% CI Study or Subgroup Events Total IV, Random, 95% CI Bal 2007 32 35 8.0% 0.47 [0.34, 0.64] Chang 2014, Ac 6 36 3.8% 0.38 [0.17, 0.87] 38 15 Chen 2016ac 103 17 97 4.0% 0.44 [0.20, 0.98] ₿ Cheng 2014 2.3% 3 60 15 60 0.20 [0.06, 0.66] Chu 2017, Ac 48 12 49 2.7% 0.34 [0.12, 0.98] Fan 2007, Ac 4 30 21 30 3.2% 0.19 [0.07, 0.49] Feng 2016 9 0.53 [0.28, 0.99] 30 17 30 5.1% Han 2004 22 34 32 8.1X 25 0.83 [0.61, 1.13] Huang 2008, Ac 9 25 9 18 0.72 [0.36, 1.45] 4.6% 1 10 1.0% Huang 2010 32 30 0.09 [0.01, 0.69] Jla 2006 27 32 0.77 [0.60, 0.99] 40 28 8.6X Jin 2010, Acupu 21 30 23 30 8.1% 0.91 [0.67, 1.24] 54 19 30 Llu 2000 16 6.3% 0.47 [0.29, 0.77] ⊔µ 2004 1 44 3 38 0.8% 0.29 [0.03, 2.65] ⊔u 2012. Ac 7 36 15 36 4.2% 0.47 [0.22, 1.01] Llu 2019 0 50 1 50 0.4% 0.33 [0.01, 7.99] 2 0.29 [0.06, 1.26] Ma 2014 35 8 40 1.6X Ma 2015, Ac 13 40 22 40 6.0X 0.59 [0.35, 1.00] 16 4.9% 0.56 [0.29, 1.10] Meng 2015, Ac 168 14 83 Wu 2011 26 75 32 7.1% 0.87 [0.57, 1.31] 8 4.9X Yin 2013 57 39 56 0.20 [0.10, 0.39] Zeng 2011, Ac 0 42 6 36 0.5% 0.05 [0.00, 0.85] Zhou 2013 0.43 [0.18, 1.00] 40 14 40 3.7% Total (95% CI) 1169 1008 100.0% 0.51 [0.41, 0.63] Total events 399 234

Figure 1: Effect of acupuncture on dysphagia at end in patients with dysphagia with stroke

Figure 2: Effect of acupuncture on overall change in dysphagia score in patients with dysphagia with stroke

Heterogeneity:  $Tau^2 = 0.11$ ;  $Chi^2 = 52.81$ , df = 22 (P = 0.0002);  $i^2 = 58\%$ 

Test for overall effect: Z = 6.41 (P < 0.00001)

	Acu	puncti	ıre	c	ontro	l	:	Std. Mean Difference		Std. Mean Difference	
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI		IV, Random, 95% CI	
Chan 2012	2.1	0.6	20	1.9	0.6	19	28.7%	0.33 [-0.31, 0.96]		<del></del>	
Chen 2016ac	4.51	0.45	68	3.8	0.77	65	36.3×	1.13 [0.76, 1.49]		_ <del></del>	
XIa 2016, ac	4	1.3	60	2.1	1.1	60	35.1%	1.57 [1.16, 1.98]		-	
Total (95% CI)			148			144	100.0%	1.05 [0.45, 1.65]		•	
Heterogeneity: Tau <sup>2</sup> = Test for overall effect					(P = 0	.005);	r² = 61%		<del>_</del> 4	-2 0 2 Control Acupuncture	4

0.002

0.1

Acupuncture Control

500

Figure 3: Effect of acupuncture on overall dysphagia score in patients with dysphagia with stroke

	Acu	puncti	ıre	c	ontrol			Std. Mean Difference		Std. Mean Difference	
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI		IV, Random, 95% CI	
Chan 2012	1	0.6	20	1.2	0.6	19	17.4%	-0.33 [-0.96, 0.31]		<del></del>	
Chen 2016ac	1	0.45	68	1	0.77	65	21.9%	0.00 [-0.34, 0.34]		+	
Jin 2010, Acupu	3.9	0.6	30	4.6	0.9	30	19.0%	-0.90 [-1.44, -0.37]			
Ma 2014	1.36	0.6	42	1.9	0.9	49	20.7%	-0.69 [-1.11, -0.27]			
XIa 2016, ac	1	1.3	60	2.5	1.1	60	21.1%	-1.24 [-1.63, -0.85]			
Total (95% CI)			220			223	100.0%	-0.63 [-1.12, -0.14]		•	
Heterogeneity: Tau <sup>2</sup> =	0.26;	Chi² =	24.28,	df = 4	(P < 0	.0001);	$1^2 = 84\%$		+	_2 0 2	<u>_</u>
Test for overall effect:	Z = 2.9	2 (P =	0.01)							Acupuncture Control	•

Figure 4: Effect of acupuncture on DOSS in patients with dysphagia with stroke

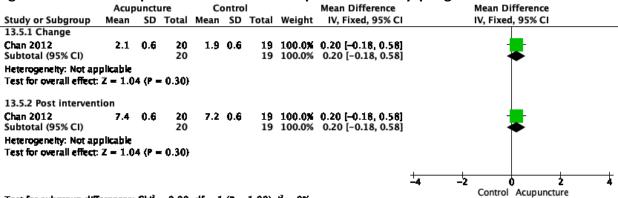
_	Acur	unct	iro		ontro	.i	-	Mean Difference	_	Moan	Difference	
Ctudy or Cubarana		SD					Walaht	IV. Fixed. 95% CI				
Study or Subgroup	Mean	30	Total	mean	30	Total	weight	iv, rixea, 95% Ci		IV, FIX	ed, 95% CI	
13.3.1 Change												
XIa 2016, ac	4	1.3	60	2.1	1.1	60	100.0%	1.90 [1.47, 2.33]			-	
Subtotal (95% CI)			60			60					•	
Heterogeneity: Not as	pplicable											
Test for overall effect	z = 8.6	4 (P -	< 0.000	101)								
13.3.2 Post interven	tion											
XIa 2016, ac	5.8	1.3	60	3.7	1.1	60	100.0%	2.10 [1.67, 2.53]			-	
Subtotal (95% CI)		_	60	_		60	100.0%	2.10 [1.67, 2.53]			•	
Heterogeneity: Not as	oolkable											
Test for overall effect	•	5 (P -	< 0.000	101)								
				· • - ,								
									+			
									<u>-</u> 4	-2	Ò Ż	4
										Contr	ol Acupuncture	

Test for subgroup differences:  $Chi^2 = 0.41$ , df = 1 (P = 0.52),  $i^2 = 0\%$ 

Figure 5: Effect of acupuncture on VFSS in patients with dysphagia with stroke

	Acu	puncti	ıre	c	ontro	l		Mean Difference		Mean I	Difference	
Study or Subgroup	Mean	ean SD Total Mean  1.51 0.45 68 3.8 0.68  able = 6.45 (P < 0.00001)  1.77 0.45 68 9.35 0.68  able		SD	Total	Weight	IV, Fixed, 95% CI		ed, 95% CI			
13.4.1 Change												
Chen 2016ac	4.51	0.45	68	3.8	0.77	65	100.0%	0.71 [0.49, 0.93]				
Subtotal (95% CI)			68			65	100.0%	0.71 [0.49, 0.93]			<b>→</b>	<b>—</b>
Heterogeneity: Not ap	plicable											
Test for overall effect	Z = 6.4	15 (P <	0.000	01)								
13.4.2 Post interven	tion											
Chen 2016ac	9.77	0.45	68	9.35	0.77	65	100.0%	0.42 [0.20, 0.64]				
Subtotal (95% CI)			68			65	100.0%	0.42 [0.20, 0.64]				
Heterogeneity: Not ap	plicable											
Test for overall effect	z = 3.6	32 (P =	0.000	1)								
									-1	-0.5	0 0.5	<del>-</del>
									-1		ol Acupuncture	-
Test for subgroup dif	ferences	: Chi² :	= 3.48,	df = 1	P = 0	).06), ř	= 71.2%	i		00		

Figure 6: Effect of acupuncture on RBHOMS in patients with dysphagia with stroke



Test for subgroup differences:  $Cht^2 = 0.00$ , df = 1 (P = 1.00),  $t^2 = 0\%$ 

Figure 7: Effect of acupuncture on water swallow test in patients with dysphagia with stroke

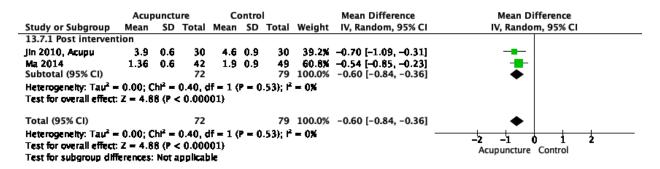


Figure 8: Effect of acupuncture on latent time in swallowing reflux in patients with dysphagia with stroke

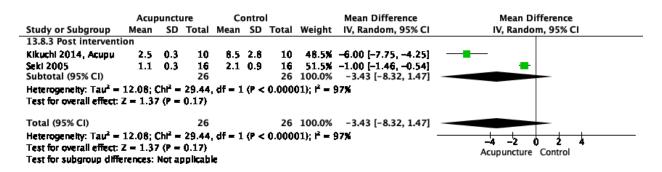


Table 2: Effect of acupuncture on dysphagia in patients with dysphagia after stroke

Outcome	Mean±SD/ In	cidence (%)	n (N)	MD/OR [95% CI]	l <sup>2</sup>	P value
	Acupuncture	Control				
Pneumonia	3.3%	8.3%	1(120)	0.40 [0.08, 1.98]	NA	0.26
SQoL	197±19	165±20	1(120)	32.0 [24.99, 39.01]	NA	<0.00001
MMSE	8.3±2.9	6.1±2.9	1(20)	2.20 [-0.34, 4.74]	NA	0.09
Nasal feeding tube						
removal	89.5%	50.0%	1(74)	1.79 [1.27, 2.53]	NA	0.0009
BI	78±11	63±12	2(140)	7.40 [-12.39, 27.19]	95%	0.46
FMA						
<ul> <li>Change</li> </ul>	18.2±14.2	16.6±16.5	1(241)	1.61 [-2.27, 5.49]	NA	0.42
<ul> <li>Post intervention</li> </ul>	64.4±14.2	66.9±16.5	1(241)	-2.44 [-6.32, 1.44]	NA	0.22
Adverse effects						
• Pain	1.7%	0.0%	1(120)	3.00 [0.12, 72.20]	NA	0.5
Hematoma	3.3%	0.0%	1(120)	5.00 [0.25, 102.00]	NA	0.3
Discomfort	11.7%	8.3%	1(120)	1.40 [0.47, 4.17]	NA	0.55

CI: Confidence intervals; FMA: Fugl-Meyer Assessment; I<sup>2</sup>: Heterogeneity; MMSE: Mini Mental State Examination; n: Number of studies; N: Number of patients; NA: Not applicable; p: Statistical significance value; SD: Standard Deviation; MD: Mean Difference; SQoL: Swallowing quality of life

Figure 9: Effect of acupuncture on pneumonia in patients with dysphagia with stroke

	Acupun	cture	Cont	rol		Risk Ratio		Risk Ra	tio	
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% CI		M-H, Randon	1, 95% CI	
Cheng 2014	2	60	5	60	100.0%	0.40 [0.08, 1.98]			_	
Total (95% CI)		60		60	100.0%	0.40 [0.08, 1.98]			-	
Total events	2		5							
Heterogeneity: Not ap Test for overall effect:		(P = 0.	26)				0.01	0.1 1 Acupuncture C	10 ontrol	100

Figure 10: Effect of acupuncture on swallowing quality of life in patients with dysphagia with stroke

	Acu	puncti	ıre	c	ontrol			Mean Difference	Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Fixed, 95% CI	IV, Fixed, 95% CI
13.10.3 Swallowing	QoL, 1 n	ıonth							
XIa 2016, ac Subtotal (95% CI)	197.1	19.3	60 60	165.1	19.9	<b>6</b> 0 60		32.00 [24.99, 39.01] 32.00 [24.99, 39.01]	
Heterogeneity: Not ap Test for overall effect		4 (P <	0.000	01)					
Total (95% CI)			60			60	100.0%	32.00 [24.99, 39.01]	•
Heterogeneity: Not ap	•								-100 -50 0 50 100
Test for overall effect Test for subgroup dif		-							Control Acupuncture

Figure 11: Effect of acupuncture on Mini-Mental State Examination in patients with dysphagia with stroke

	Acup	uncti	ure	Co	ontro	ı		Mean Difference	Mean Difference		
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI	IV, Random, 95% CI		
13.11.3 Post interven	tion										
Kikuchi 2014, Acupu Subtotal (95% CI)	8.3	2.9	10 10	6.1	2.9	10 10	100.0% 100.0%	2.20 [-0.34, 4.74] 2.20 [-0.34, 4.74]			
Heterogeneity: Not app Test for overall effect:		) (P =	0.09)								
Total (95% CI)			10			10	100.0%	2.20 [-0.34, 4.74]			
Heterogeneity: Not app Test for overall effect: Test for subgroup diffe	Z = 1.70			le				_	-4 -2 0 2 4 Control Acupuncture		

Figure 12: Effect of acupuncture on Nasal Feeding Tube Removal in patients with dysphagia with stroke

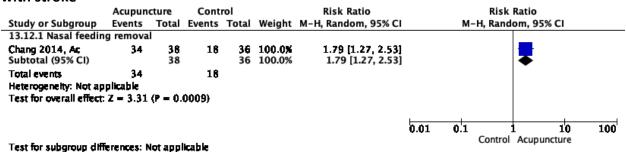
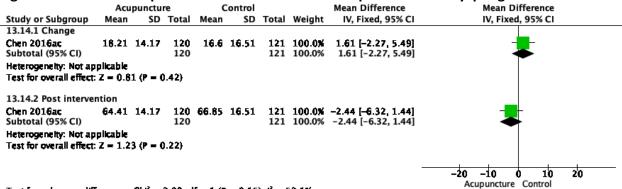


Figure 13: Effect of acupuncture on BI in patients with dysphagia with stroke

	Acu	puncti	ıre	c	ontro	l		Mean Difference		Mean Diff	erence	
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	l Weight IV, Random, 95% CI		IV, Random, 95% CI			
13.13.2 1 month												
Kikuchi 2014, Acupu	15	10.4	10	16	7.7	10	48.5%	-3.00 [-11.02, 5.02]			-	
XIa 2016, ac	88.2	11.1	60	71	12.3	60	51.5%	17.20 [13.01, 21.39]			-	
Subtotal (95% CI)			70			70	100.0%	7.40 [-12.39, 27.19]				
Heterogeneity: Tau2 =	193.36	; Cht² •	= 19.14	1, df =	1 (P <	0.0003	1); $t^2 = 95$	5 <b>%</b>				
Test for overall effect:				•	•							
Total (95% CI)			70			70	100.0%	7.40 [-12.39, 27.19]				
Heterogeneity: Tau <sup>2</sup> =	193.36	: Cht² •	= 19.14	1. df =	1 (P <	0.0003	1);	5 <b>%</b>	1-	1-	<u> </u>	
Test for overall effect:				•	•				-50	-25 0	25	5
Test for subgroup diffi		-								Control A	Acupuncture	

Figure 14: Effect of acupuncture on FM Assessment in patients with dysphagia with stroke



Test for subgroup differences:  $Chi^2 = 2.09$ , df = 1 (P = 0.15),  $i^2 = 52.1\%$ 

Figure 14: Effect of acupuncture on adverse effects in patients with dysphagia with stroke

•	Acupun	cture	Cont	rol		Risk Ratio		Risk Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% CI		M-H, Random, 95% CI
13.15.1 Pain								
XIa 2016, ac	1	60	0	60				
Subtotal (95% CI)		60		60	100.0%	3.00 [0.12, 72.20]		
Total events	1		0					
Heterogeneity: Not ap	•							
Test for overall effect:	Z = 0.68	(P = 0.	50)					
13.15.2 Hematoma								
XIa 2016, ac	2	60	0	60				<del>-   -   -   -   -   -   -   -   -   -  </del>
Subtotal (95% CI)		60		60	100.0%	5.00 [0.25, 102.00]		
Total events	2		0					
Heterogenelty: Not ap	•							
Test for overall effect:	Z = 1.05	(P = 0.	30)					
13.15.3 Discomfort								
XIa 2016, ac	7	60	5	60	100.0%	1.40 [0.47, 4.17]		
Subtotal (95% CI)		60		60	100.0%	1.40 [0.47, 4.17]		<b>*</b>
Total events	7		5					
Heterogenelty: Not ap								
Test for overall effect:	z = 0.60	(P=0.	55)					
							0.005	0.1 1 10 200
		m	·-					Control Acupuncture

Test for subgroup differences:  $Chl^2 = 0.74$ , df = 2 (P = 0.69),  $l^2 = 0\%$ 

## **Treatment 3 – Nutritional Therapy**

Table 1: Effect of early compared to late initiation of oral nutrition therapy on mortality and pneumonia in patients with post-stroke dysphagia

Outcome	Incider		n (N)	RR [95% CI]	l <sup>2</sup>	P value
	Early nutrition	Late nutrition				
Mortality						
• RCT	11.7%	12.6%	4(4337)	0.88 [0.57, 1.37]	26%	0.57
Pneumonia						
• RCT	6.4%	5.8%	1(4023)	1.12 [0.88, 1.42]	NA	0.38

CI: Confidence intervals; I<sup>2</sup>, p: Heterogeneity; n: Number of studies; N: Number of patients; NA: Not applicable; p: Statistical significance value; RR: Risk Ratio

Figure 1: Effect of early compared to late initiation of nutrition therapy on mortality in patients with post-stroke dysphagia

	Early nutrition	therapy	Late nutrition	therapy		Risk Ratio	Risk Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% CI	I M-H, Random, 95% CI
3.1.1 RCT							
Dennis 2006	241	2016	253	2007	67.9%	0.95 [0.80, 1.12]	<b> </b>
Gariballa 1998	2	21	7	21	8.1%	0.29 [0.07, 1.22]	<u> </u>
на 2010а	12	84	10	86	22.0%	1.23 [0.56, 2.69]	<b>→•</b>
Rabadi 2008	0	51	2	51	2.0%	0.20 [0.01, 4.07]	1 ———
Subtotal (95% CI)		2172		2165	100.0%	0.88 [0.57, 1.37]	1 ◆
Total events	255		272				
Heterogeneity: Tau2	= 0.07; Cht <sup>2</sup> = 4.0	7, df = 3	(P = 0.25); P = 3	26%			
Test for overall effect	t: Z = 0.56 (P = 0.	57)					
Total (95% CI)		2172		2165	100.0%	0.88 [0.57, 1.37]	1 📥
Total events	255		272				
Heterogeneity: Tau <sup>2</sup>	= 0.07; Chl2 = 4.0	7, df = 3	(P = 0.25); P = 3	26%			0.01 0.1 1 10 100
Test for overall effect	t: $Z = 0.56$ (P = 0.	57)					0.01 0.1 1 10 100  Early nutrition therapy Late nutrition therapy
Test for subgroup dif	fferences: Not appl	icable					Larry Hutrition therapy Late nutrition therapy

Figure 2: Effect of early compared to late initiation of nutrition therapy on pneumonia in patients with post-stroke dysphagia

	Late nutrition therapy Early nutrition therapy				Risk Ratio	Risk Ratio			
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% CI	M-H, Random, 95% CI		
3.2.1 RCT									
Dennis 2006	130	2016	116	2007	100.0%	1.12 [0.88, 1.42]	<del>-   -   -   -   -   -   -   -   -   -  </del>		
Subtotal (95% CI)		2016		2007	100.0%	1.12 [0.88, 1.42]			
Total events	130		116						
Heterogeneity: Not as	plicable								
Test for overall effect	Z = 0.88 (P = 0)	.38)							
Total (95% CI)		2016		2007	100.0%	1.12 [0.88, 1.42]			
Total events	130		116						
Heterogeneity: Not as	plicable					_	0.7 0.85 1 1.2 1.5		
Test for overall effect	Z = 0.88 (P = 0)	.38)					Early nutrition therapy Late nutrition therapy		
Test for subgroup dif	ferences: Not app	licable					Larry nation therapy Late nation therapy		

Table 2: Effect of early compared to late initiation of oral nutrition therapy on mRS and swallowing in patients with post-stroke dysphagia

Outcome	Incider	nce (%)	n (N)	RR [95% CI]	l <sup>2</sup>	P value
	Early nutrition	Late nutrition				
MRS, RCT						
• mRS, 0, 1	23.4%	23.5%	1(4023)	1.00 [0.89, 1.11]	NA	0.94
• mRS, 0-2	40.4%	41.1%	1(4023)	0.98 [0.91, 1.06]	NA	0.68
Complications						
Recurrent stroke						
• RCT	2.5%	2.1%	1(4023)	1.16 [0.77, 1.73]	NA	0.48
Infections						
• RCT	8.5%	10.0%	1(4023)	0.86 [0.71, 1.04]	NA	0.12
Pressure sores						
• RCT	0.7%	1.3%	1(4023)	0.57 [0.31, 1.08]	NA	0.09
GIT hemorrhage						
• RCT	1.4%	0.9%	1(4023)	1.55 [0.86, 2.79]	NA	0.15

CI: Confidence intervals; GIT: Gastrointestinal; I<sup>2</sup>: Heterogeneity; n: Number of studies; N: Number of patients; NA: Not applicable; p: Statistical significance value; RR: Risk Ratio

Figure 3: Effect of early compared to late initiation of nutrition therapy on mRS in patients with post-stroke dysphagia

	Early nutrition therapy Late nutrit		Late nutrition	therapy		Risk Ratio	Risk Ratio	
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% CI	M-H, Random, 95% CI	
3.3.1 mRS 0, 1, RCT								
Dennis 2006	472	2016	472	2007	100.0%	1.00 [0.89, 1.11]		
Subtotal (95% CI)		2016		2007	100.0%	1.00 [0.89, 1.11]		
Total events	472		472					
Heterogeneity: Not appl	licable							
Test for overall effect: Z	r = 0.08 (P = 0.00)	.94)						
3.3.2 mRS 0-2, RCT								
Dennis 2006	815	2016	824	2007	100.0%	0.98 [0.91, 1.06]	<del></del>	
Subtotal (95% CI)		2016		2007	100.0%	0.98 [0.91, 1.06]		
Total events	815		824					
Heterogeneity: Not appl	licable							
Test for overall effect: Z	t = 0.41 (P = 0.1)	.68)						
						_	0.85 0.9 1 1.1 1.2	
							Early nutrition therapy Late nutrition therapy	

Test for subgroup differences:  $Chl^2=0.03$ , df=1 (P = 0.87),  $l^2=0\%$ 

Figure 4: Effect of early compared to late initiation of oral nutrition therapy on complications in patients with post-stroke dysphagia

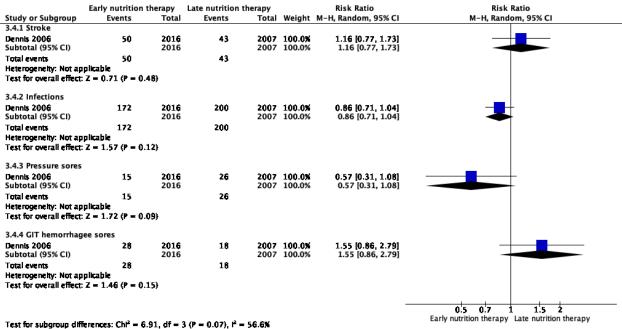


Table 3: Effect of early compared to late initiation of oral nutrition therapy on length of stay, living and tubing in patients with post-stroke dysphagia

Outcome		nce (%)/ n±SD	n (N)	RR [95% CI]/ MD [95% CI]	l <sup>2</sup>	P value
	Early nutrition	Late nutrition				
Length of stay, days						
• RCT	31.1±46.5	31.4±43.2	4(4289)	0.93 [-1.05, 2.91]	0%	0.36
ВІ						
• RCT			1(40)	10.00 [-7.11,		
	45±25	35±30		27.11]	NA	0.25
Living at home						
RCT	20.2%	18.4%	3(4165)	1.20 [0.95, 1.52]	38%	0.13
Living in institution						
• RCT	6.7%	7.0%	2(4063)	0.96 [0.77, 1.21]	0%	0.73

CI: Confidence intervals; I<sup>2</sup>,p: Heterogeneity; MD: Mean difference; n: Number of studies; N: Number of patients; NA: Not applicable; p: Statistical significance value; RR: Risk Ratio; SD: Standard deviation

Figure 5: Effect of early compared to late initiation of nutrition therapy on length of stay in hospital in patients with post-stroke dysphagia

	Early nut	rition th	erapy	Late nutr	ition the	erapy		Mean Difference	Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI	IV, Random, 95% CI
3.6.1 RCT									
Dennis 2006	34	48	2016	32	45	2007	47.5%	2.00 [-0.88, 4.88]	<b>⊨</b>
Gariballa 1998	24	88	20	42	55	20	0.2%	-18.00 [-63.48, 27.48]	<del></del>
Ha 2010a	12	13	58	13	13	66	18.7%	-1.00 [-5.59, 3.59]	+
Rabadi 2008	26	10.1	51	25.4	7.3	51	33.6%	0.60 [-2.82, 4.02]	+
Subtotal (95% CI)			2145			2144	100.0%	0.93 [-1.05, 2.91]	<b>&gt;</b>
Heterogenelty: Tau <sup>2</sup> =				= 0.59); t <sup>2</sup>	= 0%				
Test for overall effect:	Z = 0.92 (1	P = 0.36	}						
Total (95% CI)			2145			2144	100.0%	0.93 [-1.05, 2.91]	•
Heterogeneity: Tau <sup>2</sup> =	0.00; Chr2	= 1.91,	df = 3 (P	$= 0.59$ ); $t^2$	- 0%			_	
Test for overall effect:									-50 -25 0 25 50 Late nutrition therapy Early nutrition therapy
Test for subgroup diff	erences: No	t annika	ble						Late nutrition therapy Early nutrition therapy

Figure 6: Effect of early compared to late initiation of nutrition therapy on activities of daily living Barthel index (ADLBI) in patients with post-stroke dysphagia

	Early nutri	ition the	erapy	Late nutr	ition the	rapy		Mean Difference	Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI	IV, Random, 95% CI
Gariballa 1998	45	25	20	35	30	20	100.0%	10.00 [-7.11, 27.11]	
Total (95% CI)			20			20	100.0%	10.00 [-7.11, 27.11]	
Heterogeneity: Not ap Test for overall effect:		= 0.25)							-20 -10 0 10 20 Late nutrition therapy Early nutrition therapy

Figure 7: Effect of early compared to late initiation of nutrition therapy on home or institution living in patients with post-stroke dysphagia

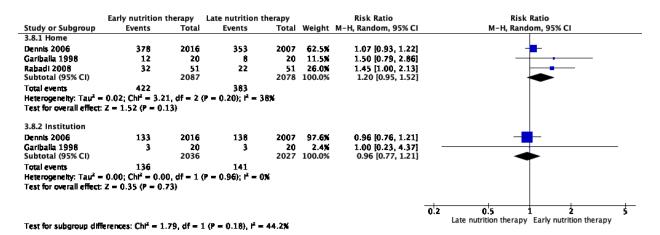


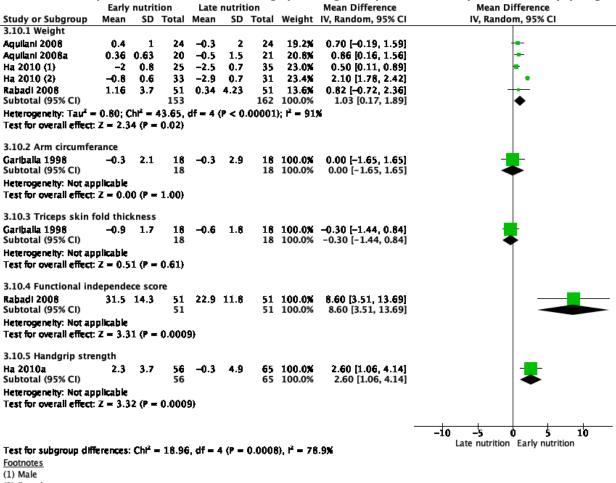
Table 4: Effect of early compared to late initiation of oral nutrition therapy on change in weight functional independence score, hand grip strength, energy and protein intake, energy

and protein intake in patients with post-stroke dysphagia

Outcome	Inciden	ce (%)/	n (N)	RR [95% CI]/	l <sup>2</sup>	P value
	Mean±SD			MD [95% CI]		
	Early	Late				
	nutrition	nutrition				
Weight, change, kg						
• RCT	0.0±1.7	-1.1±2.1	4(315)	1.03 [0.17, 1.89]	91%	0.02
Arm circumference						
RCT	-0.3±2.1	-0.3±2.9	1(36)	0.00 [-1.65, 1.65]	NA	1.00
Triceps skin fold thickness						
RCT	-0.9±1.7	-0.6±1.8	1(36)	-0.30 [-1.44, 0.84]	NA	0.61
Functional independence						
measure, change						
RCT	31.5±14.3	22.9±11.8	1(102)	8.60 [3.51, 13.69]	NA	0.0009
Handgrip strength,						
change						
• RCT	2.3±3.7	-0.3±4.9	1(121)	2.60 [1.06, 4.14]	NA	0.00009
Mini Mental State						
Examination						
RCT			1(48)			<
	3.9±3.3	0.6±1.2		3.30 [1.90, 4.70]	NA	0.00001
Energy, kj/kg						
• RCT	61.6±20.8	49.7±15.0	5(264)	8.25 [1.97, 14.53]	81%	0.01
Protein intake, g/kg						
• RCT	0.9±0.3	0.7±0.3	5(264)	0.21 [0.01, 0.41]	88%	0.04

CI: Confidence intervals; I<sup>2</sup>,p: Heterogeneity; MD: Mean difference; n: Number of studies; N: Number of patients; NA: Not applicable; p: Statistical significance value; RR: Risk Ratio; SD: Standard deviation

Figure 8: Effect of early compared to late initiation of nutrition therapy on change in weight functional independence score and hand grip strength in patients with post-stroke dysphagia



(2) Female

Figure 9: Effect of early compared to late initiation of nutrition therapy on Mini-mental state examination in patients with post-stroke dysphagia

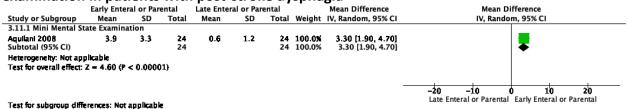
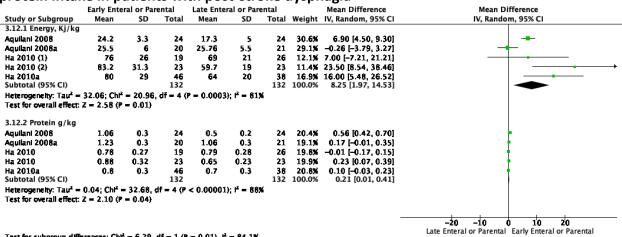


Figure 10: Effect of early compared to late initiation of nutrition therapy on energy and protein intake in patients with post-stroke dysphagia



Test for subgroup differences:  $Chl^2 = 6.29$ , df = 1 (P = 0.01),  $l^2 = 84.1\%$ 

Footnotes

(1) Male (2) Female

Table 1: Effect of early compared to late or restrictive enteral or parenteral nutrition therapy on mortality and pneumonia in patients with post-stroke dysphagia

Outcome	Incide	nce (%)	n (N)	RR [95% CI]	l <sup>2</sup>	P value
	Early Enteral or Parenteral	Late/ Restrictive Enteral or Parenteral				
Mortality						
• RCT	42.4%	48.1%	1(859)	0.88 [0.76, 1.02]	NA	0.09
Pneumonia						
• NRCT	28.4%	29.5%	2(1005)	0.97 [0.80, 1.17]	0%	0.75

CI: Confidence intervals; I<sup>2</sup>, p: Heterogeneity; n: Number of studies; N: Number of patients; NA: Not applicable; p: Statistical significance value; RR: Risk Ratio

Figure 1: Effect of early compared to late or restrictive enteral or parenteral nutrition therapy on mortality in patients with post-stroke dysphagia

	Early Enteral or I	Parental	Late Enteral or I	Parental		Risk Ratio	Risk Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% CI	M-H, Random, 95% CI
4.1.1 RCT							
Dennis 2005 T Subtotal (95% CI)	182	429 429	207		100.0% 100.0%	0.88 [0.76, 1.02] 0.88 [0.76, 1.02]	
Total events Heterogeneity: Not ap Test for overall effect:		19)	207				
Total (95% CI)		429		430	100.0%	0.88 [0.76, 1.02]	•
Total events Heterogeneity: Not ap Test for overall effect: Test for subgroup diff	Z = 1.68 (P = 0.0)		207			-	0.5 0.7 1 1.5 2 Early Enteral or Parental Late Enteral or Parental

Figure 2: Effect of early compared to late or restrictive enteral or parenteral nutrition therapy on pneumonia in patients with post-stroke dysphagia

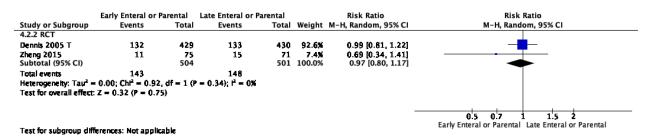
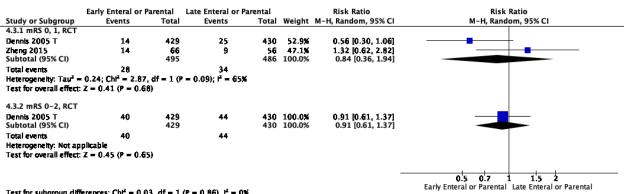


Table 2: Effect of early compared to late or restrictive enteral or parenteral nutrition therapy on mRS in patients with post-stroke dysphagia

Outcome	Incide	ence (%)	n (N)	RR [95% CI]	l <sup>2</sup>	P value
	Early	Late/				
	Enteral or	Restrictive				
	Parenteral	Enteral or				
		Parenteral				
MRS						
mRS, 0, 1	5.7%	7.0%	2(981)	0.84 [0.36, 1.94]	65%	0.68
• RCT						
mRS, 0-2	9.3%	10.2%	1(859)	0.91 [0.61, 1.37]	NA	0.65
• RCT						
Complications						
Recurrent stroke						
• RCT	3.5%	5.3%	1(859)	0.65 [0.35, 1.24]	NA	0.19
Infections						
• RCT	23.8%	27.3%	2(1005)	0.80 [0.55, 1.18]	65%	0.27
Pressure sores						
• RCT	2.8%	2.3%	1(859)	1.20 [0.53, 2.75]	NA	0.66
Malnutrition						
• RCT	27.1%	48.3%	1(128)	0.56 [0.35, 0.90]	NA	0.02
GIT hemorrhage						
• RCT	5.1%	2.6%	1(859)	2.00 [0.98, 4.08]	NA	0.06

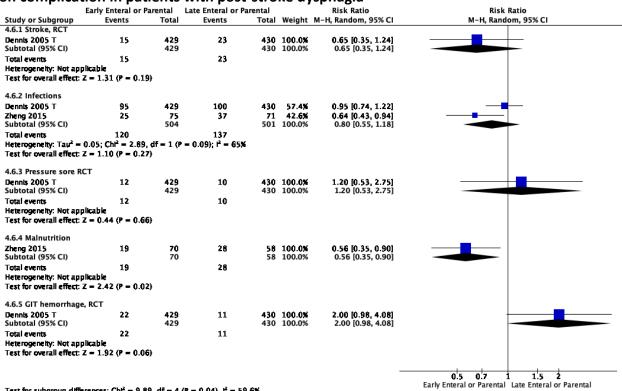
CI: Confidence intervals; GIT: Gastrointestinal; I<sup>2</sup>,p: Heterogeneity; n: Number of studies; N: Number of patients; NA: Not applicable; p: Statistical significance value; RR: Risk Ratio

Figure 3: Effect of early compared to late or restrictive enteral or parenteral nutrition therapy on mRS in patients with post-stroke dysphagia



Test for subgroup differences:  $Chi^2 = 0.03$ , df = 1 (P = 0.86),  $i^2 = 0\%$ 

Figure 4: Effect of early compared to late or restrictive enteral or parenteral nutrition therapy on complication in patients with post-stroke dysphagia



Test for subgroup differences:  $Chl^2 = 9.89$ , df = 4 (P = 0.04),  $l^2 = 59.6\%$ 

Table 3: Effect of early compared to late or restrictive enteral or parenteral nutrition therapy on length of stay, living and tubing and Quality of life in patients with post-stroke dysphagia

Outcome		nce (%)/ n±SD	n (N)	RR [95% CI]/ MD [95% CI]	l <sup>2</sup>	P value
	Early Enteral or Parenteral	Late/ Restrictive Enteral or Parenteral				
Length of stay, days						
• RCT	45±58	44±50	1(859)	1.00 [-6.24, 8.24]	NA	0.79
BI						
• RCT	46.7±8.8	44.4±9.3	1(146)	2.30 [-0.64, 5.24]	NA	0.13
Living at home						
• RCT	35.7%	31.6%	1(859)	1.13 [0.93, 1.36]	NA	0.21
Living in Rehabilitation/ institution						
• RCT	21.9%	20.0%	1(859)	1.10 [0.84, 1.42]	NA	0.49
Nasogastric tube						
• RCT	7.0%	5.3%	1(859)	1.31 [0.77, 2.21]	NA	0.32
PEG						
• RCT	3.3%	2.3%	1(859)	1.40 [0.63, 3.12]	NA	0.41
Quality of life						
• Utilities						
• RCT (Dennis 2005 T)	NR	NR	1(859)	0.013	NA	0.76

CI: Confidence intervals; I<sup>2</sup>,p: Heterogeneity; MD: Mean difference; n: Number of studies; N: Number of patients; NA: Not applicable; p: Statistical significance value; RR: Risk Ratio; SD: Standard deviation

Figure 5: Effect of early compared to late or restrictive enteral or parenteral nutrition therapy on length of stay in patients with post-stroke dysphagia

	Early Enter	al or Par	ental	Late Enter	ral or Pai	rental		Mean Difference	Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI	IV, Random, 95% CI
4.4.1 LOS, RCT									
Dennis 2005 T Subtotal (95% CI)	45	58	429 429	44	50	430 430	100.0% 100.0%	1.00 [-6.24, 8.24] 1.00 [-6.24, 8.24]	<b>.</b>
Heterogeneity: Not app Test for overall effect:		= 0.79)							
Total (95% CI)			429			430	100.0%	1.00 [-6.24, 8.24]	•
Heterogeneity: Not app Test for overall effect: Test for subgroup diffe	Z = 0.27 (P =		e						-50 -25 0 25 50 Late Enteral or Parental Early Enteral or Parental

Figure 6: Effect of early compared to late or restrictive enteral or parenteral nutrition therapy on activities of daily living Barthel index (ADLBI) in patients with post-stroke dysphagia

	Early Enter	ral or Par	rental	Late Ente	ral or Par	ental		Mean Difference	Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI	IV, Random, 95% CI
Zheng 2015	46.7	8.8	75	44.4	9.3	71	100.0%	2.30 [-0.64, 5.24]	+
Total (95% CI)			75			71	100.0%	2.30 [-0.64, 5.24]	•
Heterogeneity: Not ap Test for overall effect:		= 0.13)							-20 -10 0 10 20 Late Enteral or Parental Early Enteral or Parental

Figure 7: Effect of early compared to late or restrictive enteral or parenteral nutrition therapy on living or discharge in patients with post-stroke dysphagia

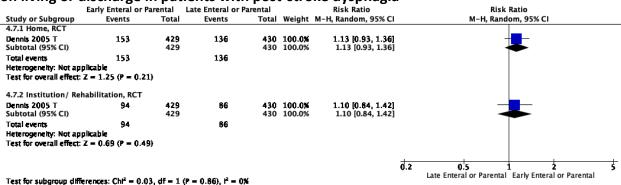


Figure 8: Effect of early compared to late or restrictive enteral or parenteral nutrition therapy on tubing in patients with post-stroke dysphagia

	Early Enteral or P	arental	Late Enteral or I	Parental		Risk Ratio	Risk Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% CI	M-H, Random, 95% CI
4.8.1 NGT							
Dennis 2005 T Subtotal (95% CI)	30	429 429	23		100.0% 100.0%	1.31 [0.77, 2.21] 1.31 [0.77, 2.21]	
Fotal events Heterogeneity: Not app			23				
Test for overall effect:	Z = 1.00 (P = 0.3)	2)					
1.8.2 PEG							
Dennis 2005 T Subtotal (95% CI)	14	429 429	10	430 430	100.0% 100.0%	1.40 [0.63, 3.12] 1.40 [0.63, 3.12]	
Fotal events Heterogeneity: Not app	14 plicable Z = 0.63 (P = 0.4)	n.	10				

Test for subgroup differences:  $\mathrm{Chi}^2 = 0.02$ ,  $\mathrm{df} = 1$  (P = 0.88),  $\mathrm{i}^2 = 0\%$ 

## **Treatment 4 – Oral Health Interventions**

Table 1: Effect of oral health on mortality in patients with dysphagia after stroke

Outcome	Inciden	ce %	n (N)	OR [95% CI]	l <sup>2</sup>	P value
	Oral health	Control				
Mortality						
<ul> <li>Overall</li> </ul>	17.4%	29.8%	3(349)	0.66 [0.45, 0.96]	0%	0.03
• RCT	8.7%	14.0%	1(203)	0.62 [0.28, 1.38]	NA	0.24
• NRCT	32.8%	47.7%	2(146)	0.67 [0.44, 1.03]	0%	0.07
In-patients						
• RCT	8.7%	11.0%	1(203)	0.79 [0.34, 1.83]	NA	0.59
1 month						
• RCT	NR	NR	NR	NR	NR	NR
• NRCT	12.1%	25.0%	2(146)	0.48 [0.22, 1.05]	0%	0.07
3 months						
• RCT	8.7%	14.0%	1(203)	0.62 [0.28, 1.38]	NA	0.24
6 months						
• RCT	NR	NR	NR	NR	NR	NR
• NRCT	32.8%	47.7%	2(146)	0.67 [0.44, 1.03]	0%	0.07

CI: Confidence intervals; I<sup>2</sup>: Heterogeneity; n: Number of studies; N: Number of patients; NR: Not reported; p: Statistical significance value; OR: Odds ratio

Figure 1: Effect of oral health on mortality in patients with dysphagia after stroke

	Oral healt	h care	No oral heal	th care		Risk Ratio	Risk Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% CI	M-H, Random, 95% CI
5.1.1 In patients, RCT							
Gosney 2006 Subtotal (95% CI)	9	103 103	11	100 100	14.1% 14.1%	0.79 [0.34, 1.83] 0.79 [0.34, 1.83]	
Total events	9		11				
Heterogeneity: Not applicable							
Test for overall effect: $Z = 0.5$	54 (P = 0.5)	9)					
5.1.2 1 month, NRCT							
igrensen 2013, Oral heath	3	29	9	30	6.8%	0.34 [0.10, 1.15]	
Sørensen 2013, Oral heath	4	29	13	58	9.3%	0.62 [0.22, 1.72]	<del></del>
Subtotal (95% CI)		58		88	16.1%	0.48 [0.22, 1.05]	•
Fotal events	7		22				
Heterogeneity: $Tau^2 = 0.00$ ; (			$(P = 0.47); 1^2$	- 0%			
Test for overall effect: $Z = 1.6$	33 (P = 0.0	7)					
5.1.4 3 months, RCT							
Gosney 2006	9	103	14	100	15.7%	0.62 [0.28, 1.38]	<del></del>
Subtotal (95% CI)		103		100	15.7%	0.62 [0.28, 1.38]	•
Fotal events	9		14				
Heterogeneity: Not applicable							
Test for overall effect: $Z = 1.1$	17 (P = 0.2)	4)					
5.1.5 6 months, NRCT							
Sørensen 2013, Oral heath	10	29	25	58	29.0%	0.80 [0.45, 1.43]	<del></del>
Sørensen 2013, Oral heath	9	29	17	30	25.1%	0.55 [0.29, 1.02]	<del></del>
Subtotal (95% CI)		58		88	54.1%	0.67 [0.44, 1.03]	•
Fotal events	19		42				
Heterogeneity: $Tau^2 = 0.00$ ; (			$(P = 0.39); 1^2$	- 0%			
Test for overall effect: $Z = 1.6$	83 (P = 0.0)	7)					
Total (95% CI)		322		376	100.0%	0.64 [0.47, 0.88]	•
Total events	44		69				-
Heterogeneity: $Tau^2 = 0.00$ ; (	$Cht^2 = 2.09$	, df = 5	$(P = 0.84); I^2$	- 0%			0.01 0.1 1 10 10
est for overall effect: $Z = 2.7$							0.01 0.1 1 10 10 Oral health care No oral health care
est for subgroup differences	$: Cht^2 = 0.6$	31, df =	3 (P = 0.85).	r <sup>2</sup> = 0%			Grai neatth care INO Grai neatth Care

Table 2: Effect of oral health on pneumonia in patients with dysphagia after stroke

Outcome	Incidence %		n (N)	OR [95% CI]	l <sup>2</sup>	P value
	Oral health	Control				
Pneumonia						
Overall	8.7%	13.9%	7(2110)	0.39 [0.17, 0.91]	53%	0.03
• RCT	0.6%	5.6%	3(284)	0.14 [0.02, 1.11]	NA	0.06
NRCT	10.0%	15.2%	4(1826)	0.47 [0.21, 1.06]	51%	0.07
Symptoms of RTI						
• RCT	0.4±0.7	0.6±0.7	1(94)	-0.20 [-0.48, 0.08]	NA	0.17

CI: Confidence intervals; I<sup>2</sup>: Heterogeneity; n: Number of studies; N: Number of patients; NR: Not reported; p: Statistical significance value; RTI: respiratory tract infection; OR: Odds ratio

Figure 2: Effect of oral health on pneumonia in patients with dysphagia after stroke

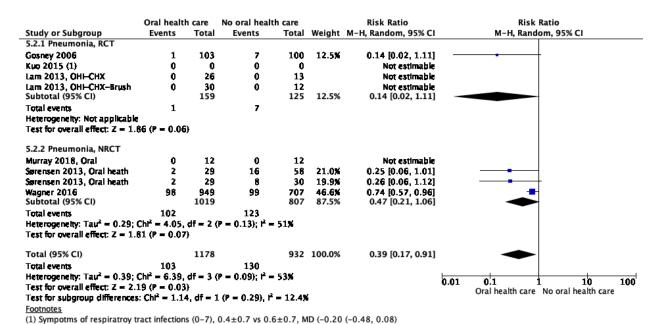
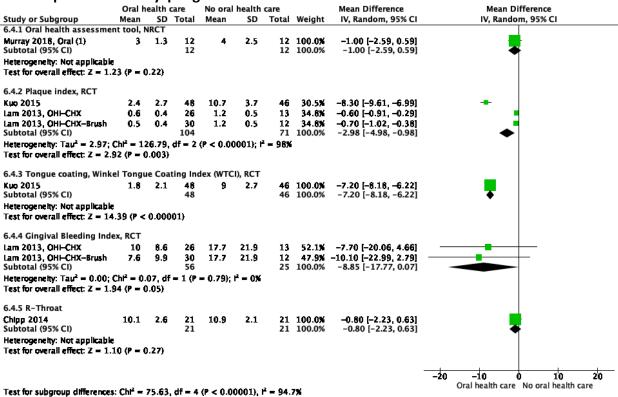


Table 3: Effect of oral health on oral index in patients with dysphagia after stroke

Outcome	Mean	±SD	n (N)	MD [95% CI]	l <sup>2</sup>	P value
	Oral health	Control				
Oral Health						
Overall*	NA	NA	6(235)	-1.27 [-2.26, -0.28]	93%	0.01
OHAT						
• RCT	NR	NR	NR	NR	NR	NR
• NRCT	3.0±1.3	4.0±2.5	1(24)	-1.00 [-2.59, 0.59]	NA	0.22
Oral index						
Plaque index						
• RCT	1.4±1.5	7.4±2.6	3(175)	-2.98 [-4.98, -0.98]	98%	0.003
Tongue coating, WTCI						
• RCT	1.8±2.1	9.0±2.7	1(94)	-7.20 [-8.18, -6.22]	NA	<0.00001
Gingival bleeding index						
• RCT	8.7±9.3	17.7±21.9	2(81)	-8.85 [-17.77, 0.07]	27%	0.05
R-Throat						
• RCT	10.1±2.6	10.9±2.1	1(42)	-0.80 [-2.23, 0.63]	NA	0.27

I<sup>2</sup>: Heterogeneity; MD: Mean difference; n: Number of studies; N: Number of patients; p: Statistical significance value; OHAT: Scores on oral health assessment tool; SD: Standard Deviation; WTCI: Winkel Tongue Coating Index; \*: SMD

Figure 3: Effect of oral health on Oral Health Assessment Tool (OHAT) and R-throat and oral index in patients with dysphagia after stroke



Test for subgroup differences: Cnr = 75.65,  $\alpha$ r = 4 (r < 0.00001), r = 94.7%

Footnotes

(1) OHAT: Lower the store, better the health; Good ( $\leq$ 3), poor ( $\geq$ 4)

Table 4: Effect of oral health on outcomes in patients with dysphagia after stroke

Outcome	Inciden	ice %	n (N)	OR/ MD [95% CI]	l <sup>2</sup>	P value
	Mean	± <b>SD</b>				
	Oral health	Control				
FOIS						
Change						
• RCT	2.9±1.2	0.6±0.8	1(43)	2.30 [1.70, 2.90]	NA	<0.00001
Post intervention						
• RCT	5.8±1.1	3.6±2.1	1(43)	2.20 [1.14, 3.26]	NA	<0.001
Tubing						
Overall	18.1%	29.1%	4(1853)	0.62 [0.48, 0.79]	36%	0.0001
• RCT	41.4%	100.0%	51 (1)	0.43 [0.28, 0.65]	NA	< 0.0001
• NRCT			1802			
	17.5%	27.2%	(3)	0.68 [0.57, 0.81]	0%	< 0.0001
NPO						
• RCT	NR	NR	NR	NR	NR	NR
<ul><li>NRCT</li></ul>	3.9%	24.2%	1(84)	0.16 [0.04, 0.72]	NA	0.02
PEG						
• RCT	NR	NR	NR	NR	NR	NR
• NRCT	12.1%	9.1%	2(146)	1.41 [0.51, 3.90]	0%	0.5
Unintended oral						
feeding						
• RCT	NR	NR	NR	NR	NR	NR
• NRCT	31.8%	54.5%	1(44)	0.58 [0.28, 1.20]	NA	0.14
Length of stay						
• RCT	NR	NR	NR	NR	NR	NR
• NRCT	11.7±9.7	16.8±7.6	2(200)	-3.21 [-5.26, -1.16]	0%	0.002

CI: Confidence intervals; I<sup>2</sup>: Heterogeneity; MD: Mean difference; n: Number of studies; N: Number of patients; NPO: Nil per oral; p: Statistical significance value; PEG: Percutaneous endoscopic gastrostomy; OR: Odds ratio; SD: Standard Deviation; WTCI: Winkel Tongue Coating Index

Figure 4: Effect of oral health on FOIS in patients with dysphagia after stroke

	Oral h	ealth	care	No oral	health	care		Mean Difference	Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI	IV, Random, 95% CI
5.5.1 Change									
hipp 2014	2.9	1.2	25	0.6	0.8	18	100.0%	2.30 [1.70, 2.90]	
Subtotal (95% CI)			25			18	100.0%	2.30 [1.70, 2.90]	▼
leterogeneity: Not ap	plicable								
Test for overall effect	Z = 7.5	4 (P <	0.0000	)1)					
5.5.2 Post interventi	on								
hipp 2014	5.8	1.1	25	3.6	2.1	18	100.0%	2.20 [1.14, 3.26]	<del>     </del>
ubtotal (95% CI)			25			18	100.0%	2.20 [1.14, 3.26]	- ▼
leterogenelty: Not ap	plicable								
est for overall effect	Z = 4.06	6 (P <	0.0001	l)					
									-10 -5 0 5 10
									No health care Oral oral health care
	<b></b>	ALIZ		JE _ 1 /m	_ ^ 07		•		110 health care of all of all health care

Test for subgroup differences:  $Cht^2 = 0.03$ , df = 1 (P = 0.67),  $t^2 = 0\%$ 

Figure 5: Effect of oral health on tubing, NPO, PEG and unintended oral feeding in patients with dysphagia after stroke

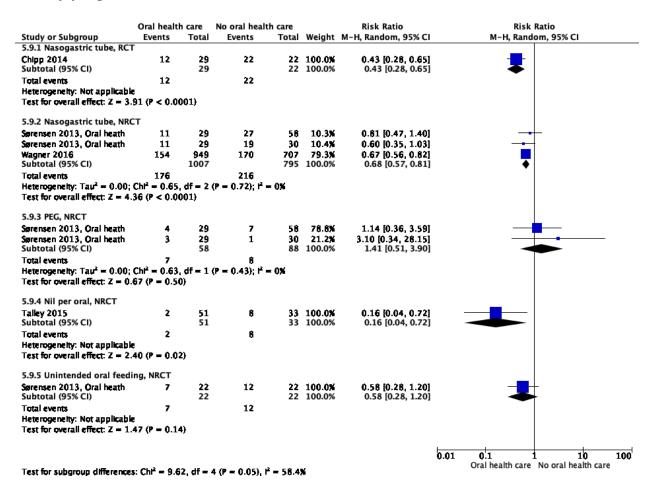


Figure 6: Effect of oral health on length of stay in hospital in patients with dysphagia after stroke

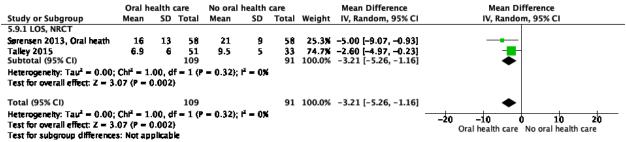


Table 5: Effect of oral health on outcomes in patients with dysphagia after stroke

Outcome	Incidence %		n (N)	OR [95% CI]	l <sup>2</sup>	P value
	Oral health	Control				
AGNB isolated						
• RCT	6.8%	21.0%	1(203)	0.32 [0.14, 0.73]	NA	0.006
AGNB carriage						
• RCT	14.6%	16.0%	1(203)	0.91 [0.48, 1.74]	NA	0.78
Infections						
• RCT	3.9%	10.0%	1(203)	0.39 [0.13, 1.20]	NA	0.1
UTI						
• NRCT	44.8%	41.4%	1(116)	1.08 [0.71, 1.65]	NA	0.71

AGNB: Aerobic Gram-negative bacilli; CI: Confidence intervals; I<sup>2</sup>: Heterogeneity; MD: Mean difference; n: Number of studies; N: Number of patients; p: Statistical significance value; OR: Odds ratio

Figure 7: Effect of oral health on infections in patients with dysphagia after stroke

21 100 100.00 100 100.00	M -H, Random, 95% CI  M 0.32 [0.14, 0.73]	M-H, Random, 95% CI
21 100 100.09 100 100.09	¥ 0.32 [0.14, 0.73]	_
100 100.09	<b>%</b> 0.32 [0.14, 0.73]	
	% 0.32 [0.14, 0.73]	•
21		
16 100 100.09 100 100.09		<b>‡</b>
16		
10 100 100.09 100 100.09		
10		
24 58 100.00 58 100.00		
24		

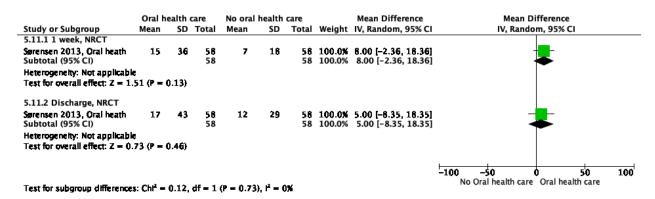
Test for subgroup differences: Chi' = 8.54, df = 3 (P = 0.04), i' = 64.9%

Table 6: Effect of oral health on oral index in patients with dysphagia after stroke

Outcome	Incidence % Mean±SD		n (N)	OR/ MD [95% CI]	l <sup>2</sup>	P value
	Oral health	Control				
BI						
1 week						
• RCT	NR	NR	NR	NR	NR	NR
• NRCT	15±36	7±18	1(116)	8.00 [-2.36, 18.36]	NA	0.13
Discharge						
• RCT	NR	NR	NR	NR	NR	NR
• NRCT	17±43	12±29	1(116)	5.00 [-8.35, 18.35]	NA	0.46

CI: Confidence intervals; I<sup>2</sup>: Heterogeneity; MD: Mean difference; n: Number of studies; N: Number of patients; p: Statistical significance value; OR: Odds ratio; SD: Standard Deviation

Figure 8: Effect of oral health on BI in patients with dysphagia after stroke



## **Treatment 5 – Pharmacological Treatment**

Table 1: Effect of drugs on mortality and pneumonia in patients with dysphagia after stroke

Outcome	Incide	nce %	n (N)	RR [95% CI]	l <sup>2</sup>	P value
	Drugs	Control				
Mortality						
ACE inhibitors						
Overall	10.3%	10.5%	4(6733)	0.96 [0.54, 1.69]	75%	0.88
RCTs: vs Control	10.6%	11.0%	3(6244)	0.97 [0.46, 2.04]	83%	0.93
NRCT: vs Control	4.8%	5.6%	1(489)	0.86 [0.37, 1.99]	NA	0.72
TRPV-agonists: RCT	0.0%	2.9%	1(70)	0.33 [0.01, 7.91]	NA	0.5
Dopaminergic drugs:						
RCT	15.2%	42.9%	1(68)	0.35 [0.14, 0.86]	NA	0.02
Antibiotics: RCTs	16.1%	15.3%	7(4301)	1.05 [0.87, 1.26]	16%	0.61
Metoclopramide: RCT	26.7%	40.0%	1(60)	0.67 [0.32, 1.39]	NA	0.28
Pneumonia						
ACE inhibitors						
Overall	4.1%	7.6%	12(10611)	0.60 [0.51, 0.70]	61%	< 0.00001
RCTs: Vs Control	4.4%	5.2%	2(6176)	0.86 [0.69, 1.06]	61%	0.16
(Fatal)	(2.2%)	(2.2%)	2(6176)	(1.02 [0.74, 1.42])	(79%)	(0.89)
NRCTs: Vs Control	3.6%	11.4%	4(1491)	0.41 [0.26, 0.64]	0%	< 0.0001
NRCTs: vs other						
antihypertensives	3.9%	10.6%	6(2944)	0.38 [0.28, 0.52]	0%	< 0.00001
TRPV-agonists						
Overall	9.6%	32.7%	2(104)	0.31 [0.15, 0.66]	0%	0.002
RCT: Vs Control	0.0%	2.9%	1(70)	0.33 [0.01, 7.91]	NA	0.50
NRCT: Vs Control	29.4%	94.1%	1(34)	0.31 [0.15, 0.66]	NA	0.002
Dopaminergic drugs:						
RCT	6.0%	27.5%	1(163)	0.22 [0.09, 0.55]	NA	0.001
Antibiotics: RCTs	10.3%	11.1%	6(4201)	0.93 [0.78, 1.10]	17%	0.40
Metoclopramide: RCT	26.7%	86.7%	1(60)	0.31 [0.17, 0.57]	NA	0.0002

ACE: Angiotensin converting enzyme; CI: Confidence intervals; I<sup>2</sup>, p: Heterogeneity; n: Number of studies; N: Number of patients; NA: Not applicable; NRCT: Non-Randomized Controlled Trial; p: Statistical significance value; RCT: Randomized Controlled Trial; RR: Risk ratio; TRPV: transient receptor potential vanilloid

Figure 1: Mortality with ACE inhibitors in patients with dysphagia after stroke

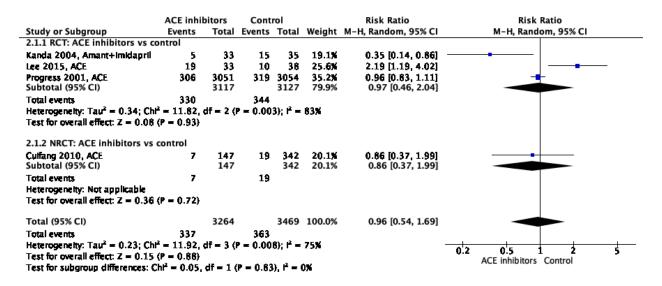


Figure 2: Mortality with TRPV-agonists, dopaminergic drugs, antibiotics and metoclopramide in patients with dysphagia after stroke

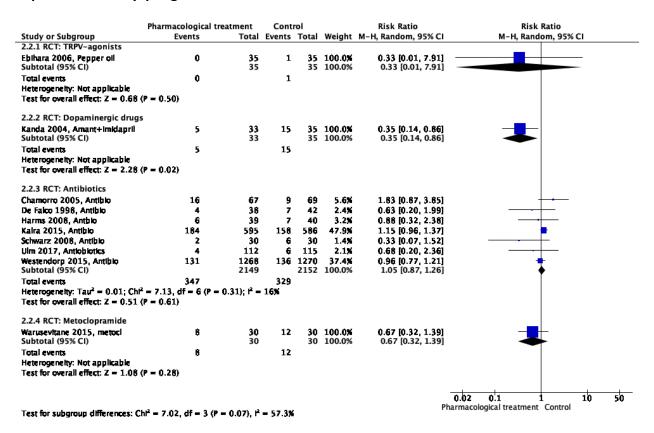


Figure 3: Pneumonia with ACE inhibitors in patients with dysphagia after stroke

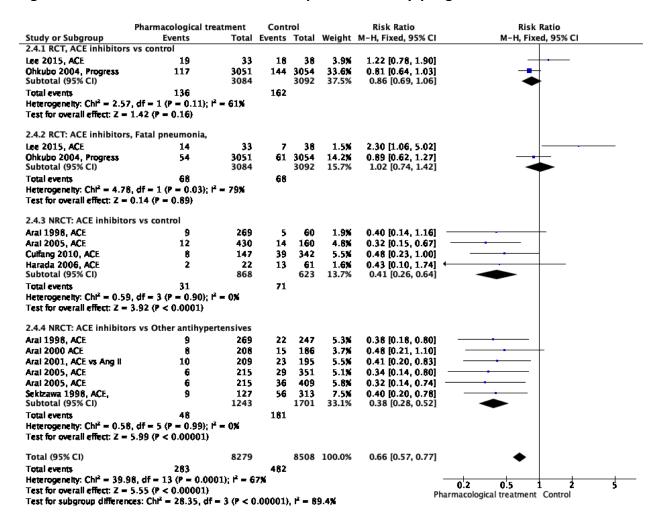
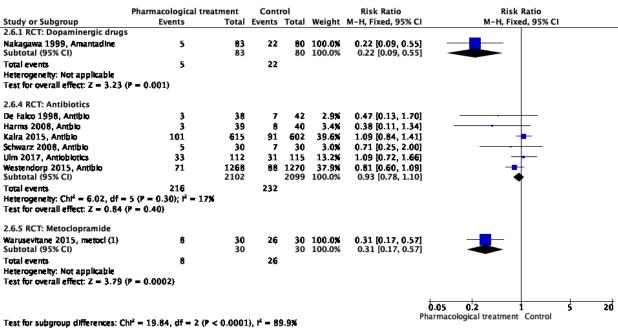


Figure 4: Pneumonia with TRPV-agonists in patients with dysphagia after stroke

ı	Pharmacological trea	tment	Cont	rol		Risk Ratio	Risk Ratio	
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Fixed, 95% C	M-H, Fixed, 95% CI	
10.5.1 RCT: TRPV-agonists								
Ebihara 2006, Pepper oil Subtotal (95% CI)	0	35 35	1	35 35	8. <b>6%</b> 8.6%	0.33 [0.01, 7.91 0.33 [0.01, 7.91		
Total events Heterogeneity: Not applicable Test for overall effect: $Z=0.68$ (P = 0.1	0 50)		1					
10.5.2 NRCT: TRPV-agonists								
Ebihara 2010, Capsaicin-Pepper oil Subtotal (95% CI)	5	17 17	16	17 17	91.4% 91.4%			
Total events Heterogeneity: Not applicable Test for overall effect: $Z=3.06$ (P = 0.6	5 (002)		16					
Total (95% CI)		52		52	100.0%	0.31 [0.15, 0.66	5]	
Total events Heterogeneity: $Chi^2 = 0.00$ , $df = 1$ (P = Test for overall effect: Z = 3.09 (P = 0.0 Test for subgroup differences: $Chi^2 = 0$ .	002)	), i² = 0%	17				0.01 0.1 1 Pharmacological treatment Control	100

Figure 5: Pneumonia with dopaminergic drugs, antibiotics and metoclopramide in patients with dysphagia after stroke



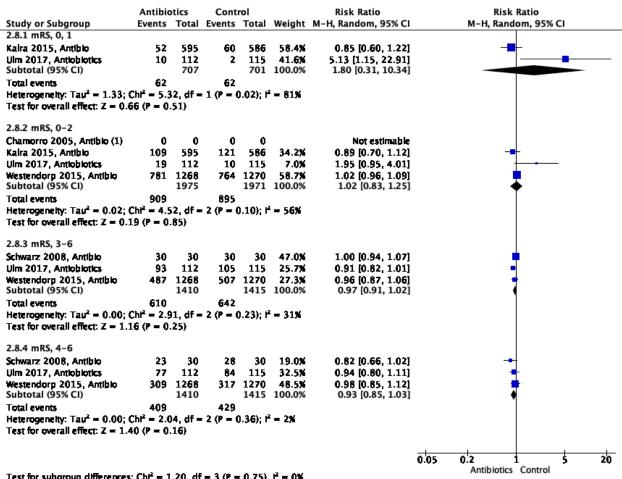
(1) Mean episodes: 0.27±0.45 vs 1.33±0.76

Table 2: Effect of antibiotics on mRS in patients with dysphagia after stroke

Outcome	Incidence %		n (N)	RR [95% CI]	l <sup>2</sup>	P value
	Drugs	Control				
mRS						
<ul> <li>Antibiotics: RCTs</li> </ul>						
• mRS 0, 1	8.8%	8.8%	2(1408)	1.80 [0.31, 10.34]	81%	0.51
• mRS 0-2	46.0%	45.4%	3(3946)	1.02 [0.83, 1.25]	56%	0.85
• mRS 3-6	43.3%	45.4%	3(2825)	0.97 [0.91, 1.02]	31%	0.25
• mRS 4-6	29.0%	30.3%	3(2825)	0.93 [0.85, 1.03]	2%	0.16

CI: Confidence intervals; I<sup>2</sup>, p: Heterogeneity; n: Number of studies; N: Number of patients; p: Statistical significance value; RCT: Randomized Controlled Trial; RR: Risk ratio

Figure 6: mRS with antibiotics in patients with dysphagia after stroke



Test for subgroup differences:  $Chl^2 = 1.20$ , df = 3 (P = 0.75),  $l^2 = 0\%$ 

Footnotes

(1) OR: 0.19, 95% CI (0.04-0.87)

Table 3: Effect of drugs on tracheobronchitis and pneumothorax in patients with dysphagia after stroke

Outcome	Incide	Incidence %		RR [95% CI]	l <sup>2</sup>	P value
	Drugs	Control				
Tracheobronchitis						
Antibiotics: RCT	6.7%	10.0%	1(60)	0.67 [0.12, 3.71]	NA	0.64
Pneumothorax						
Antibiotics: RCT	0.0%	2.5%	1(79)	0.34 [0.01, 8.14]	NA	0.51

CI: Confidence intervals; I<sup>2</sup>, p: Heterogeneity; n: Number of studies; N: Number of patients; NA: Not applicable; p: Statistical significance value; RCT: Randomized Controlled Trial; RR: Risk ratio

Figure 7: Chest complications with antibiotics in patients with dysphagia after stroke

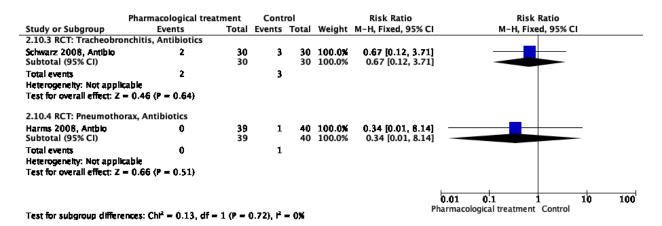
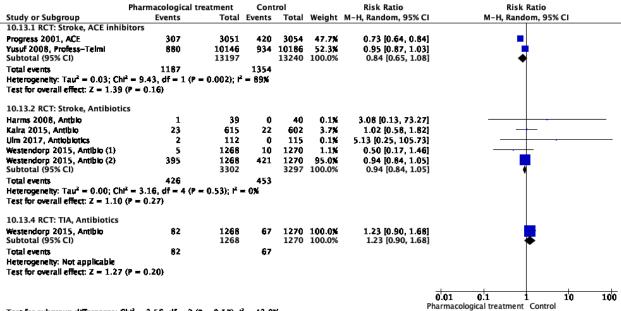


Table 4: Effect of drugs on stroke and TIA in patients with dysphagia after stroke

Outcome	Incidence %		n (N)	RR [95% CI]	l <sup>2</sup>	P value
	Drugs	Control				
Stroke						
ACE inhibitors:						
RCTs	9.0%	10.2%	2(26437)	0.84 [0.65, 1.08]	89%	0.16
Antibiotics: RCTs	12.9%	13.7%	5(6599)	0.94 [0.84, 1.05]	0%	0.27
TIA						
Antibiotics: RCT	6.5%	5.3%	1(2538)	1.23 [0.90, 1.68]	NA	0.2

ACE: Angiotensin converting enzyme; CI: Confidence intervals; I<sup>2</sup>, p: Heterogeneity; n: Number of studies; N: Number of patients; NA: Not applicable; p: Statistical significance value; RCT: Randomized Controlled Trial; RR: Risk ratio; TIA: Transient ischemic attack

Figure 8: Stroke and TIA with ACE inhibitors and antibiotics in patients with dysphagia after stroke



Test for subgroup differences:  $Chl^2 = 3.56$ , df = 2 (P = 0.17),  $l^2 = 43.8\%$ 

Footnotes

(2) Ischemic stroke

<sup>(1)</sup> Hemorrhagic stroke

Table 5: Effect of drugs on infections in patients with dysphagia after stroke

Outcome	Incide	Incidence %		RR [95% CI]	l <sup>2</sup>	P value
	Drugs	Control				
Infections						
ACE inhibitors: RCT	12.1%	45.7%	1(68)	0.27 [0.10, 0.71]	NA	<b>0.</b> 008
Dopaminergic drugs:						
RCT	12.1%	45.7%	1(68)	0.27 [0.10, 0.71]	NA	<b>0.</b> 008
Antibiotics: RCTs	14.5%	20.8%	6(4090)	0.68 [0.54, 0.86]	52%	0.001
<ul> <li>Overall</li> </ul>	15.3%	21.2%	7(4317)	0.73 [0.58, 0.92]	59%	0.007
• UTI	4.0%	9.6%	5(4121)	0.46 [0.32, 0.68]	40%	<0.0001
E coli	5.1%	32.5%	1(79)	0.16 [0.04, 0.65]	NA	0.01
C difficile	0.3%	0.7%	1(1217)	0.49 [0.09, 2.66]	NA	0.41
• MRSA	1.8%	2.3%	1(1217)	0.77 [0.35, 1.68]	NA	0.51
Metoclopramide:						
RCT	10.0%	36.7%	1(60)	0.27 [0.08, 0.88]	NA	0.03

ACE: Angiotensin converting enzyme; CI: Confidence intervals; I<sup>2</sup>, p: Heterogeneity; MRSA: Methicillin-resistant Staphylococcus aureus; n: Number of studies; N: Number of patients; NA: Not applicable; p: Statistical significance value; RCT: Randomized Controlled Trial; RR: Risk ratio; UTI: Urinary tract infections

Figure 9: Infections with ACE inhibitors and dopaminergic drugs in patients with dysphagia after stroke

	Pharmacological trea	atment	Cont	rol		Risk Ratio	Risk Ratio	
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% CI	M-H, Random, 95% CI	
2.14.1 RCT: ACE inhibitors								
Kanda 2004, Amant+imidapril	4	33	16	35	100.0%	0.27 [0.10, 0.71]		
Subtotal (95% CI)		33		35	100.0%	0.27 [0.10, 0.71]	<b>-</b>	
Total events	4		16					
Heterogeneity: Not applicable								
Test for overall effect: $Z = 2.64$ (P	= 0.008)							
2.14.2 RCT: Dopaminergic drugs	i							
Kanda 2004, Amant+imidapril	4	33	16	35	100.0X	0.27 [0.10, 0.71]		
Subtotal (95% CI)		33		35	100.0%	0.27 [0.10, 0.71]		
Total events	4		16					
Heterogeneity: Not applicable								
Test for overall effect: $Z = 2.64$ (P	- 0.008)							
•								
						<del>_</del>	1.05 0.2 1 5	20
							1.05 0.2 1 5 acological treatment Control	20

Test for subgroup differences:  $Cht^2 = 0.00$ , df = 1 (P = 1.00),  $t^2 = 0$ %

Figure 10: Various infections with antibiotics in patients with dysphagia after stroke

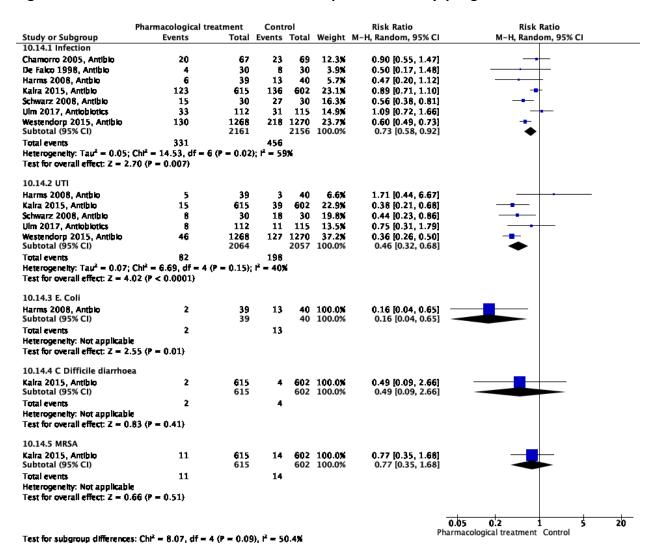


Figure 11: Infections with metoclopramide in patients with dysphagia after stroke

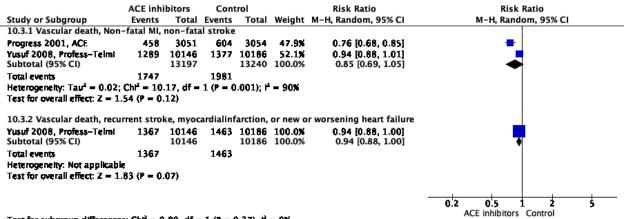
	Pharmacological trea	tment	Cont	rol		Risk Ratio	Risk Ratio
Study or Subgroup	Events	Total	Events Total		Weight	M-H, Random, 95% CI	M-H, Random, 95% CI
2.15.1 RCT: Metoclopramide							
Warusevitane 2015, metoci Subtotal (95% CI)	3	30 30	11	30 30	100.0% 100.0%		
Total events  Heterogeneity: Not applicable  Test for overall effect: Z = 2.13	3 7 (P = 0.03)		11				
Test for subgroup differences:	Not applicable					P	0.05 0.2 1 5 20 harmacological treatment Control

Table 6: Effect of drugs on composite outcomes in patients with dysphagia after stroke

Outcome	Incid	ence %	n (N)	RR [95% CI]	l <sup>2</sup>	P value
	Drugs	Control				
Vascular death, Non-fatal						
MI, non-fatal stroke						
ACE inhibitor, ARB: RCT	13.2%	15.0%	2(26437)	0.85 [0.69, 1.05]	90%	0.12
Vascular death, recurrent						
stroke, MI, or new or						
worsening heart failure						
ARB: RCT	13.5%	14.4%	1(20332)	0.94 [0.88, 1.00]	NA	0.07

ARB: Angiotensin receptor blocker; ACE: Angiotensin converting enzyme; CI: Confidence intervals; I<sup>2</sup>, p: Heterogeneity; n: Number of studies; N: Number of patients; NA: Not applicable; p: Statistical significance value; RCT: Randomized Controlled Trial; MI: Myocardial infarction; RR: Risk ratio

Figure 12: Composite outcomes (Vascular death, myocardial infarction, stroke or heart failure) in patients with dysphagia after stroke



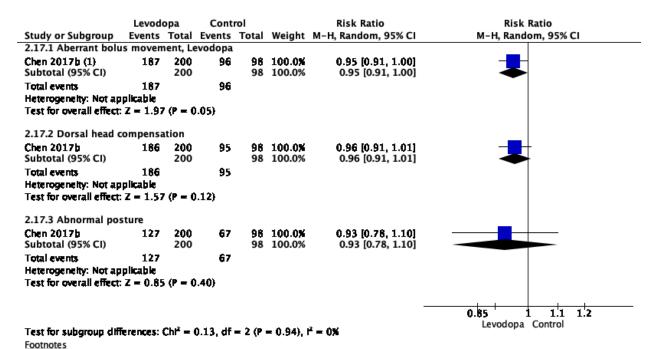
Test for subgroup differences:  $Chi^2 = 0.80$ , df = 1 (P = 0.37),  $i^2 = 0\%$ 

Table 7: Effect of drugs on complications in patients with dysphagia after stroke

Outcome	Incid	ence %	n (N)	RR [95% CI]	l <sup>2</sup>	P value
	Drugs	Control				
Aberrant bolus movement						
Levodopa: RCT	93.5%	98.0%	1(298)	0.95 [0.91, 1.00]	NA	0.05
Dorsal head compensation						
Levodopa: RCT	93.0%	96.9%	1(298)	0.96 [0.91, 1.01]	NA	0.12
Abnormal posture						
Levodopa: RCT	63.5%	68.4%	1(298)	0.93 [0.78, 1.10]	NA	0.40
Bleeding, intracranial						
Antibiotics: RCT	2.3%	2.0%	1(1217)	1.14 [0.53, 2.45]	NA	0.73
Bleeding GIT						
Antibiotics: RCT	0.8%	1.0%	1(1217)	0.82 [0.25, 2.66]	NA	0.74
Transfer to ICU						
Antibiotics: RCT	1.0%	0.7%	1217	1.47 [0.42, 5.18]	NA	0.55

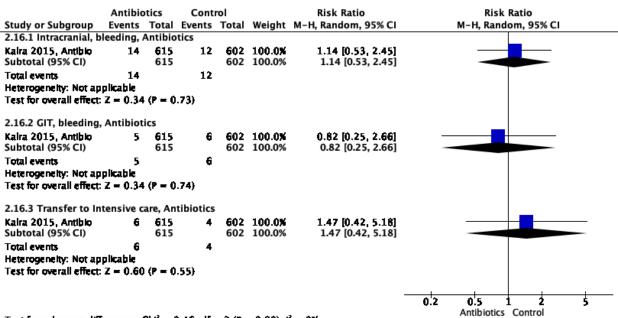
CI: Confidence intervals; I<sup>2</sup>, p: Heterogeneity; MD: Mean difference; n: Number of studies; N: Number of patients; NA: Not applicable; p: Statistical significance value; RCT: Randomized Controlled Trial; RR: Risk ratio

Figure 13: Bolus movement, dorsal head compensation and abnormal posture in patients with dysphagia after stroke



(1) Levodopa

Figure 14: Bleeding and transfer of patients (of stroke with dysphagia) to intensive care unit



Test for subgroup differences:  $Chl^2 = 0.46$ , df = 2 (P = 0.60),  $l^2 = 0\%$ 

Table 8: Effect of drugs on dysphagia score, swallowing and referred to PEG in patients with dysphagia after stroke

Outcome	Incidence % Mean±SD		n (N)	RR [95% CI]/ MD [95% CI]	l <sup>2</sup>	P value
	Drugs	Control				
RBHOMS						
ACE inhibitors: RCT						
<ul> <li>Change</li> </ul>	0.5±1.5	0.6±1.5	1(48)	-0.10 [-0.96, 0.76]	NA	0.82
Post intervention	4.2±1.5	3.5±1.5	1(48)	0.70 [-0.16, 1.56]	NA	0.11
PAS						
TRPV agonists: NRCT						
<ul> <li>Post intervention</li> </ul>	1.9±0.3	2.7±0.4	1(40)	-0.61 [-0.76, -0.45]	98%	0.22
Improvement in						
swallowing						
Metoclopramide: RCT	66.7%	36.7%	1(60)	1.82 [1.07, 3.10]	NA	0.03
Referred to PEG						
Metoclopramide; RCT	23.3%	40.0%	1(60)	0.58 [0.27, 1.28]	NA	0.18

a: Standard Mean Difference; ACE: Angiotensin converting enzyme; CI: Confidence intervals; I<sup>2</sup>, p: Heterogeneity; MD: Mean difference; n: Number of studies; N: Number of patients; NA: Not applicable; p: Statistical significance value; RBHOMS: Royal Brisbane Hospital Outcome; RR: Risk ratio; SD: Standard Deviation; TRPV: transient receptor potential vanilloid

Figure 15: RBHOMS: Royal Brisbane Hospital Outcome in patients with dysphagia after stroke

tudy or Subgroup 17.1 Change se 2015, ACE ubtotal (95% CI) eterogeneity: Not applic est for overall effect: Z		SD 1.5	Total 20 20		SD 1.5	28	100.0%	IV, Random, 95% CI -0.10 [-0.96, 0.76]		ndom, 95% CI	
e 2015, ACE ubtotal (95% CI) eterogenelty: Not applic	cable	1.5		0.6	1.5			-0.10 [-0.96, 0.76]			
ubtotal (95% CI) eterogenelty: Not appli	cable	1.5		0.6	1.5			-0.10 [-0.96, 0.76]		_	
eterogeneity: Not applic			20			20					
						28	100.0%	-0.10 [-0.96, 0.76]			
est for overall effect. 2	- vs (	0.82)									
.17.2 Post											
e 2015, ACE	4.2	1.5	20	3.5	1.5	28	100.0%	0.70 [-0.16, 1.56]			_
ubtotal (95% CI)			20			28	100.0%	0.70 [-0.16, 1.56]			_
eterogeneity: Not applic	cable										
est for overall effect: Z		0.11)									
									<u> </u>	<del> </del>	
								В	harmacological treatm	ont Control	

Fig 16: PAS with capsaicin in patients with dysphagia after stroke

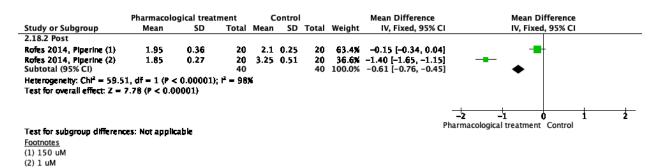


Figure 17: Improvement in swallowing with metoclopramide in patients with dysphagia after stroke

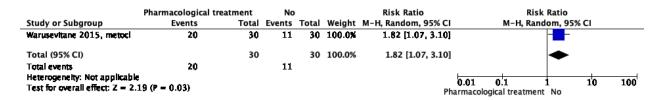


Figure 18: Referred to PEG with metoclopramide in patients with dysphagia after stroke

	Pharmacological treatmen	nt	No			Risk Ratio	Risk Ratio
Study or Subgroup	Events To	otal	Events	Total	Weight	M-H, Random, 95% CI	M–H, Random, 95% CI
Warusevitane 2015, metoci	7	30	12	30	100.0%	0.58 [0.27, 1.28]	
Total (95% CI)		30		30	100.0%	0.58 [0.27, 1.28]	•
Total events  Heterogeneity: Not applicable  Test for overall effect: Z = 1.			12			Ph	0.01 0.1 1 10 100 armacological treatment No

Table 9: Effect of drugs on cough reflex, substance P levels in patients with dysphagia after stroke

Outcome	Inciden Mean	•	n (N)	RR [95% CI]/ MD [95% CI]	l <sup>2</sup>	P value
	Drugs	Control				
Cough reflex sensitivity,						
log mg/mL						
TRPV agonists						
Overall	1.1±0.3	1.2±0.3	2(98)	-0.10 [-0.15, -0.05]	0%	<0.0001
• RCT	1.3±0.1	1.4±0.1	1(64)	-0.10 [-0.15, -0.05]	NA	<0.0001
NRCT	0.8±0.6	0.9±0.8	1(34)	-0.10 [-0.58, 0.38]	NA	0.68
Cough						
Dopaminergic drugs: RCT	56.0%	55.1%	1(298)	1.02 [0.82, 1.26]	NA	0.88
Substance P levels						
ACE inhibitors						
Change from baseline						
<ul> <li>Overall</li> </ul>	39.2±6.9	-2.0±1.0	3(80)	39.12 [23.30, 54.95]	98%	<0.00001
o RCT	36.6±6.7	-1.1±1.1	2(54)	32.12 [8.79, 55.44]	99%	0.007
o NRCT	50.5±8.0	-2.7±1.0	1(26)	53.20 [48.22, 58.18]	NA	<0.00001
Post intervention						
o Overall	65.3±6.9	24.2±1.0	3(80)	38.99 [23.26, 54.72]	98%	<0.00001
o RCT	62.7±6.7	25.3±1.1	2(54)	31.92 [8.99, 54.85]	98%	0.006
o NRCT	76.5±8.0	23.3±1.0	1(26)	53.20 [48.22, 58.18]	NA	<0.00001
TRPV agonist						
Change from						
baseline, RCT	5.5±10.6	-3.4±8.7	1(70)	8.90 [4.36, 13.44]	NA	0.00001
Post intervention						
from baseline, RCT	40.8±10.6	30.9±8.7	1(70)	9.90 [5.36, 14.44]	NA	<0.0001

ACE: Angiotensin converting enzyme; CI: Confidence intervals; I<sup>2</sup>, p: Heterogeneity; MD: Mean difference; n: Number of studies; N: Number of patients; NA: Not applicable; p: Statistical significance value; RR: Risk ratio; SD: Standard Deviation; TRPV: transient receptor potential vanilloid

Fig 19: Cough reflex sensitivity, log mg/mL in patients with dysphagia after stroke

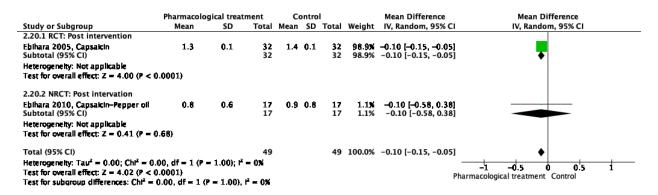
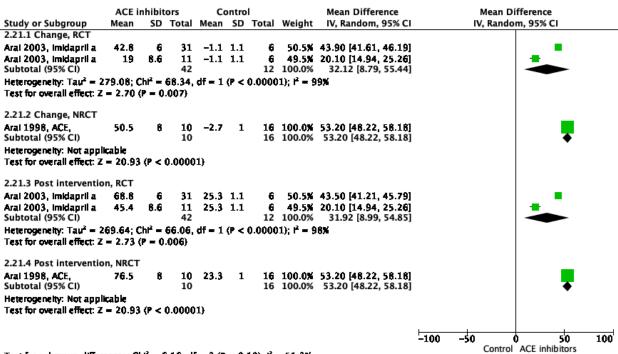


Fig 20: Substance P levels with ACE inhibitors in patients with dysphagia after stroke



Test for subgroup differences:  $Cht^2 = 6.16$ , df = 3 (P = 0.10),  $t^2 = 51.3\%$ 

Fig 21: Cough with dopaminergic drugs in patients with dysphagia after stroke

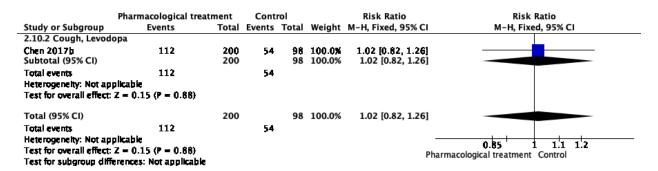


Fig 22: Substance P levels with TRPV agonist in patients with dysphagia after stroke

	TRPV	-agon	ists	Co	ontro	d		Mean Difference		Mean Dif	fference	
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI		IV, Randon	n, 95% CI	
2.22.2 Change, RCT												
Ebihara 2006, Pepper oil Subtotal (95% CI)	5.5	10.6	35 35	-3.4	8.7	35 35	50.0% 50.0%	8.90 [4.36, 13.44] 8.90 [4.36, 13.44]			<b>+</b>	
Heterogeneity: Not applical	ble											
Test for overall effect: Z =	3.84 (P	- 0.00	01)									
2.22.3 Post intervention,	RCT											
Ebihara 2006, Pepper oil Subtotal (95% CI)	40.8	10.6	35 35	30.9	8.7	35 35	50.0% 50.0%	9.90 [5.36, 14.44] 9.90 [5.36, 14.44]			•	
Heterogeneity: Not applica	ble											
Test for overall effect: Z =	4.27 (P	< 0.00	01)									
Total (95% CI)			70			70	100.0%	9.40 [6.19, 12.61]			•	
Heterogeneity: Tau <sup>2</sup> = 0.00 Test for overall effect: Z = Test for subgroup different	5.74 (P	< 0.00	001)			_			-100 -50		50 TRPV-agonists	100

Table 10: Effect of drugs on NIHSS, Mini-mental state examination, quality of life, anxiety and depression in patients with dysphagia after stroke

Outcome	Incidence % Mean±SD		n (N)	RR [95% CI]/ MD [95% CI]	l <sup>2</sup>	P value
	Drugs	Control				
NIHSS						
Antibiotics: RCT	11.7±8.1	10.1±7.7	1(1217)	1.60 [0.71, 2.49]	NA	0.0004
Mini-mental state examination						
TRPV agonist: RCT	11.2±7.7	12.4±7.3	1(70)	-1.20 [-4.72, 2.32]	NA	0.50
EUR, Quality of life						
Problem with mobility						
Antibiotics: RCT	70.3%	69.2%	1(839)	1.02 [0.93, 1.11]	NA	0.72
Problem with selfcare						
Antibiotics: RCT	71.0%	69.9%	1(839)	1.02 [0.93, 1.11]	NA	0.71
Problem with usual activities						
Antibiotics: RCT	85.3%	85.8%	1(833)	0.99 [0.94, 1.05]	NA	0.83
Pain or discomfort						
Antibiotics: RCT	53.6%	49.5%	1(823)	1.08 [0.95, 1.24]	NA	0.24
Anxiety or depression						
Antibiotics: RCT	53.0%	51.6%	1(813)	1.03 [0.90, 1.17]	NA	0.68

CI: Confidence intervals; I<sup>2</sup>, p: Heterogeneity; MD: Mean difference; n: Number of studies; N: Number of patients; NA: Not applicable; p: Statistical significance value; RR: Risk ratio; SD: Standard Deviation

Figure 23: NIHSS, Mini mental state examination, number of swallows per min in patients with dysphagia after stroke

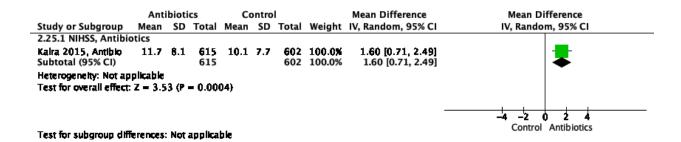


Fig 24: Mini-mental state examination in patients with dysphagia after stroke

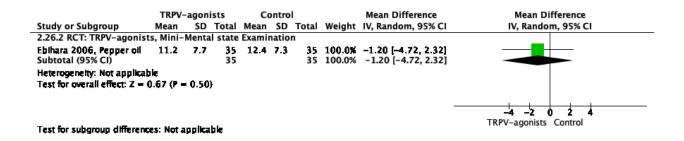
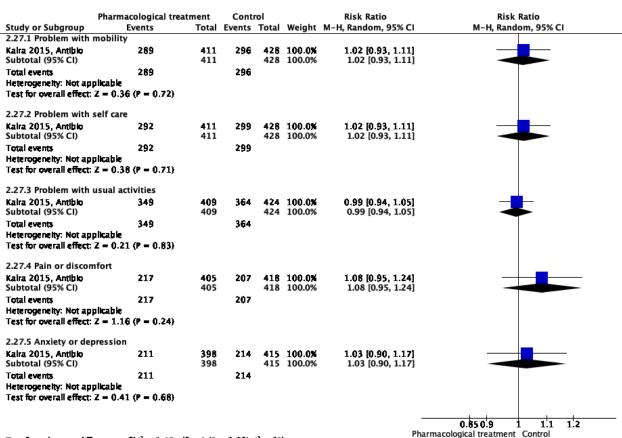


Fig 25: EUR QoL, anxiety and depression with the use of antibiotics in patients with dysphagia after stroke



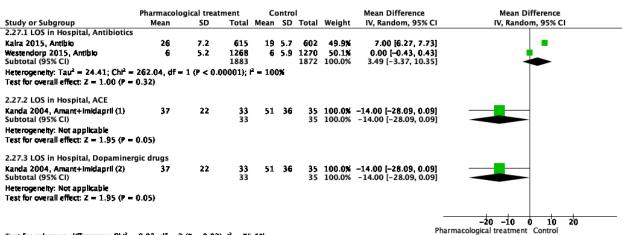
Test for subgroup differences:  $Chi^2 = 1.45$ , df = 4 (P = 0.63),  $i^2 = 0\%$ 

Table 11: Effect of drugs on length of stay, time to infection and number of febrile days in patients with dysphagia after stroke

Outcome	Mea	n±SD	n (N)	MD [95% CI]	l <sup>2</sup>	P value
	Drugs	Control				
Length of stay in hospital, days						
ACE inhibitor: RCT				-14.00 [-28.09,		
	37±22	51±36	1(68)	0.09]	NA	0.05
Dopaminergic: RCT				-14.00 [-28.09,		
	37±22	51±36	1(68)	0.09]	NA	0.05
<ul> <li>Antibiotics: RCT</li> </ul>	12.5±5.9	10.2±5.8	2(3755)	3.49 [-3.37, 10.35]	100%	0.32
Time to first infection						
Antibiotics: RCT	3.9±3.7	3.6±3.1	2(196)	0.76 [-1.30, 2.82]	81%	0.47
Number of febrile days						
TRPV agonist: NRCT	1.3±1.7	6.8±4.7	1(34)	-5.50 [-7.88, -3.12]	NA	<0.00001

ACE: Angiotensin converting enzyme; CI: Confidence intervals; I<sup>2</sup>, p: Heterogeneity; MD: Mean difference; n: Number of studies; N: Number of patients; NA: Not applicable; p: Statistical significance value; SD: Standard deviation; TRPV: transient receptor potential vanilloid

Fig 26: Length of stay in hospital in patients with dysphagia after stroke



Test for subgroup differences:  $Chl^2 = 6.03$ , df = 2 (P = 0.02),  $l^2 = 75.1\%$ 

(1) Use of antibiotics 17 vs 39 days, p<0.01

(2) Use of antibiotics 17 vs 39 days, p<0.01

Fig 27: Time to first infection in patients with dysphagia after stroke

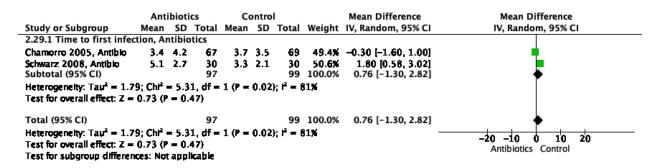


Fig 28: Number of febrile days in patients with dysphagia after stroke

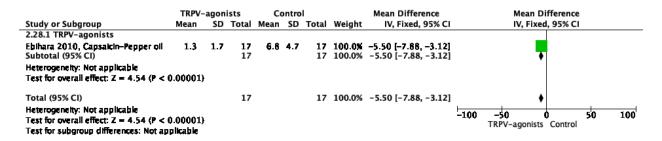


Table 12: Effect of drugs on length of stay and timing of swallowing in patients with dysphagia after stroke

Outcome	Incide	ence % n±SD	n (N)	RR [95% CI]/ MD [95% CI]	l <sup>2</sup>	P value
	Drugs	Control				
Aspiration						
ACE inhibitors: RCT	26.2%	91.7%	1(54)	0.29 [0.17, 0.49]	NA	<0.00001
Dopaminergic drugs: RCT	25.9%	91.7%	1(39)	0.30 [0.16, 0.58]	0%	0.0003
Latency of swallowing						
reflex						
TRPV agonist						
Change						
<ul> <li>Overall</li> </ul>				-5.14 [-7.86, -		
	-7.4±1.2	-0.5±7.2	3(174)	2.41]	100%	0.80
o RCT				-6.68 [-15.75,		
	-7.9±1.5	-0.6±9.4	2(134)	2.39]	90%	0.15
o NRCT				-5.50 [-5.50, -		
	-5.5±0.0	0.0±0.01	1(40)	5.50]	NA	<0.00001
<ul> <li>Post intervention</li> </ul>						
<ul> <li>Overall</li> </ul>				-4.54 [-10.86,		
	7.3±6.0	12.0±12.2	3(168)	1.77]	72%	0.16
o RCT				-5.54 [-13.11,		
	4.0±1.5	10.2±9.4	2(134)	2.02]	86%	0.15
o NRCT				1.70 [-14.20,		
	20.6±23.9	18.9±23.4	1(34)	17.60]	NA	0.83
Upper oesophageal						
sphincter opening time,						
sec						
<ul> <li>TRPV agonist</li> </ul>				-0.08 [-0.13, -		
	0.9±0.1	1.0±0.0	2(50)	0.04]	41%	0.0002
Laryngeal vestibule						
closure time, sec						
TRPV agonist				-0.10 [-0.12, -		
	0.3±0.0	0.4±0.0	3(116)	0.08]	70%	<0.00001
Hyoid bone maximum						
anterior extension time,						
sec						
TRPV agonist				-0.15 [-0.16, -		
	0.5±0.0	0.6±0.1	3(146)	0.13]	0%	<0.0001
Bolus velocity	_	_				
TRPV agonist	0.3±0.0	0.3±0.0	3(146)	0.04 [0.01, 0.08]	96%	0.02
Swallowing reflex (sec)						
<ul> <li>Dopaminergic drugs:</li> </ul>	2.9±0.8	8.3±1.2	1(54)	-5.40 [-5.94, -	NA	<0.00001

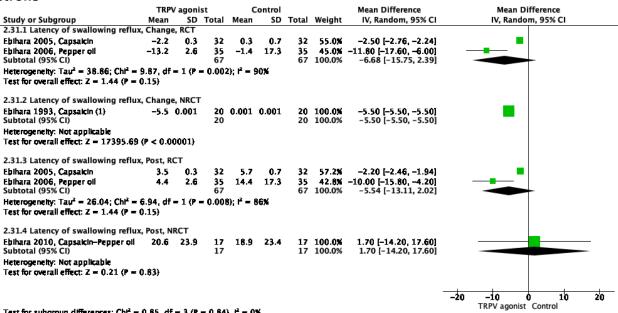
Outcome	Incidence % Mean±SD		n (N)	RR [95% CI]/ MD [95% CI]	l <sup>2</sup>	P value
	Drugs	Control				
RCT				4.86]		
Swallows/min						
TRPV agonist						
Change: RCT	3.3±2.5	0.0±0.05	1(70)	3.30 [2.47, 4.13]	NA	<0.00001
Post intervention:						
RCT	3.7±2.5	0.5±0.5	1(70)	3.20 [2.36, 4.04]	NA	<0.00001

a: Standard Mean Difference; ACE: Angiotensin converting enzyme: CI: Confidence intervals; I<sup>2</sup>, p: Heterogeneity; MD: Mean difference; n: Number of studies; N: Number of patients; NA: Not applicable; p: Statistical significance value; RR: Risk ratio; TRPV: transient receptor potential vanilloid

Figure 29: Aspiration with ACE inhibitors and dopaminergic drugs in patients with dysphagia after stroke

1	Pharmacological treat	ment	Conti	rol		Risk Ratio	Risk Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Fixed, 95% CI	M-H, Fixed, 95% CI
10.8.1 RCT: ACE inhibitor	s						
Arai 2003, imidapril a Subtotal (95% CI)	11	42 42	11		100.0% 100.0%	0.29 [0.17, 0.49] 0.29 [0.17, 0.49]	
Total events Heterogeneity: Not applical Test for overall effect: Z = 4			11				
10.8.2 RCT: Dopaminergio	c drugs						
Arai 2003, Amantadine	3	13	6	6	55.3%	0.27 [0.11, 0.68]	
Arai 2003, Cabergoline Subtotal (95% CI)	4	14 27	5	6 12	44.7% 100.0%	0.34 [0.14, 0.85] 0.30 [0.16, 0.58]	
Total events Heterogeneity: Chi² = 0.13 Test for overall effect: Z = 3		- 0%	11				
Test for subgroup difference		/n - A	00) 13 <u>-</u>	O#/		ı	0.1 0.2 0.5 1 2 5 10 Pharmacological treatment Control

Figure 30: Latency of swallowing reflex with TRPV agonist in patients with dysphagia after stroke



Test for subgroup differences:  $Chi^2 = 0.85$ , df = 3 (P = 0.84),  $i^2 = 0\%$ 

Footnotes

(1) Before after

Fig 31: Effect of TRPV on swallow timing in patients with dysphagia after stroke

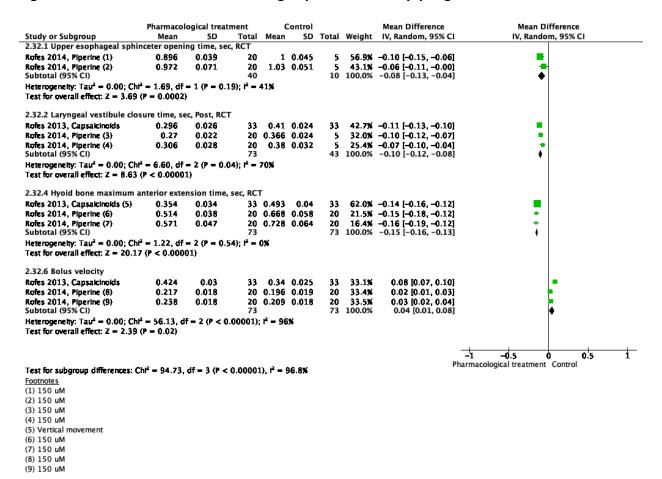
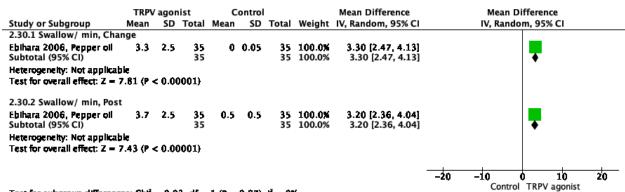


Fig 32: Latency of swallowing reflex (sec) in patients with dysphagia after stroke

	ACE Control Mean Difference		Mean Difference	Mean D	ifference					
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI	IV, Rando	m, 95% CI
2.19.1 Dopaminergic dru	ugs, RC	T: po	st							
Kobayashi 1996, LDopa Subtotal (95% CI)	2.9	0.8	27 27	8.3	1.2			-5.40 [-5.94, -4.86] -5.40 [-5.94, -4.86]	-	
Heterogeneity: Not applicated Test for overall effect: Z =		(P <	0.0000	1)						
Total (95% CI)			27			27	100.0%	-5.40 [-5.94, -4.86]		
Heterogeneity: Not applica Test for overall effect: Z = Test for subgroup differer	19.46	-		1)					-20 -10 ACE	0 10 20 Control

Fig 33: Swallow per min with TRPV agonist in patients with dysphagia after stroke



Test for subgroup differences:  $Chi^2 = 0.03$ , df = 1 (P = 0.87),  $i^2 = 0\%$ 

## **Treatment 6 - Neurostimulation**

Table 1: Effect of stimulation on dysphagia score in patients with dysphagia after stroke

Outcome	Mean	±SD	n (N)	SMD [95% CI]	l <sup>2</sup>	P value
	Stimulation	Control				
Improvement in dy	ysphagia score					
TES						
Overall	5.8±2.7	3.5±2.6	22(868)	0.90 [0.62, 1.18]	69%	<0.00001
• RCT	6.2±2.8	3.7±2.7	19(746)	0.90 [0.60, 1.19]	70%	<0.00001
• NRCT	3.7±1.9	1.8±1.9	3(122)	1.14 [-0.13, 2.41]	78%	0.08
rTMS						
Overall	9.6±6.1	4.7±5.1	11(236)	1.33 [0.51, 2.16]	85%	0.002
• RCT	10.5±6.4	5.3±5.5	10(212)	1.51 [0.60, 2.42]	85%	0.001
• NRCT	0.8±2.6	0.7±2.5	1(24)	0.04 [-0.76, 0.84]	NA	0.93
tDCS						
Overall	2.8±2.3	2.0±1.8	8(196)	0.75 [0.38, 1.12]	26%	<0.0001
• RCT	2.8±2.3	2.0±1.8	8(196)	0.75 [0.38, 1.12]	26%	<0.0001
PES, Non-						
tracheostomized						
<ul> <li>Overall</li> </ul>	2.3±1.9	1.6±2.2	5(204)	0.77 [-0.06, 1.60]	80%	0.07
• RCT	2.3±1.9	1.6±2.2	5(204)	0.77 [-0.06, 1.60]	80%	0.07
PES,						
tracheostomized						
<ul> <li>Overall</li> </ul>	5.6±3.9	5.2±4.3	2(83)	0.25 [-0.19, 0.69]	0%	0.27
• RCT	5.6±3.9	5.2±4.3	2(83)	0.25 [-0.19, 0.69]	0%	0.27
Post-intervention d	ysphagia score					
TES						
<ul> <li>Overall</li> </ul>	8.2±2.8	12.1±3.1	21(869)	-1.03 [-1.41, -0.66]	83%	<0.00001
• RCT	9.2±3.0	12.6±3.2	19(759)	-1.00 [-1.37, -0.63]	80%	<0.00001
• NRCT	2.9±1.8	6.6±2.1	2(110)	-1.16 [-3.50, 1.18]	94%	0.33
rTMS						
<ul> <li>Overall</li> </ul>	14.5±6.3	16.2±5.5	11(232)	-1.71 [-2.75, -0.66]	89%	0.001
• RCT	15.7±6.7	18.1±5.9	10(208)	-1.96 [-3.14, -0.78]	90%	0.001
• NRCT	2.5±2.6	2.6±2.5	1(24)	-0.04 [-0.84, 0.76]	NA	0.93
tDCS						
<ul> <li>Overall</li> </ul>	3.7±3.2	5.4±3.7	4(122)	-0.29 [-0.92, 0.33]	61%	0.36
• RCT	3.7±3.2	5.4±3.7	4(122)	-0.29 [-0.92, 0.33]	61%	0.36
PES, Non- tracheostomized						
Overall	3.9±3.0	4.8±3.0	4(201)	-0.22 [-0.70, 0.25]	49%	0.35
RCT	3.9±3.0 3.9±3.0	4.8±3.0 4.8±3.0	4(201) 4(201)	-0.22 [-0.70, 0.25]	49%	0.35

PES,						
tracheostomized						
Overall	4.8±3.9	6.2±4.3	2(83)	-0.68 [-1.69, 0.33]	76%	0.19
• RCT	4.8±3.9	6.2±4.3	2(83)	-0.68 [-1.69, 0.33]	76%	0.19

CI: Confidence intervals; tDCS: transcranial Direct Current Stimulation; I<sup>2</sup>: Heterogeneity; n: Number of studies; N: Number of patients; NMES: Neuromuscular Electrical Stimulation; NRCT: RCT: Non-randomized controlled trial (Cohort, before after, case-control studies); p: Statistical significance value; PES: Pharyngeal Electrical Stimulation; RCT: Randomized controlled trial; SD: Standard Deviation; SMD: Standard Mean Difference; rTMS: repetitive Transcranial Magnetic Stimulation

Figure 1: Improvement in dysphagia score with different stimulations in patients with dysphagia after stroke

itudy or Subgroup	Stin Mean	nulation SD -	Total	Mean	Sham SD	Total	Weight	Std. Mean Different IV, Random, 955	
1.1.1 NMES, RCT									
krreola 2018b	1.3	1.9	30	0	0.02	15	5.7%	0.82 [0.17, 1	46]
krreola 2018b	0.9	2.3	30	0	0.02	15	5.8%	0.47 [-0.16, 1	
Julow 2008	10.3	4.4	12	8.2	5.2	12	4.9%	0.42 [-0.39, 1	
lyeon 2016, NMES	11.6	8.5	27	9.7	9.2	18	5.9%	0.23 [-0.36, 0	
Guillén-Solà 2017	1.1	2.2	18	1.3	2.2	20	5.8%	-0.09 [-0.73, 0	
luang 2014	3.7	1.6	10	3	1.4	11	4.7%	0.45 [-0.42, 1	
ee 2014, NMES	3.1	1.4	31	1.7	0.9	26	6.1%	1.15 [0.59, 1	
Jm 2009	2.5	. 1	16	0.5	_ 1	12	4.4%	1.94 [1.01, 2	
Jm 2014, NMES		12.71	16	12.6	7.35	15	5.4%	0.73 [0.02, 1	
Aeng 2017, NMESa	1.6	1.4	10	0.9	1.1	5	3.6%	0.50 [-0.59, 1	
Meng 2017, NMESb	1.6	1.45	10	0.9	1.1	. 5	3.6%	0.49 [-0.61, 1	
ark 2016, NMES	1.36	1.5	25	0.2	0.5	25	6.0%	1.02 [0.43, 1	
Permsirivanich 2009	3.17	1.27	12	2.46	1.04	12	4.9X	0.59 [-0.23, 1	
iproson 2018, NMES	1.8	1.9	12	0.8	2.2	14	5.1%	0.47 [-0.32, 1	
Ferre 2015, NMES	3.4	1.5	10	2.5	1.5	10	4.5%	0.57 [-0.32, 1	
Jmay 2017, SES	2.4	0.99	58	0.94	0.97	40	6.6%	1.48 [1.02, 1	
(la 2011, Vitalstim	18.1	3.5	40	10.8	3.8	40	6.2%	1.98 [1.44, 2	
hang 2016, NMES	12	2.8	28	3	5.9	14	5.0%	2.17 [1.36, 2	
hang 2016, NMES-MA Subtotal (95% CI)	8	2.2	27 424	3	5.9	13	5.3% 100.0%	1.30 [0.57, 2 0.90 [0.60, 1	
leterogeneity: $Tau^2 = 0.29$ ; C			- 18 (	P < 0.0	00001)	_		0.50 [0.00, 1	15]
est for overall effect: Z = 5.9	5 (P < 0	).00001)							
11.1.2 NMES, NRCT to 2016, NMES	1.39	1.64	12	1.34	1.73	6	36.1%	0.03 [-0.95, 1	01]
(ushner 2013	4.4	2.1	65	2.4	2.3	27	43.2%	0.92 [0.45, 1	
Alchou 2012, PAS	0.78	0.4	6	-0.5		6	20.7%	3.54 [1.48, 5	
Subtotal (95% CI)	-		83		-		100.0%	1.14 [-0.13, 2	
leterogenelty: Tau <sup>2</sup> = 0.91; C lest for overall effect: Z = 1.7			2 (P -	- 0.010	));	78%			
1.1.3 rTMS, RCT									
Du 2016, rTMS, 1H	5	0.5	13	3.08	2.5	6	10.6%	1.29 [0.22, 2	361
Du 2016, rTMS, 3H	5.77	0.25	13	3.08	2.5	6	10.5%	1.87 [0.70, 3	
(hedr 2009, rTMS	2.6	0.1	14	0.6	0.1	12		19.37 [13.60, 25	
(hedr 2010, rTMS	2.2	0.6	11	0.23	0.4	11	9.6%	3.72 [2.24, 5	
(im 2011 rTM\$	1.6	1.8	20	0.7	1.2	10	11.7%	0.66 [-0.12, 1	- I
Jm 2014, rTM\$		11.19	18		7.35	15	11.9%	0.47 [-0.23, 1	
Alchou 2014, rTMS	5.6	6.1	-6		10.2	- 6	10.6%	0.26 [-0.88, 1	
ark 2013, rTMS	2.03	0.87	9	0.19	2.15	9	11.1%	1.07 [0.06, 2	
ark 2016, rTMS	2.03	22	11	17.5	2.15	5	10.9%	0.20 [-0.86, 1	
ark 2016, rTMS	43.8	24	11	17.5	21	é	10.8%	1.08 [0.01, 2	
ubtotal (95% CI)		-	126				100.0%	1.51 [0.60, 2	
leterogeneity: $Tau^2 = 1.69$ ; Constitution of the set for overall effect: $Z = 3.2$			= 9 (P	< 0.00	0001);	r = 85	×		
1.1.4 rTMS, NRCT									
ee 2015, rTMS	0.8	2.6	12	0.7	2.5	12	100.0%	0.04 [-0.76, 0	84] —
Subtotal (95% CI)	7.0		12	4.,	,		100.0%	0.04 [-0.76, 0	
leterogeneity: Not applicable									- T
est for overall effect: Z = 0.0	9 (P = C	).93)							
11.1.5 tDCS, RCT									
	0.62	0.77	13	0.38	0 60	12	15.3%	0 30 1_0 47 4	121
thn 2017, tDCS	0.92	0.77	15	0.35	0.05	5	10.4%	0.32 [-0.47, 1	
(o 2016, tDCS						5		0.42 [-0.60, 1	
(o 2016, tDCS	0.47 1	0.87 0.97	15 15	0.35	0.7	5	10.6% 10.2%	0.14 [-0.88, 1	
to 2016, tDCS	2.6	0.97	7	1.26	0.7	7	7.9%	0.68 [-0.36, 1 1.39 [0.18, 2	
(umar 2011 ihkgematsu 2013, tDCS									
	2.8	0.9	10 29	1.2	0.9	10	9.9%	1.70 [0.65, 2	
iuntrup-Krueger 2018	12	2.8	_	1.5	1.6	30	23.7%	1.09 [0.54, 1	
/ang 2012, tDCS Subtotal (95% CI)	13	12.2	9 113	9.8	7.1	83	12.0% 100.0%	0.31 [-0.63, 1	
leterogeneity: $Tau^2 = 0.07$ ; C				= 0.22)	; i² = 2		100.0%	0.75 [0.38, 1	▼
est for overall effect: Z = 3.9	-								
1.1.6 PES, non-tracheoston									
lath 2016	1.5	1.6	70	1.7	1.8	56	25.9%	-0.11 [-0.46, 0	
ayasekeran 2010, PES	4.3	1.1	16	1.7	1.6	12	20.4%	1.89 [0.97, 2	
Alchou 2014, PES	4.2	3.3	6	2	8.8	6	18.0%	0.31 [-0.84, 1	
ingh 2006 PES	1.04	0.63	. 4	-0.5		- 6	13.5%	1.75 [0.15, 3	
/asant 2016, PES	3.35	3.22	14	1.83	2.2	14	22.2X	0.54 [-0.22, 1	
Subtotal (95% CI)	L12 ~-		110		Mrs -		100.0%	0.77 [-0.06, 1	00]
leterogeneity: Tau² = 0.66; C lest for overall effect: Z = 1.8			= 4 (P	= 0.00	JO5); ř	= 60%			
1.1.7 PES, tracheostomized									
Iziewas 2018	7.4	5.3	27	6.3	5.1	26	66.7%	0.21 [-0.33, 0	75] 📥
untrup-Krueger 2015, PES	3.1	2	20	2.4	2.1	10	33.3×	0.34 [-0.43, 1	
Subtotal (95% CI)		-	47				100.0%	0.25 [-0.19, 0	
leterogeneity: $Tau^2 = 0.00$ ; C	$ht^2=0.$	07, df =	1 (P -	- 0.79)	;			- '	ľ
			- •-	,					
est for overall effect: $Z = 1.1$									
est for overall effect: Z = 1.1	-, -								
est for overall effect: Z = 1.1									-4 -2 0 2 4

Figure 2: Dysphagia score after different stimulations in patients with dysphagia after stroke

Study or Subgroup	Stin Mean	nulatio SD		Mean	Sham SD	Total	Weight	Std. Mean Difference IV, Random, 95% CI	Std. Mean Difference IV, Random, 95% CI
11.3.1 NMES, RCT									
Arreola 2018b	3.4	1.9	30	4.5	1.7	15	5.8%	-0.59 [-1.22, 0.04]	<del></del>
Arreola 2018b	3.7	2.3	30	4.5	1.7	15	5.8%	-0.37 [-1.00, 0.25]	<del></del>
Bulow 2008	-2.6	1.9	12	-2.5	3.1	12	5.3%	-0.04 [-0.84, 0.76]	+
Byeon 2016, NMES	14.3	8.5	27	15.8	9.2	18	5.9%	-0.17 [-0.77, 0.43]	+
Guillén-Solà 2017	2	2.3	18	6	2.2	20	5.4%	-1.74 [-2.50, -0.98]	<del></del>
Huang 2014	2.5	2.1	10	5	1.9	11	4.8%	-1.20 [-2.15, -0.26]	
Lee 2014, NMES	1.9	1.3	31	2.9	1.5	26	6.1%	-0.71 [-1.25, -0.17]	*
Lim 2009	5	1	16	6.5	1	12	5.1%	-1.46 [-2.31, -0.60]	<del></del>
LIM 2014, NMES		17.6	18		10.8	15	5.6X	-0.52 [-1.21, 0.18]	<del>-</del>
Meng 2017, NMESa	0.8	1.4 1.45	10 10	1.1 1.1	1.1 1.1	5	4.4% 4.4%	-0.21 [-1.29, 0.86]	$\equiv$
Meng 2017, NMESb Park 2016, NMES		1.35	25		1.56	25	6.0%	-0.14 [-1.21, 0.94] -0.62 [-1.19, -0.05]	
Permsirivanich 2009	2.6	1.1	12	10	1.1	12	2.1%	-6.50 [-8.66, -4.33]	
Sproson 2018, NMES	2.7	1.9	12	2.9	2.2	14	5.3%	-0.09 [-0.87, 0.68]	+
Terre 2015, NMES	2.5	1.5	10	5	1.5	10	4.5%	-1.60 [-2.63, -0.56]	<del></del>
Jmay 2017, SES	1.36	0.8	58	2.78		40	6.3%	-1.34 [-1.79, -0.90]	+
(la 2011, Vitalstim	21.4	3.5	40	30.1	3.8	40	6.0%	-2.36 [-2.94, -1.78]	<b>→</b>
hang 2016, NMES	25	2.8	28	32	5.9	27	5.9%	-1.50 [-2.11, -0.90]	<del></del>
Zhang 2016, NMES-MA	28	2.2	27	32	5.9	13	5.6%	-1.04 [-1.74, -0.33]	<del>-</del>
Subtotal (95% CI)			424			335	100.0%	-1.00 [-1.37, -0.63]	<b>♦</b>
Heterogeneity: $Tau^2 = 0.51$ ; Cl Test for overall effect: $Z = 5.30$				(P < 0.	.00001	);	80%		
11.3.2 NMES, NRCT									
Ko 2016, NMES	2.45	1.64	12	2.33	1.73	6	48.5%	0.07 [-0.91, 1.05]	<u>+</u> -
Cushner 2013	3	1.6	65	7.5	2.2	27	51.5%	-2.32 [-2.88, -1.75]	<b>-</b> T
Subtotal (95% CI)	_		77				100.0%	-1.16 [-3.50, 1.18]	-
leterogeneity: $Tau^2 = 2.68$ ; Clest for overall effect: $Z = 0.97$			f = 1 (	P < 0.0	001); (	<sup>2</sup> = 94	×		
11.3.3 rTMS, RCT									
	10	Λ.Ε	12	22 6	2 5		10.46	2 02 1 4 40 -1 501	
Du 2016, rTMS, 1H	19	0.5 0.25	13 13	23.5 23.5	2.5 2.5	6	10.4% 10.4%	-3.03 [-4.48, -1.58] -3.13 [-4.61, -1.66]	<u> </u>
Du 2016, rTMS, 3H Chedr 2009, rTMS		0.01	14	23.3	0.1	12		-3.13 [-4.61, -1.65] -28.44 [-36.87, -20.01] *	•
hedr 2010, rTMS	1.45	0.3	11	3.5	0.4	11	9.1%	-5.58 [-7.58, -3.58]	
Im 2011 rTM\$	2.7	1	20	3.7	1.2	10	11.7%	-0.91 [-1.71, -0.11]	
Im 2014, rTM\$		14.9	14		10.8	15	11.6%	-0.52 [-1.26, 0.22]	-
Michou 2014, rTMS		11.4	6	23.4	9.6	-6	11.1%	0.04 [-1.10, 1.17]	
ark 2013, rTMS		0.87	9	3.11		9	11.4%	-1.01 [-2.01, -0.01]	-
ark 2016, rTMS	19.5	20	11	38	20	6	11.3%	-0.88 [-1.93, 0.17]	<del></del>
ark 2016, rTMS	48	25	11	38	20	5	11.2%	0.40 [-0.67, 1.47]	<del> </del>
Subtotal (95% CI)			122			86	100.0%	-1.96 [-3.14, -0.78]	•
leterogeneity: Tau² = 2.93; Cl lest for overall effect: Z = 3.26			f = 9 (	P < 0.0	(0001)	r² = 9	0%		
11.3.4 rTMS, NRCT									
Lee 2015, rTMS	2.5	2.6	12	2.6	2.5	12	100.0%	-0.04 [-0.84, 0.76]	<u> </u>
Subtotal (95% CI)	2.3	2.0	12	2.0	2.5		100.0%	-0.04 [-0.84, 0.76]	<u>.</u>
leterogeneity: Not applicable lest for overall effect: Z = 0.05	9 (P = 1	0.93)					100.070	0.0 . [ 0.0 ., 0.7 0]	Ţ
11.3.7 tDCS, RCT	•	,							
Ahn 2017, tDCS	4.08	1.5	13	3.46	1.2	12	25.1%	0.44 [-0.36, 1.24]	<b>-</b>
Shigematsu 2013, tDCS	1.3	1.4	10	2	2.9	10	22.9%	-0.29 [-1.18, 0.59]	<b>-</b>
untrup-Krueger 2018	4.5	4.1	29	5.3	4.1	30	33.0%	-0.19 [-0.70, 0.32]	+
ang 2012, tDCS		4.65		11.83		9	19.0%	-1.42 [-2.49, -0.36]	<del></del> -
Subtotal (95% CI)	-	-	61		-		100.0%	-0.29 [-0.92, 0.33]	<b>♦</b>
leterogeneity: $Tau^2 = 0.24$ ; Clifest for overall effect: $Z = 0.91$			= 3 (P	- 0.06	i); ř =	61%			
11.3.10 PES, Non-tracheosto	mized	RCT							
lath 2016			70	9	21	c.e	40 50	0.14 [_0.21_0.40]	<u> </u>
	3.3		70 16	3 2 0	2.1	56 12	40.6%	0.14 [-0.21, 0.49]	
ayasekeran 2010, PES Alchou 2014, PES			16	3.9		12	21.5% 12.1%	-0.80 [-1.58, -0.02] -0.74 [-1.93 0.45]	
riichou 2014, PES Zasant 2016, PES	4.3	10.8 4	6 18	23.8 4.6		6 17	25.8%	-0.74 [-1.93, 0.45] -0.07 [-0.73, 0.59]	<u></u>
ubtotal (95% CI)	4.3	4	110	4.0	4.4		100.0%	-0.22 [-0.70, 0.25]	<b>⊿</b>
	hř = 5	93 45		= 0.11	): P =		200.070	0.22 [ 0.70, 0.23]	٦
			~ W	<b>4.11</b>	VI	- 674			
leterogeneity: Tau <sup>2</sup> = 0.11; Cl									
Heterogeneity: $Tau^2 = 0.11$ ; Cl Fest for overall effect: $Z = 0.93$	i, RCT				5.1	26	54.8%	-0.21 [-0.75, 0.33]	<b>*</b>
teterogeneity: Tau <sup>2</sup> = 0.11; Cl Test for overall effect: Z = 0.93 11.3.12 PES, tracheostomized	i, RCT 4.6	5.3	27	5.7					
Heterogeneity: Tau² = 0.11; Cl Fest for overall effect: Z = 0.93 11.3.12 PES, tracheostomized Dziewas 2018 Buntrup-Krueger 2015, PES	-	5.3 2	20	7.6	2.1	10	45.2%	-1.24 [-2.08, -0.41]	<del></del> -
Heterogeneity: Tau <sup>2</sup> = 0.11; Cl Test for overall effect: Z = 0.93 11.3.12 PES, tracheostomized Dziewas 2018 Suntrup-Krueger 2015, PES Subtotal (95% Cl)	4.6 5	2	20 47	7.6		36	45.2% 100.0%	-1.24 [-2.06, -0.41] -0.68 [-1.69, 0.33]	<b>-</b>
leterogenetry: Tau² = 0.11; Cl Fest for overall effect: Z = 0.93 11.3.12 PES, tracheostomized Dziewas 2018 Juntrup-Krueger 2015, PES Jubtotal (95% Cl) Heterogenetry: Tau² = 0.41; Cl	4.6 5 hi² = 4	.20, df	20 47	7.6		36			•
leterogenetry: Tau <sup>2</sup> = 0.11; Cl lest for overall effect: Z = 0.93; 11.3.12 PES, tracheostomized Dziewas 2018 Juntrup-Krueger 2015, PES Jubtotal (95% CI) Jeterogenetry: Tau <sup>2</sup> = 0.41; Cl	4.6 5 hi² = 4	.20, df	20 47	7.6		36			•
Heterogeneity: Tau² = 0.11; Cl Fest for overall effect: Z = 0.93 11.3.12 PES, tracheostomized Dziewas 2018 Buntrup-Krueger 2015, PES	4.6 5 hi² = 4	.20, df	20 47	7.6		36			-4 -2 0 2 4

Test for subgroup differences:  $\mathrm{Chi^2} = 15.00$ ,  $\mathrm{df} = 6~\mathrm{(P=0.02)}$ ,  $\mathrm{I^2=60.0\%}$ 

Table 2: Effect of stimulation on dysphagia score of increasing-order<sup>a</sup> in patients with dysphagia after stroke

Outcome		Mean	±SD	n (N)	MD [95% CI]	l <sup>2</sup>	P value
		Stimulation	Control				
DSRS							
• Change, RCT	-	-3.7±2.7	-2.0±2.3	9(380)	-2.00 [-2.08, -1.93]	0%	< 0.00001
Post-interve	ntion,	3.4±3.6	4.3±3.6	8(352)		23%	< 0.00001
RCT					-1.97 [-2.16, -1.78]		
FEDSS							
• Change, RCT	-	-2.1±1.0	-0.8±0.9	2(157)	-1.14 [-1.79, -0.49]	78%	0.0005
<ul><li>Post-interve RCT</li></ul>	ntion,	1.7±1.0	2.7±1.4	2(157)	-0.96 [-1.96, 0.03]	79%	0.06
FDS							
Change, ove	rall	-11.3±10.3	-7.1±9.0	9(231)	-2.37 [-4.51, -0.23]	0%	0.03
<ul> <li>Change, RCT</li> </ul>	-	-11.6±9.8	-7.0±6.7	7(189)	-2.39 [-4.58, -0.19]	0%	0.03
<ul> <li>Change, NRC</li> </ul>	СТ	-10.4±12.5	-7.3±18.4	2(42)	-2.09 [-11.74, 7.55]	0%	0.67
<ul> <li>Post-interve overall</li> </ul>	ntion,	18.1±12.3	19.9±12.0	9(227)	-3.64 [-5.77, -1.51]	0%	0.0008
Post-interve     RCT	ntion,	18.5±12.2	20.8±10.5	7(185)	-3.79 [-5.97, -1.61]	0%	0.0007
Post-interve     NRCT	ntion,	16.3±12.5	16.4±18.4	2(42)	-0.73 [-10.38, 8.91]	0%	0.88
PAS					0.75 [ 10.50, 0.51]		
Change, ove	rall	-1.7±2.0	-0.9±1.8	21(606)	-1.19 [-1.72, -0.66]	79%	< 0.0001
<ul> <li>Change, RCT</li> </ul>		-1.8±2.0	-0.9±1.8	18(552)	-1.28 [-1.94, -0.61]	82%	< 0.00001
Change, NRC		-1.0±1.8	-0.6±1.7	3(54)	-0.87 [-1.73, -0.01]	36%	0.05
Post-interve		3.9±2.3	4.7±2.6	19(590)	. , ,	10%	0.0006
overall	,				-0.61 [-0.96, -0.26]		
Post-interve	ntion,	4.1±2.3	4.9±2.6	17(548)		16%	0.0006
RCT					-0.67 [-1.05, -0.29]		
Post-interve	ntion,	2.5±2.1	2.5±2.2	3(42)		0%	0.96
NRCT					0.03 [-1.26, 1.32]		
SSA							
• Change, ove	rall	-11.6±2.4	-7.0±4.3	5(200)	-4.88 [-7.79, -1.97]	88%	0.001
• Change, RCT	-	-11.6±2.4	-7.0±4.3	5(200)	-4.88 [-7.79, -1.97]	88%	0.001
<ul> <li>Post-interve overall</li> </ul>	ntion,	23.2±2.4	29.9±4.5	5(213)	-5.41 [-7.82, -3.00]	84%	< 0.00001
• Post-interve RCT	ntion,	23.2±2.4	29.9±4.5	5(213)	-5.41 [-7.82, -3.00]	84%	< 0.00001
VDS					2.12[1.02, 0.00]		
Change, RCT	•	-22.0±13.4	-8.4±6.7	4(101)	-9.66 [-15.62, -3.69]	38%	0.002
Post-interve		41.5±16.2	48.2±12.8	4(101)	-5.33 [-17.01, 6.36]	70%	0.37

Outcome	Mean	±SD	n (N)	MD [95% CI]	l <sup>2</sup>	P value
	Stimulation	Control				
RCT						
CDS						
Change, RCT	-32.9±23.0	-17.5±21.0	2(33)	-15.55 [-36.91, 5.82]	46%	0.15
Post-intervention,     RCT	33.8±22.5	38.0±20.0	2(33)	-4.84 [-32.75, 23.06]	70%	0.73
WST						
Change, RCT	-2.1±1.0	-0.4±1.4	2(150)	-1.58 [-2.20, -0.96]	47%	< 0.00001
• Post-intervention,	2.1±0.8	3.5±1.4	2(150)		41%	< 0.00001
RCT				-1.42 [-1.97, -0.86]		
NEDS						
Change, RCT	-2.9±1.5	-0.8±2.0	1(98)	-2.11 [-2.84, -1.38]	NA	< 0.00001
<ul> <li>Post-intervention,</li> <li>RCT</li> </ul>	4.0±1.7	5.8±1.6	1(98)	-1.77 [-2.44, -1.10]	NA	< 0.00001
BDS						
Change, RCT	-2.0±1.2	-0.5±2.4	1(98)	-1.50 [-2.29, -0.71]	NA	0.0002
• Post-intervention, RCT	4.0±2.1	4.8±1.8	1(98)	-0.75 [-1.53, 0.03]	NA	0.06
TDS						
Change, RCT	-4.8±2.1	-1.1±3.2	1(98)	-3.76 [-4.90, -2.62]	NA	< 0.00001
Post-intervention,     RCT	7.0±3.6	10.0±2.6	1(98)	-2.95 [-4.16, -1.74]	NA	< 0.00001

a: Worsening of dysphagia with increase of dysphagia score; BDS: Bedside dysphagia scale; CDS: Clinical dysphagia scale; CI: Confidence intervals; DSRS: Dysphagia Severity Rating Scale; FDS: Functional Dysphagia Scale; FEDSS: Fiberoptic Endoscopic Dysphagia Severity Scale; I<sup>2</sup>: Heterogeneity; MD: Mean Difference; n: Number of studies; N: Number of patients; NEDS: Neurological Examination of Dysphagia Scale; p: Statistical significance value; PAS: Penetration-Aspiration Scale; SD: Standard Deviation; SFSS: Swallow function scoring system; SSA: Standardized Swallowing Assessment; TDS: Total Dysphagia Score

Fig 3: Effect of stimulation on DSRS in patients with dysphagia after stroke

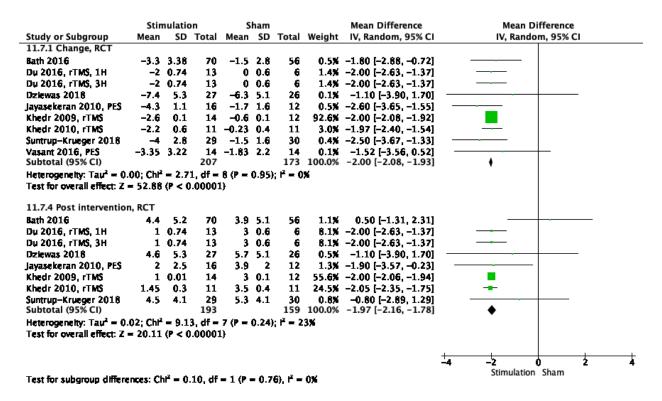
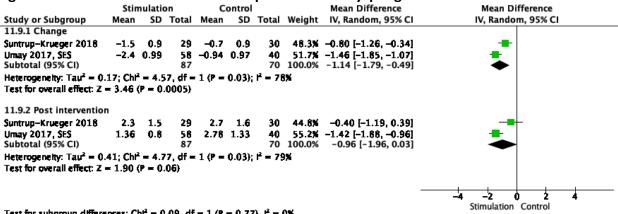
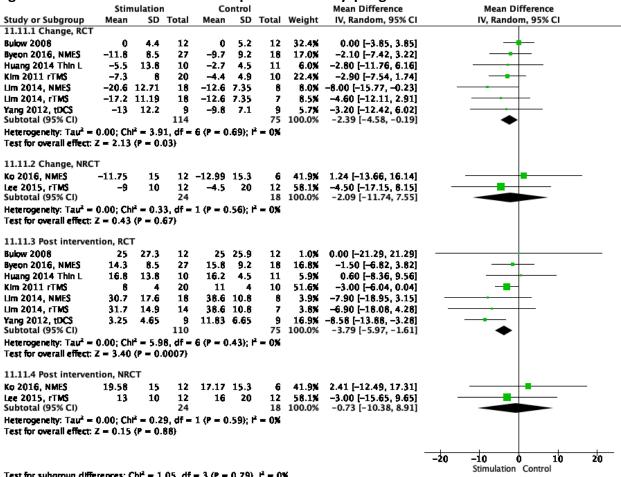


Fig 4: Effect of stimulation on FEDSS in patients with dysphagia after stroke



Test for subgroup differences:  $Cht^2 = 0.09$ , df = 1 (P = 0.77),  $t^2 = 0\%$ 

Fig 5: Effect of stimulation on FDS in patients with dysphagia after stroke



Test for subgroup differences:  $Cht^2 = 1.05$ , df = 3 (P = 0.79),  $t^2 = 0$ %

Fig 6: Effect of stimulation on PAS in patients with dysphagia after stroke

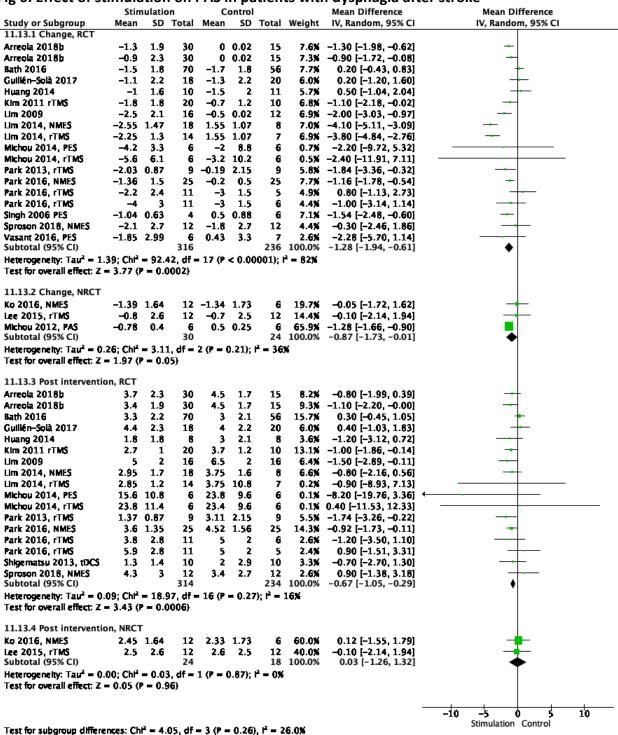
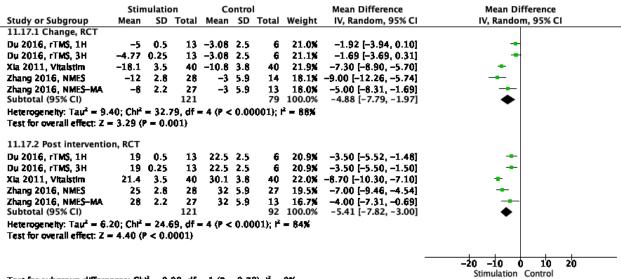
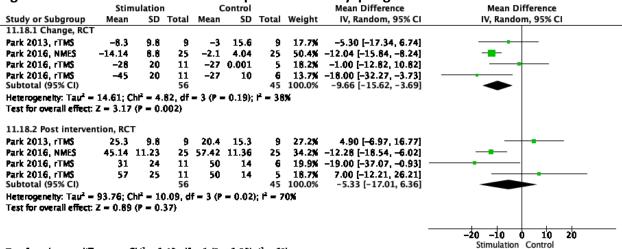


Fig 7: Effect of stimulation on SSA in patients with dysphagia after stroke

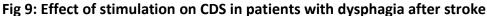


Test for subgroup differences:  $Cht^2 = 0.08$ , df = 1 (P = 0.78),  $t^2 = 0\%$ 

Fig 8: Effect of stimulation on VDS in patients with dysphagia after stroke



Test for subgroup differences:  $Chi^2 = 0.42$ , df = 1 (P = 0.52),  $i^2 = 0$ %



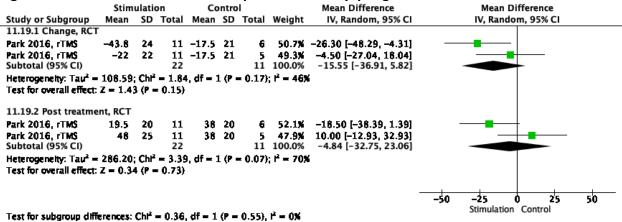


Fig 10: Effect of stimulation on WST in patients with dysphagia after stroke

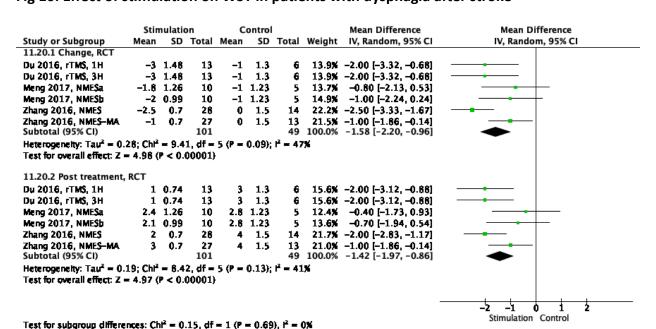


Fig 11: Effect of stimulation on NEDS, BDS, and TDS scores in patients with dysphagia after stroke

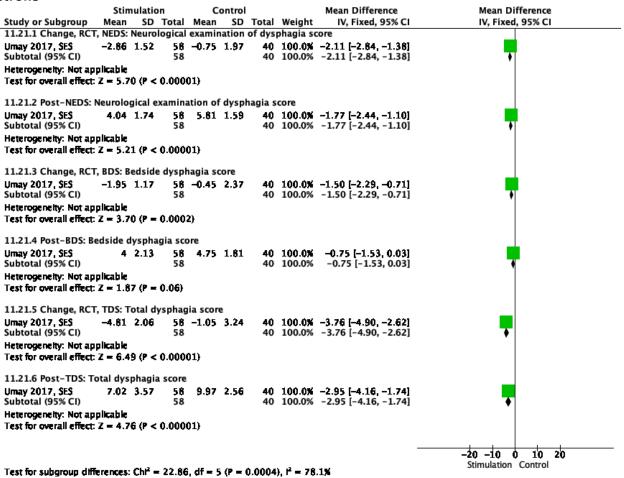


Table 3: Effect of stimulation on dysphagia score of decreasing-order<sup>a</sup> in patients with dysphagia after stroke

Outcome	Mean	±SD	n (N)	MD [95% CI]	l <sup>2</sup>	P value
	Stimulation	Control				
FOIS						
Change, overall	3.4±1.9	1.9±1.8	11(464)	1.28 [0.75, 1.80]	60%	< 0.00001
Change, RCT	3.1±1.8	1.8±1.7	10(372)	1.19 [0.63, 1.76]	60%	<0.0001
Change, NRCT	4.4±2.1	2.4±2.3	1(92)	2.00 [0.99, 3.01]	NA	< 0.0001
<ul> <li>Post-intervention, overall</li> </ul>	5.0±1.9	4.0±2.1	11(464)	1.04 [0.57, 1.52]	40%	< 0.0001
• Post-intervention, RCT	4.9±1.9	4.1±2.0	10(372)	0.94 [0.44, 1.44]	36%	0.0002
• Post-intervention, NRCT	5.1±1.8	3.3±2.2	1(92)	1.80 [0.86, 2.74]	NA	0.0002
DOSS						
<ul> <li>Change, overall</li> </ul>	2.2±1.3	1.5±1.2	12(286)	0.85 [0.45, 1.24]	55%	< 0.0001
<ul> <li>Change, RCT</li> </ul>	2.3±1.3	1.6±1.2	11(262)	0.81 [0.39, 1.24]	58%	0.0002
Change, NRCT	1.7±1.6	0.4+1.4	1(24)	1.30 [0.10, 2.50]	NA	0.03
<ul> <li>Post-intervention, overall</li> </ul>	5.2±1.5	4.5±1.3	8(212)	0.62 [0.08, 1.17]	80%	0.006
• Post-intervention, RCT	5.3±1.4	4.6±1.3	7(188)	0.72 [0.16, 1.29]	49%	0.01
• Post-intervention, NRCT	4.3±1.6	4.4±1.4	1(24)	-0.10 [-1.30, 1.10]	NA	0.87
ASHA						
Change, overall	1.2±1.2	1.0±1.1	3(65)	0.31 [-0.17, 0.80]	0%	0.21
Change, RCT	1.0±1.0	0.7±0.8	2(47)	0.33 [-0.17, 0.83]	0%	0.20
Change, NRCT	1.6±1.7	1.6±2.1	1(18)	0.04 [-1.86, 1.94]	NA	0.97
• Post-intervention, overall	4.8±1.3	4.6±1.4	3(65)	0.31 [-0.33, 0.95]	0%	0.34
• Post-intervention, RCT	4.6±1.1	4.2±1.1	2(47)	0.38 [-0.29, 1.06]	0%	0.27
• Post-intervention, NRCT	5.4±1.7	5.7±2.1	1(18)	-0.26 [-2.16, 1.64]	NA	0.79
SFS				- · · -		
Change, RCT	2.0±1.0	0.0±1.0	1(32)	2.00 [1.31, 2.69]	NA	< 0.00001
• Post-intervention, RCT	4.0±2.0	4.0±2.0	1(32)	0.00 [-1.39, 1.39]	NA	1.0
MASA						
Change, RCT	46.2±27.1	25.5±18.5	1(98)	20.70 [11.67, 29.73]	NA	< 0.00001
• Post-intervention,	181.3±20.7	157.8±33.6	1(98)	23.46 [11.77, 35.15]	NA	< 0.00001

Outcome	Mean	±SD	n (N)	MD [95% CI]	l <sup>2</sup>	P value
	Stimulation	Control				
RCT						
RSST						
Change, RCT	1.5±1.8	1.2±1.4	2(30)	0.30 [-0.86, 1.46]	0%	0.61
• Post-intervention,	5.3±1.8	5.1±1.4	2(30)		0%	0.80
RCT				0.15 [-1.01, 1.30]		
Dysphagia limit						
Change, RCT	5.0±5.6	1.9±3.2	1(55)	3.1 [0.06, 6.14]	NA	0.05
Post-intervention,     RCT	10.9±7.8	9.6±7.1	1(55)	1.3 [-3.05, 5.65]	NA	0.56

a: Worsening of dysphagia with decrease of dysphagia score; CI: Confidence intervals; DOSS: Dysphagia Outcome and Severity Scale; FOIS: Functional oral intake scale; I<sup>2</sup>: Heterogeneity; MASA: Mann Assessment of Swallowing Ability; MD: Mean Difference; n: Number of studies; N: Number of patients; p: Statistical significance value; SD: Standard Deviation; SFS: Swallow functional score

Fig 12: Effect of stimulation on FOIS in patients with dysphagia after stroke

		nulatio			Sham			Mean Difference	Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI	IV, Random, 95% CI
11.24.1 Change, RCT									
Dziewas 2016	3.6		27	2.9	2.5	26	8.7%	0.70 [-0.67, 2.07]	+-
Huang 2014	3.7	1.6	10	3	1.4	11	9.3%	0.70 [-0.59, 1.99]	+
Lee 2014, NMES	3.1	1.4	31	1.7	0.9	26	14.9X	1.40 [0.80, 2.00]	
Permsirivanich 2009	3.17	1.27	12	2.46	1.04	12	12.1%	0.71 [-0.22, 1.64]	<del>  • -</del>
Sproson 2018, NMES	1.6	1.9	12	0.8	2.2	14	7.5%	1.00 [-0.58, 2.58]	+
Suntrup-Krueger 2015, PES	3.1	2	20	2.4	2.1	10	7.5%	0.70 [-0.87, 2.27]	<del></del>
Suntrup-Krueger 2018	1.8	1.6	29	1	1.4	30	13.5%	0.80 [0.03, 1.57]	-
Terre 2015, NMES	3.4	1.5	10	2.5	1.5	10	9.1×	0.90 [-0.41, 2.21]	+
Zhang 2016, NMES	5	1.5	28	1	2.2	14	9.3%	4.00 [2.72, 5.28]	_ <del></del>
Zhang 2016, NMES-MA	2	2.2	27	1	2.2	13	8.2%	1.00 [-0.46, 2.46]	+
Subtotal (95% CI)			206			166	100.0%	1.19 [0.63, 1.76]	•
Heterogeneity: $Tau^2 = 0.46$ ;	$Cht^2 = 2$	2.74,	df = 9 (	(P = 0.0	)07); ř	- 60%	4		
Test for overall effect: $Z = 4$ .									
11.24.2 Change, NRCT									
Kushner 2013	4.4	2.1	65	2.4	2.3	27	100.0%	2.00 [0.99, 3.01]	-
Subtotal (95% CI)			65				100.0%	2.00 [0.99, 3.01]	-
Heterogeneity: Not applicable	!								
Test for overall effect: $Z = 3.1$		0.000	L)						
11.24.4 Post intervention, R	СТ								
Dziewas 2018	4.6	2.6	27	3.9	2.5	26	9.0%	0.70 [-0.67, 2.07]	+
Huang 2014	5.5	2	10	4.6	1.8	11	7.0%	0.90 [-0.73, 2.53]	<del></del>
Lee 2014, NMES	5.1	1.3	31	3.9	1.5	26	17.7%	1.20 [0.46, 1.94]	<del></del>
Permsirivanich 2009	5.4	1.1	12	4.8	1.5	12	12.6%		+-
Sproson 2018, NMES	5.3	1.9	12	5.1	2.2	14	7.4%		-
Suntrup-Krueger 2015, PES	4.1	2	20	3.4	2.1	10	7.4%	0.70 [-0.87, 2.27]	<del></del>
Suntrup-Krueger 2018	4.9	2.3	29	4.8	2.3	30	11.1%	0.10 [-1.07, 1.27]	<del></del>
Terre 2015, NMES	5.3	1.5	10	4.6	1.5	10	9.6%	0.70 [-0.61, 2.01]	+-
Zhang 2016, NMES	6	1.5	28	3	2.2	14	9.9X	3.00 [1.72, 4.28]	
Zhang 2016, NMES-MA	4	2.2	27	3	2.2	13	8.3×	1.00 [-0.46, 2.46]	+-
Subtotal (95% CI)			206	-			100.0%	0.94 [0.44, 1.44]	•
Heterogeneity: $Tau^2 = 0.22$ ;	$Cht^2 = 1$	3.98.	df = 9 (	(P = 0.1)	(2); ř	- 36X			-
Test for overall effect: $Z = 3.3$				-					
11.24.5 Post intervention, N	IRCT								
Kushner 2013	5.1	1.6	65	3.3	2.2	27	100.0%	1.80 [0.86, 2.74]	- <mark></mark> -
Subtotal (95% CI)			65				100.0%	1.80 [0.86, 2.74]	-
Heterogeneity: Not applicable	!								
Test for overall effect: $Z = 3.3$		0.0002	2)						
								_	<del></del>
									-4 -2 0 2 4
T &	. ALB _	- ^^	JE 0	/a A	2	_ 40.0			Sham Stimulation

Test for subgroup differences:  $Chi^2 = 5.00$ , df = 3 (P = 0.17),  $i^2 = 40.0\%$ 

Fig 13: Effect of stimulation on DOSS in patients with dysphagia after stroke

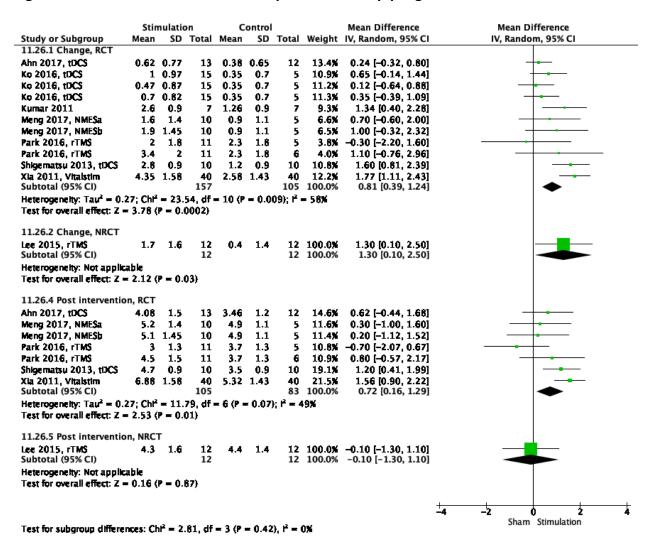


Fig 14: Effect of stimulation on ASHA in patients with dysphagia after stroke

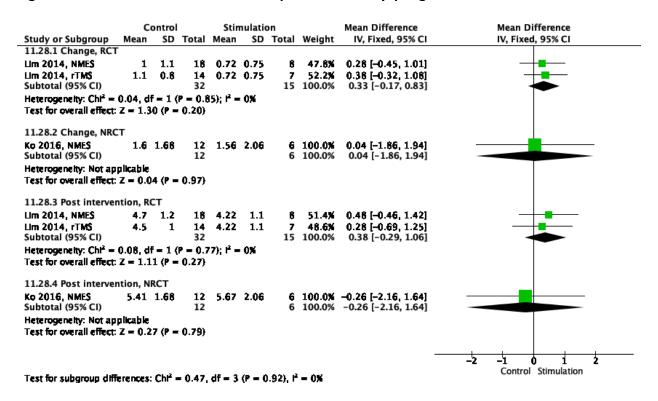


Fig 15: Effect of stimulation on SFS (Swallow functional score) in patients with dysphagia after stroke

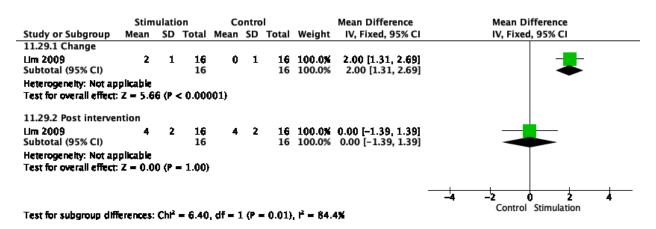


Fig 16: Effect of stimulation on MASA in patients with dysphagia after stroke

	Stin	nulatior	1	c	ontrol			Mean Difference	Mean Di	fference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Fixed, 95% CI	IV, Fixed	, 95% CI
11.30.1 Change, RCT										
Umay 2017, SES Subtotal (95% CI)	46.2	27.1	58 58	25.5	18.5	40 40		20.70 [11.67, 29.73] 20.70 [11.67, 29.73]		-
Heterogeneity: Not ap Test for overall effect:		(P < 0.	00001)	•						
11.30.2 Post interver	ntion, RC	Т								
Umay 2017, SES Subtotal (95% CI)	181.27	20.66	58 58	157.81	33.58	40 40		23.46 [11.77, 35.15] 23.46 [11.77, 35.15]		
Heterogeneity: Not ap Test for overall effect:		(P < 0.	0001)							
Test for subgroup diff		-Liš _ A	12 45	_ 1 /9 _	A 71\ I	2 _ AW			-20 -10 0 Control	10 20 Stimulation

Test for subgroup differences:  $Chi^2 = 0.13$ , df = 1 (P = 0.71),  $i^2 = 0\%$ 

Fig 17: Effect of stimulation on RSST in patients with dysphagia after stroke

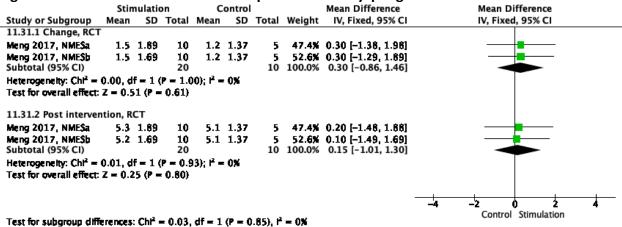


Fig 18: Effect of stimulation on Dysphagia limit in patients with dysphagia after stroke

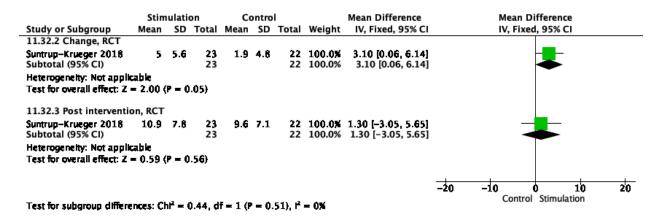


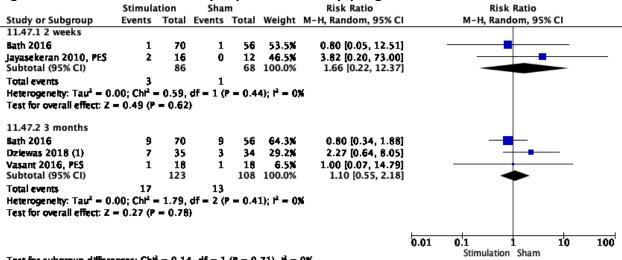
Table 4: Effect of stimulation on mortality, mRS, pneumonia, BI, and length of stay in patients with dysphagia after stroke

Outcome	Mean±	SD/ %	n (N)	MD/ RR [95% CI]	l <sup>2</sup>	P value
	Stimulation	Control				
Mortality, RCT						
• 2 weeks, PES	3.5%	1.5%	2(154)	1.66 [0.22, 12.37]	0%	0.62
• 3 months, PES	13.8%	12.0%	3(231)	1.10 [0.55, 2.18]	0%	0.78
mRS, RCT	3.2±1.0	3.9±1.0	3(215)	-0.68 [-1.22, -0.13]	62%	0.01
• rTMS	1.0±0.7	2.5±1.3	1(38)	-1.50 [-2.29, -0.71]	0%	0.0002
• PES	3.8±1.1	4.2±1.0	2(177)	-0.33 [-0.63, -0.02]	0%	0.04
Pneumonia, RCT						
• TES	5.8%	8.5%	2(99)	0.75 [0.19, 2.95]	NA	0.68
• tDCS	37.9%	53.3%	1(59)	0.71 [0.40, 1.26]	NA	0.24
• PES	7.6%	11.5%	2(209)	0.66 [0.29, 1.52]	0%	0.33
BI						
• rTMS, Overall	76.8±7.9	52.8±14.5	5(110)	29.54 [25.82, 33.26]	87%	< 0.00001
• rTMS, RCT	79.8±5.1	46.9±12.7	4(86)	31.57 [27.75, 35.39]	73%	< 0.00001
• rTMS, NRCT	64.0±20.0	70.0±20.0	1(24)	-6.00 [-22.00, 10.00]	NA	0.46
<ul> <li>PES, RCT</li> </ul>	36.1±30.5	27.0±25.7	2(154)	-0.34 [-1.19, 0.51]	74%	0.43
LOS, Hospital (d), RCT						
• tDCS	16.2±6.8	13.4±5.1	1(59)	2.80 [-0.28, 5.88]	NA	0.07
• PES	32.4±20.7	35.3±22.1	3(192)	-4.23 [-12.11, 3.66]	33%	0.29
LOS, ICU (d), RCT						
• tDCS	6.7±4.4	7.0±3.3	1(59)	-0.30 [-2.29, 1.69]	NA	0.77
• PES	38.2±14.9	38.8±19.7	1(59)	-0.60 [-14.45, 13.25]	NA	0.93

CI: Confidence intervals; ICU: Intensive care unit; I<sup>2</sup>: Heterogeneity; LOS: Length of Stay; n: Number of studies; N: Number of patients; NA: Not applicable; p: Statistical significance value;

QoL: Quality of life; SD: Standard Deviation; MD: Mean Difference; RR: Risk Ratio

Fig 19: Effect of PES on Mortality in patients with dysphagia after stroke



Test for subgroup differences:  $Cht^2 = 0.14$ , df = 1 (P = 0.71),  $t^2 = 0\%$ 

Footnotes

(1) None related to PES

Fig 20: Effect of stimulation on mRS in patients with dysphagia after stroke

	Stin	nulatio	n	S	ham			Mean Difference	Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI	IV, Random, 95% CI
11.36.1 rTMS									
Du 2016, rTMS, 1H	1	0.74	13	2.5	1.3	6	15.5%	-1.50 [-2.62, -0.38]	
Du 2016, rTMS, 3H	1	0.74	13	2.5	1.3	6	15.5%	-1.50 [-2.62, -0.38]	
Subtotal (95% CI)			26	_	_	12	31.0%	-1.50 [-2.29, -0.71]	
Heterogeneity: Tau <sup>2</sup>	= 0.00: 0	Cht² = (	0.00. d	f = 1 (I	<b>-</b> 1	.00): f	= 0%		
Test for overall effect				-	_				
	_			•					
11.36.2 PES									
Bath 2016	3.7	1.2	70	4.1	1	56	36.5%	-0.40 [-0.78, -0.02]	<del></del>
Dziewas 2016	4.1	0.8	26	4.3	1			-0.20 [-0.70, 0.30]	<del></del>
Subtotal (95% CI)			96	_		81	69.0%	-0.33 [-0.63, -0.02]	•
Heterogeneity: Tau <sup>2</sup>	<b>=</b> 0.00; 0	$Cht^2 = 0$	0.39. d	f = 1 (I	- 0	.53); f²	- 0×		
Test for overall effect	: Z = 2.1	0 (P =	0.04)						
		-							
Total (95% CI)			122			93	100.0%	-0.68 [-1.22, -0.13]	•
Heterogeneity: Tau2 -	= 0.17; (	Cht² = :	7.81, d	f = 3 (1	- 0	.05); f <sup>2</sup>	- 62%		<del></del>
Test for overall effect	-			-					-2 -1 0 1 2 Stimulation Sham
Test for subgroup dif	Terences:	: Chi <sup>2</sup> •	7.42	df = 1	(P =	0.006)	$1^2 = 86$	.5%	Sumulation Sham

Fig 21: Effect of stimulation on Pneumonia in patients with dysphagia after stroke

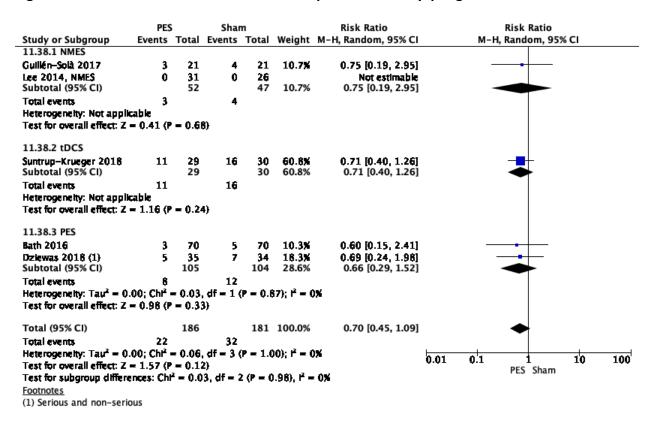


Fig 22: Effect of stimulation on BI in patients with dysphagia after stroke

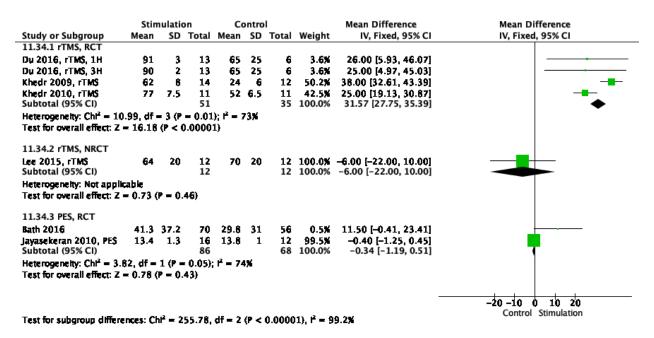


Fig 23: Effect of stimulation on Length of stay in Hospital or ICU in patients with dysphagia after stroke

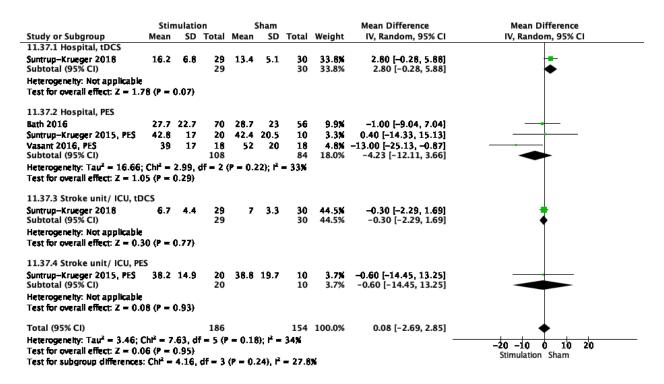


Table 5: Effect of stimulation on different outcomes in patients with dysphagia after stroke

Outcome	Mean±	SD/ %	n (N)	MD/ RR [95% CI]	l <sup>2</sup>	P value
	Stimulation	Control				
Decannulation	•					
• Tracheotomised						
patients, PES,						
Overall	59.0%	7.5%	3(145)	5.43 [2.42, 12.16]	0%	< 0.0001
<ul> <li>Tracheotomised</li> </ul>						
patients, PES,						
RCT	58.2%	11.4%	2(99)	4.64 [2.00, 10.79]	0%	0.004
<ul> <li>Tracheotomised</li> </ul>						
patients, PES,						
NRCT	60.9%	0.0%	1(46)	29.00 [1.83, 459.04]	NA	0.02
Tube removal						
<ul> <li>Other patients,</li> </ul>						
NMES, RCT	50.0%	14.3%	1(19)	3.50 [0.52, 23.42]	NA	0.2
<ul> <li>Other patients,</li> </ul>						
PES, RCT	50.0%	28.6%	1(30)	1.75 [0.67, 4.58]	NA	0.25
Quality of life, Anxiet	ty and Depressi	on				
Change, RCT						
Swallowing QoL	26.2±18.2	7.2±17.1	3(106)	18.02 [11.41, 24.63]	37%	<0.00001
Hamilton anxiety	-4.0±6.0	-0.2±6	1(112)	-3.83 [-6.06, -1.60]	NA	0.0007
scale						
Hamilton	-3.9±5.0	-0.9±5.0	1(112)	-2.94 [-4.79, -1.09]	NA	0.002
depression scale						
Functional	21.5±19.0	9.3±23.3	1(98)	12.20 [3.48, 20.92]	NA	0.006
independence						
measure						
Post intervention,						
RCT	0.00010.44	0.0410.00	4/426)	0.05 [ 0.00 0.40]	21.0	0.50
EQ-5D as HUS	0.008±0.41	-0.04±0.39	1(126)	0.05 [-0.09, 0.19]	NA	0.50
(Health Utility status)						
EQ-VAS	51.6±30.1	48.6±31.7	1(126)	3.00 [-7.89, 13.89]	NA	0.59
EQ-VA3	51.0±30.1	48.0±31.7	1(120)	3.00 [-7.69, 13.69]	INA	0.59
Swallowing QoL	228±27	213±24	4(186)	16.26 [9.92, 22.60]	41%	<0.0001
Hamilton anxiety	11.3±4.8	15.3±7.0	1(112)	-4.09 [-6.33, -1.85]	NA	0.0004
scale			, ,			
Hamilton	12.2±6.9	16.3±7.6	1(112)	-4.11 [-6.79, -1.43]	NA	0.003
depression scale			•			
Functional	74.5±23.8	61.5±21.6	1(98)	12.95 [3.87, 22.03]	NA	0.005
independence						

measure			
i measure			
IIICasaic			

CI: Confidence intervals; ICU: Intensive care unit; I<sup>2</sup>: Heterogeneity; LOS: Length of Stay; n: Number of studies; N: Number of patients; NA: Not applicable; p: Statistical significance value; QoL: Quality of life; SD: Standard Deviation; MD: Mean Difference; RR: Risk Ratio

Fig 24: Effect of stimulation on Decannulation in tracheotomized patients and tube removal after stroke

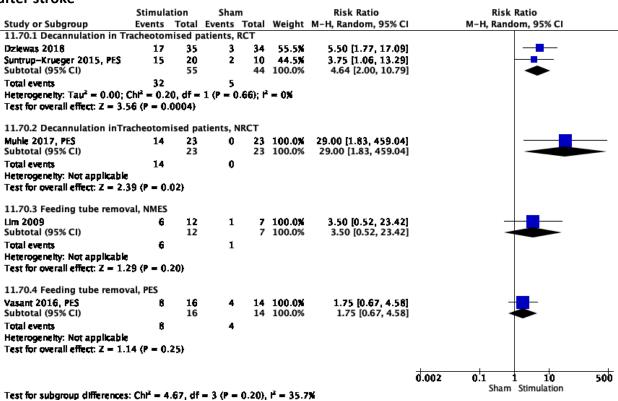


Fig 25: Effect of stimulation on Quality of life scales in patients with dysphagia after stroke

tudy or Subgroup 1.45.1 Swallowing Qol	Mean	SD.	Total	Mean	ontrol	Total	Weight	Mean Difference IV, Fixed, 95% CI	Mean Difference IV, Fixed, 95% CI
+5.1 Swallowing QoL			rotai	mean	30	iotai	weight	iv, rixea, 95% Cl	iv, rixed, 95% CI
****				_					
proson 2018, NMES	21	16	12	3	24	12	0.0%	18.00 [1.68, 34.32]	
nang 2016, NMES	33.8	19.6	28	9.1	14	14		24.70 [14.38, 35.02]	
hang 2016, NMES-MA	20.7	17.7	27	9.1	14	13	0.0%	11.60 [1.48, 21.72]	
ıbtotal (95% CI)			67			39	0.0%	18.02 [11.41, 24.63]	•
eterogeneity: Chi <sup>2</sup> = 3.1 est for overall effect: Z =				<b>= 37%</b>					
1.45.2 Hamilton anxiet	y scale,	Change							
eng 2018	-4.02	6	59	-0.19	6	53	0.4%	-3.83 [-6.06, -1.60]	-
ubtotal (95% CI)			59			53	0.4%	-3.83 [-6.06, -1.60]	<b>♦</b>
eterogenelty: Not applic est for overall effect: Z =		- 0.000	)7)						
1.45.3 Hamilton depre	ssion sc	ale, Cha	nge						
eng 2018	-3.85	5	-	-0.91	5	53	0.6%	-2.94 [-4.79, -1.09]	<b>-</b>
ibtotal (95% CI)	2.03	-	59		-	53		-2.94 [-4.79, -1.09]	<b>♦</b>
eterogeneity: Not applic	able						3.4,4		<b>*</b>
est for overall effect: Z =		- 0.002	2)						
1.45.4 FIM, Improveme									
may 2017, SES	21.5	19	58	9.3	23.3	40	0.0%	12.20 [3.48, 20.92]	<del></del>
ubtotal (95% CI)			58			40	0.0%	12.20 [3.48, 20.92]	-
eterogeneity: Not applic est for overall effect: Z =		- 0.006	S)						
1.45.5 EQ-5D as HUS (	Health U	tility sta	atus):	Europea	an Ouali	tv of L	ife-5 Dir	mensions	
ath 2016	0.008	-		-0.04	0.39	56	98.2%	0.05 [-0.09, 0.19]	<u></u>
ubtotal (95% CI)	V.VV0	V.71	70	V.V-7	4.55	56	98.2%	0.05 [-0.09, 0.19]	<b>T</b>
eterogeneity: Not applic est for overall effect: Z =		= 0.50)							
1.45.6 EQ-VAS: Europe	an Quali	tv of Lif	e VAS						
ath 2016		30.1	70	ARE	31.7	E.E	0.0%	3 00 [_7 80 13 80]	
ath 2016 ubtotal (95% CI)	51.6	<b>5</b> Ų.1	70 70	48.6	31./	56 56	0.0%	3.00 [-7.89, 13.89] 3.00 [-7.89, 13.89]	
			70			30	0.0%	3.00 [-7.03, 13.03]	
eterogeneity: Not applic est for overall effect: Z =		= 0.59)	•						
1.45.7 Swallowing QoL									
proson 2018, NMES	128	14.3	12	121	24.9	12	0.0%	7.00 [-9.25, 23.25]	<del></del>
la 2011, Vitalstim	645	58	40	624	45	40		21.00 [-1.75, 43.75]	<u> </u>
hang 2016, NMES	77.4	19.6	28	52.7	14	14		24.70 [14.38, 35.02]	
				52.7		13		10.80 [0.68, 20.92]	
301£ NUCC 144	63.5	17.7	27	34.7	14		0.0%	10.00 IU.00. ZU.9ZI	
			107			70	0.09/		
ubtotal (95% CI)	A 48 - 1	1 /n ^	107	_ 44=		79	0.0%	16.26 [9.92, 22.60]	•
ubtotal (95% CI) eterogeneity: Chi² = 5.1			16); ř	<b>= 41%</b>		79	0.0%		•
ubtotal (95% CI) eterogeneity: Chi² = 5.1 est for overall effect: Z =	5.03 (P	< 0.000	16); ř	= 41%		79	0.0%		
ubtotal (95% CI) eterogenelty: Chi <sup>2</sup> = 5.1 est for overall effect: Z = 1.45.8 Hamilton anxiet	5.03 (P y scale,	< 0.000 post	16); r² )01)		6.96			16.26 [9.92, 22.60]	_
hang 2016, NMES-MA ubtotal (95% CI) eterogeneity: Chi <sup>2</sup> = 5.1 est for overall effect: Z = 1.45.8 Hamilton anxiet eng 2018 ubtotal (95% CI)	5.03 (P	< 0.000 post	16); r² )01) 59	= 41% 15.34	6.96	53	0.4%	16.26 [9.92, 22.60] -4.09 [-6.33, -1.85]	-
ubtotal (95% CI) eterogeneity: Chi <sup>2</sup> = 5.1 est for overall effect: Z = 1.45.8 Hamilton anxiet eng 2018 ubtotal (95% CI)	5.03 (P ty scale, 11.25	< 0.000 post	16); r² )01)		6.96			16.26 [9.92, 22.60]	•
ubtotal (95% CI) eterogeneity: Chi <sup>2</sup> = 5.1 est for overall effect: Z = 1.45.8 Hamilton anxiet eng 2018 ubtotal (95% CI) eterogeneity: Not applic	= 5.03 (P ty scale,   11.25 able	< 0.000 post 4.83	16); i² )01) 59 59		6.96	53	0.4%	16.26 [9.92, 22.60] -4.09 [-6.33, -1.85]	•
ubtotal (95% CI) eterogeneity: Chi <sup>2</sup> = 5.1 est for overall effect: Z = 1.45.8 Hamilton anxiet eng 2018 ubtotal (95% CI) eterogeneity: Not applic est for overall effect: Z =	5.03 (P ty scale, 11.25 able 3.57 (P	< 0.000 post 4.83 = 0.000	16); r² )01) 59 59 (4)		6.96	53	0.4%	16.26 [9.92, 22.60] -4.09 [-6.33, -1.85]	•
ubtotal (95% CI) eterogeneity: Chi <sup>2</sup> = 5.1 est for overall effect: Z = 1.45.8 Hamilton anxiet eng 2018 ubtotal (95% CI) eterogeneity: Not applic est for overall effect: Z = 1.45.9 Hamilton depre	5.03 (P ty scale, 11.25 able 3.57 (P	< 0.000 post 4.83 = 0.000 ale, post	16); r <sup>2</sup> )01) 59 59 59	15.34	6.96 7.56	53	0.4% 0.4%	16.26 [9.92, 22.60] -4.09 [-6.33, -1.85] -4.09 [-6.33, -1.85]	•
ubtotal (95% CI) eterogeneity: Chi <sup>2</sup> = 5.1 est for overall effect: Z = 1.45.8 Hamilton anxiet eng 2018 ubtotal (95% CI) eterogeneity: Not applic est for overall effect: Z = 1.45.9 Hamilton depre eng 2018	• 5.03 (P ty scale, 11.25 able • 3.57 (P ssion sca	< 0.000 post 4.83 = 0.000 ale, post	16); r <sup>2</sup> )01) 59 59 59	15.34		53 53	0.4% 0.4% 0.3%	16.26 [9.92, 22.60] -4.09 [-6.33, -1.85]	•
ubtotal (95% CI) eterogeneity: Chi <sup>2</sup> = 5.1 est for overall effect: Z = 1.45.8 Hamilton anxiet eng 2018 ubtotal (95% CI) eterogeneity: Not applic est for overall effect: Z = 1.45.9 Hamilton depre eng 2018 ubtotal (95% CI)	• 5.03 (P ty scale, 11.25 able • 3.57 (P ssion sca	< 0.000 post 4.83 = 0.000 ale, post	16); r <sup>2</sup> )01) 59 59 )4)	15.34		53 53	0.4% 0.4% 0.3%	-4.09 [-6.33, -1.85] -4.09 [-6.33, -1.85] -4.09 [-6.33, -1.85]	•
ubtotal (95% CI) eterogeneity: Chi <sup>2</sup> = 5.1 est for overall effect: Z = 1.45.8 Hamilton anxiet ing 2018 ubtotal (95% CI) eterogeneity: Not applic est for overall effect: Z = 1.45.9 Hamilton depre eng 2018 ubtotal (95% CI) eterogeneity: Not applic eterogeneity: Not applic	• 5.03 (P ty scale,   11.25 able • 3.57 (P ssion sca 12.15 able	< 0.000 post 4.83 = 0.000 ale, post 6.86	16); f <sup>2</sup> 001) 59 59 04)	15.34		53 53	0.4% 0.4% 0.3%	-4.09 [-6.33, -1.85] -4.09 [-6.33, -1.85] -4.09 [-6.33, -1.85]	•
ubtotal (95% CI) eterogeneity: Chi <sup>2</sup> = 5.1 est for overall effect: Z = 1.45.8 Hamilton anxiet eng 2018 ubtotal (95% CI) eterogeneity: Not applic est for overall effect: Z = 1.45.9 Hamilton depre eng 2018 ubtotal (95% CI) eterogeneity: Not applic est for overall effect: Z = est for overall effect: Z =	= 5.03 (P ty scale, 11.25 able = 3.57 (P ssion sca 12.15 able = 3.00 (P	< 0.006 post 4.83 = 0.006 ale, post 6.86 = 0.003	16); p <sup>2</sup> 101) 59 59 14) : 59 59	15.34 16.26		53 53	0.4% 0.4% 0.3%	-4.09 [-6.33, -1.85] -4.09 [-6.33, -1.85] -4.09 [-6.33, -1.85]	•
ubtotal (95% CI) eterogeneity: Chi <sup>2</sup> = 5.1 est for overall effect: Z = 1.45.8 Hamilton anxiet eng 2018 ubtotal (95% CI) eterogeneity: Not applic est for overall effect: Z = 1.45.9 Hamilton depre eng 2018 ubtotal (95% CI) eterogeneity: Not applic est for overall effect: Z = 1.45.10 FIM: Functiona	= 5.03 (P ty scale, 11.25 able = 3.57 (P ssion sca 12.15 able = 3.00 (P	< 0.006 post 4.83 = 0.006 ale, post 6.86 = 0.003 ndenc m	16); p <sup>2</sup> 101) 59 59 14) : 59 59	15.34 16.26		53 53	0.4% 0.4% 0.3%	-4.09 [-6.33, -1.85] -4.09 [-6.33, -1.85] -4.09 [-6.33, -1.85]	•
ubtotal (95% CI) eterogeneity: Chi <sup>2</sup> = 5.1 est for overall effect: Z = 1.45.8 Hamilton anxiet eng 2018 ubtotal (95% CI) eterogeneity: Not applic est for overall effect: Z = 1.45.9 Hamilton depre eng 2018 ubtotal (95% CI) eterogeneity: Not applic eterogeneity: Not applic est for overall effect: Z = 1.45.10 FIM: Functiona may 2017, SE\$	= 5.03 (P ty scale, 11.25 able = 3.57 (P ssion sca 12.15 able = 3.00 (P	< 0.006 post 4.83 = 0.006 ale, post 6.86 = 0.003 ndenc m	16); P 101) 59 59 59 04) : 59 59	15.34 16.26	7.56	53 53 53	0.4% 0.4% 0.3% 0.3%	-4.09 [-6.33, -1.85] -4.09 [-6.33, -1.85] -4.09 [-6.33, -1.85] -4.11 [-6.79, -1.43] -4.11 [-6.79, -1.43]	•
ubtotal (95% CI) eterogeneity: Chi² = 5.1 est for overall effect: Z = 1.45.8 Hamilton anxiet eng 2018 abtotal (95% CI) eterogeneity: Not applic est for overall effect: Z = 1.45.9 Hamilton depre eng 2018 abtotal (95% CI) eterogeneity: Not applic est for overall effect: Z = 1.45.10 FIM: Functiona may 2017, SES abtotal (95% CI) eterogeneity: Not applic eterogeneity: Not applic eterogeneity: Not applic eterogeneity: Not applic	= 5.03 (P ty scale, 11.25 able = 3.57 (P ssion sca 12.15 able = 3.00 (P I indeper 74.45 able	< 0.006 post 4.83 = 0.006 ale, post 6.86 = 0.003 ndenc m 23.82	16); P 16); P 59 59 14) 59 59 3) leasure 58 58	15.34 16.26	7.56	53 53 53	0.4% 0.4% 0.3% 0.3%	16.26 [9.92, 22.60]  -4.09 [-6.33, -1.85] -4.09 [-6.33, -1.85]  -4.11 [-6.79, -1.43] -4.11 [-6.79, -1.43]	•
ubtotal (95% CI) eterogeneity: Chi² = 5.1 est for overall effect: Z = 1.45.8 Hamilton anxiet eng 2018 ubtotal (95% CI) eterogeneity: Not applic est for overall effect: Z = 1.45.9 Hamilton depre eng 2018 ubtotal (95% CI) eterogeneity: Not applic est for overall effect: Z = 1.45.10 FIM: Functiona may 2017, SES ubtotal (95% CI) eterogeneity: Not applic eterogeneity: Not applic eterogeneity: Not applic eterogeneity: Not applic	= 5.03 (P ty scale, 11.25 able = 3.57 (P ssion sca 12.15 able = 3.00 (P I indeper 74.45 able	< 0.006 post 4.83 = 0.006 ale, post 6.86 = 0.003 ndenc m 23.82	16); P 16); P 59 59 14) 59 59 3) leasure 58 58	15.34 16.26	7.56	53 53 53	0.4% 0.4% 0.3% 0.3%	16.26 [9.92, 22.60]  -4.09 [-6.33, -1.85] -4.09 [-6.33, -1.85]  -4.11 [-6.79, -1.43] -4.11 [-6.79, -1.43]	•
abtotal (95% CI) eterogeneity: Chi² = 5.1 est for overall effect: Z = 1.45.8 Hamilton anxiet eng 2018 abtotal (95% CI) eterogeneity: Not applic est for overall effect: Z = 1.45.9 Hamilton depre eng 2018 abtotal (95% CI) eterogeneity: Not applic est for overall effect: Z = 1.45.10 FIM: Functiona may 2017, SES abtotal (95% CI) eterogeneity: Not applic eterogeneity: Not applic est for overall effect: Z = 0tal (95% CI)	= 5.03 (P ty scale, 11.25 able = 3.57 (P ssion sca 12.15 able = 3.00 (P I indeper 74.45 able = 2.79 (P	< 0.006 post 4.83 = 0.006 ale, post 6.86 = 0.003 ndenc m 23.82 = 0.009	16); P 1001)  59 59 24)  59 59 59 59 59 666	15.34 16.26 e 61.5	7.56 21.62	53 53 53 53	0.4% 0.4% 0.3% 0.3%	16.26 [9.92, 22.60]  -4.09 [-6.33, -1.85] -4.09 [-6.33, -1.85]  -4.11 [-6.79, -1.43] -4.11 [-6.79, -1.43]	•
ubtotal (95% CI) eterogenelty: Chi <sup>2</sup> = 5.1 est for overall effect: Z = 1.45.8 Hamilton anxiet	= 5.03 (P ty scale, 11.25 able = 3.57 (P ssion sca 12.15 able = 3.00 (P d) indeper 74.45 able = 2.79 (P	< 0.006 post 4.83 = 0.006 ale, post 6.86 = 0.003 ndenc m 23.82 = 0.009	16); i' 001)  59 59 59 14)  59 59 59 666 <0.000	15.34 16.26 e 61.5	7.56 21.62	53 53 53 53	0.4% 0.4% 0.3% 0.3% 0.0%	16.26 [9.92, 22.60]  -4.09 [-6.33, -1.85] -4.09 [-6.33, -1.85]  -4.11 [-6.79, -1.43] -4.11 [-6.79, -1.43]  12.95 [3.87, 22.03] 12.95 [3.87, 22.03]	-20 -10 0 10 20

## **Supplement 5: Risk of Bias Analyses**

## **Epidemiology**

							Į.	nternal	validi	y					Overall
Author	Conduct of study	9	Selection	on of s	ubject	s			Asse	ssment			Confounding	Analysis	ROB
	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	1.10	1.11	1.12	1.13	1.14	2.1
Al-Khaled 2016	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Alsumrain 2013	Yes	CS	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	No	Yes	Acceptable
Arnold 2016	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Babi 2014	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Baroni 2012	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Bonilha 2014	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Brogan 2014	Yes	CS	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	No	Yes	Acceptable
Chua 1996	Yes	CS	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	No	Yes	Acceptable
Crary 2013	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
de Castillo 2017	Yes	CS	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	No	Yes	Acceptable
DePippo 1994	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Falsetti 2009	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Finlayson 2011	Yes	CS	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	No	Yes	Acceptable
Gordon 1987	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Gottlieb 1996	Yes	CS	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	No	Yes	Acceptable
Guyomard 2009	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Hamidon 2006	Yes	CS	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	No	Yes	Acceptable
Hinds 1998	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Hoffmann 2017	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Hoffmann 2012	Yes	CS	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	No	Yes	Acceptable
Holas 1994	Yes	CS	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	No	Yes	Acceptable
Jeyaseelan 2015	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Joundi 2017	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Kidd 1995	Yes	CS	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	No	Yes	Acceptable
Kumar 2016	Yes	CS	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	No	Yes	Acceptable
Lakshminarayan	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
2010															
Langdon 2007	Yes	CS	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	No	Yes	Acceptable
Lim 2001	Yes	CS	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	No	Yes	Acceptable
Lord 2014	Yes	CS	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	No	Yes	Acceptable
Maeshima 2014	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Mann 1999	Yes	CS	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	No	Yes	Acceptable
Muriana 2016	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Odderson 1995	Yes	CS	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	No	Yes	Acceptable
Palomeras 2014	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Rofes 2018	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Sala 1998	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Smithard 2007	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Sundar 2007	Yes	CS	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	No	Yes	Acceptable
Wade 1987	Yes	CS	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	No	Yes	Acceptable
Wang 2001	Yes	CS	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	No	Yes	Acceptable
Zhang 2016	Yes	CS	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	No	Yes	Acceptable

<sup>1.1:</sup> The study addresses an appropriate and clearly focused question; 1.2: The two groups being studied are selected from source populations that are comparable in all respects other than the factor under investigation; 1.3: The study indicates how many of the people asked to take part did so, in each of the groups being studied; 1.4. The likelihood that some eligible subjects might have the outcome at the time of enrolment is assessed and taken into account in the analysis; 1.5: What percentage of individuals or clusters recruited into each arm of the study dropped out before the study was completed; 1.6: Comparison is made between full participants and those lost to follow up, by exposure status; 1.7: The outcomes are clearly defined; 1.8: The assessment of outcome is made blind to exposure status. If the study is retrospective this may not be applicable; 1.9: Where blinding was not possible, there is some recognition that knowledge of exposure status could have influenced the assessment of outcome; 1.10: The method of assessment of exposure is reliable; 1.11: Evidence from other sources is used to demonstrate that the method of outcome assessment is valid and reliable; 1.12: Exposure level or prognostic factor is assessed more than once; 1.13: The main potential confounders are

identified and taken into account in the design and analysis; 1.14: Have confidence intervals/p value been provided? 2.1: How well was the study done to minimise the risk of bias or confounding? CS: Can't say, NA: Not applicable

#### Screening

							I	nternal	validity	,					Overall
Author	Conduct of study	:	Selecti	on of s	ubjects	5			Asses	sment			Confounding	Analysis	ROB
	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	1.10	1.11	1.12	1.13	1.14	2.1
Al-Khaled 2016	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Bray 2017	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Clements 2009	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Diniz 2009	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	High
															quality
Dhufaigh 2017	Yes	CS	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	No	Yes	Acceptable
Dziewas 2008	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Gandolfi 2014	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Guillan 2015	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Han 2018	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Hincheyn 2005	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Lakshminarayan 2010	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Masrur 2013	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
McCormack 2016	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Odderson 1995	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Palli 2017	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Perry 2000	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Schrock 2017	Yes	CS	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	No	Yes	Acceptable
Sørensen 2013	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Titsworth 2013	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Turner 2016	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Yeh 2011	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable

<sup>1.1:</sup> The study addresses an appropriate and clearly focused question; 1.2: The two groups being studied are selected from source populations that are comparable in all respects other than the factor under investigation; 1.3: The study indicates how many of the people asked to take part did so, in each of the groups being studied; 1.4. The likelihood that some eligible subjects might have the outcome at the time of enrolment is assessed and taken into account in the analysis; 1.5: What percentage of individuals or clusters recruited into each arm of the study dropped out before the study was completed; 1.6: Comparison is made between full participants and those lost to follow up, by exposure status; 1.7: The outcomes are clearly defined; 1.8: The assessment of outcome is made blind to exposure status. If the study is retrospective this may not be applicable; 1.9: Where blinding was not possible, there is some recognition that knowledge of exposure status could have influenced the assessment of outcome; 1.10: The method of assessment of exposure is reliable; 1.11: Evidence from other sources is used to demonstrate that the method of outcome assessment is valid and reliable; 1.12: Exposure level or prognostic factor is assessed more than once; 1.13: The main potential confounders are identified and taken into account in the design and analysis; 1.14: Have confidence intervals/p value been provided? 2.1: How well was the study done to minimise the risk of bias or confounding? CS: Can't say, NA: Not applicable

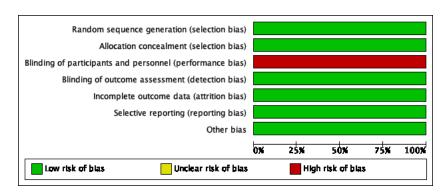
#### Assessment

							ı	nternal	/alidity	•					Overall
Author	Conduct of study	:	Selecti	on of s	ubjects	5			Asses	sment			Confounding	Analysis	ROB
	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	1.10	1.11	1.12	1.13	1.14	2.1
Bax 2014	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Bray 2017	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Radhakrishnan	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
2013															
Dhufaigh 2017	Yes	CS	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	No	Yes	Acceptable

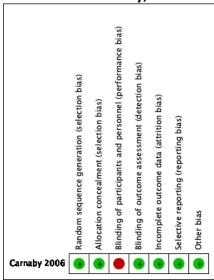
1.1: The study addresses an appropriate and clearly focused question; 1.2: The two groups being studied are selected from source populations that are comparable in all respects other than the factor under investigation; 1.3: The study indicates how many of the people asked to take part did so, in each of the groups being studied; 1.4. The likelihood that some eligible subjects might have the outcome at the time of enrolment is assessed and taken into account in the analysis; 1.5: What percentage of individuals or clusters recruited into each arm of the study dropped out before the study was completed; 1.6: Comparison is made between full participants and those lost to follow up, by exposure status; 1.7: The outcomes are clearly defined; 1.8: The assessment of outcome is made blind to exposure status. If the study is retrospective this may not be applicable; 1.9: Where blinding was not possible, there is some recognition that knowledge of exposure status could have influenced the assessment of outcome; 1.10: The method of assessment of exposure is reliable; 1.11: Evidence from other sources is used to demonstrate that the method of outcome assessment is valid and reliable; 1.12: Exposure level or prognostic factor is assessed more than once; 1.13: The main potential confounders are identified and taken into account in the design and analysis; 1.14: Have confidence intervals/p value been provided? 2.1: How well was the study done to minimise the risk of bias or confounding? CS: Can't say, NA: Not applicable

#### **Treatments**

#### 1. Dietary Interventions



#### Risk of bias summary, Consistency modification



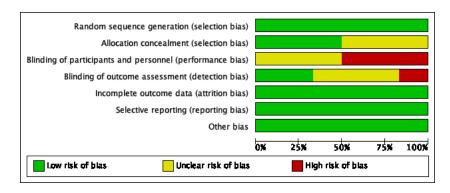
# Risk of bias assessment of non-randomized studies using SIGN 50 checklist, Consistency modification

							li	nternal v	/alidity	,					Overall
Author	Conduct	:	Selection	on of s	ubjects	6			Asses	sment			Confounding	Analysis	ROB
	of study														
	1.1	1.2					1.7	1.8	1.9	1.10	1.11	1.12	1.13	1.14	2.1
Foley 2006	Yes	CS	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	No	Yes	Acceptable

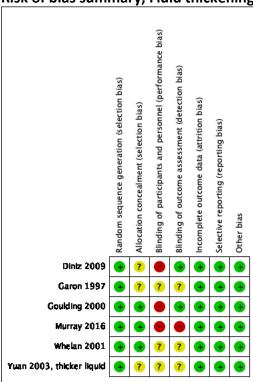
1.1: The study addresses an appropriate and clearly focused question; 1.2: The two groups being studied are selected from source populations that are comparable in all respects other than the factor under investigation; 1.3: The study indicates how many of the people asked to take part did so, in each of the groups being studied; 1.4. The likelihood that some eligible subjects might have the outcome at the time of enrolment is assessed and taken into account in the analysis; 1.5: What percentage of individuals or clusters recruited into each arm of the study dropped out before the study was completed; 1.6: Comparison is made between full participants and those lost to follow up, by exposure status; 1.7: The outcomes are clearly defined; 1.8: The assessment of outcome is made blind to exposure status. If the study is retrospective this may not be applicable; 1.9: Where blinding was not possible, there is some recognition that knowledge of exposure status could have influenced the assessment of outcome; 1.10: The method of assessment of exposure is reliable; 1.11: Evidence from other sources is used to demonstrate that the method of outcome assessment is valid and reliable; 1.12: Exposure level or prognostic factor is assessed more than once; 1.13: The main potential confounders are

identified and taken into account in the design and analysis; 1.14: Have confidence intervals/p value been provided? 2.1: How well was the study done to minimise the risk of bias or confounding? CS: Can't say, NA: Not applicable

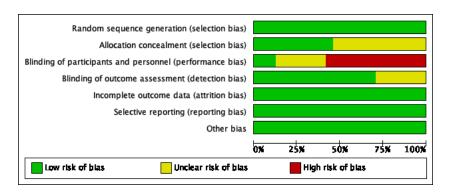
#### Risk of bias graph, Fluid thickening



Risk of bias summary, Fluid thickening



### 2a. Behavioural interventions



### Risk of bias summary, Behavioural Interventions

		(selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	a (attrition bias)	orting bias)	
	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants	Blinding of outcome as	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias
Bakhtiyari 2015a	•	•	•	•	•	•	•
Carnaby 2006	•	•	•	•	•	•	•
Choi 2017	•	?	?	?	•	•	•
DePippo 1994 Thera	•	?	?	?	•	•	•
EOM 2017	•	?	•	•	•	•	•
Fraga 2017	•	?	?	•	•	•	•
Gao 2017 Shaker	•	?	?	•	•	•	•
Guillén-Solà 2017	•	•	•	•	•	•	•
Heo 2015	•	?	•	?	•	•	•
Kim 2015, Shaker	•	?	?	?	•	•	•
Kim 2017	•	•	?	?	•	•	•
Kim 2018	•	?	•	•	•	•	•
Koyama 2017	•	•	•	•	•	•	•
Kulnik 2015	•	•	•	•	•	•	•
Lee 2015, ACE	•	•	•	•	•	•	•
Messaggi-Sartor 2015, Exe	•	•	•	•	•	•	•
Moon 2017	•	?	•	?	•	•	•
Moon 2018, Tongue Exer	•	•	•	•	•	•	•
Park 2015, Tongue	•	?	•	•	•	•	•
Park 2016, EMST	•	•	•	•	•	•	•
Park 2017, Shaker	•	?	?	?	•	•	•
Park 2018, CTAR	•	?	•	•	•	•	•
Power 2006, Oral stimul	•	?	•	•	•	•	•
Steele 2016	•	•		•	•	•	•

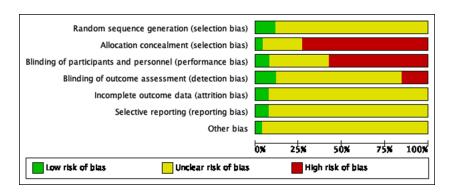
#### Risk of bias assessment of non-randomized studies using SIGN 50 checklist, Behavioural Interventions

							l)	nternal	validity	,					Overall
Author	Conduct of study	:	Selecti	on of s	ubjects	3			Asses	sment			Confounding	Analysis	ROB
	1.1	1.2					1.7	1.8	1.9	1.10	1.11	1.12	1.13	1.14	2.1
Kang 2012	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Kim 2015	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Li 2016	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Lin 2003	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable

1.1: The study addresses an appropriate and clearly focused question; 1.2: The two groups being studied are selected from source populations that are comparable in all respects other than the factor under investigation; 1.3: The study indicates how many of the people asked to take part did so, in each of the groups being studied; 1.4. The likelihood that some eligible subjects might have the outcome at the time of enrolment is assessed and taken into account in the analysis; 1.5: What percentage of individuals or clusters recruited into each arm of the study dropped out before the study was completed; 1.6: Comparison is made between full participants and those lost to follow up, by exposure status; 1.7: The outcomes are clearly defined; 1.8: The assessment of outcome is made blind to exposure status. If the study is retrospective this may not be applicable; 1.9: Where blinding was not possible, there is some recognition that knowledge of exposure status could have influenced the assessment of outcome; 1.10: The method of assessment of exposure is reliable; 1.11: Evidence from other sources is used to demonstrate that the method of outcome assessment is valid and reliable; 1.12: Exposure level or prognostic factor is assessed more than once; 1.13: The main potential confounders are identified and taken into account in the design and analysis; 1.14: Have confidence intervals/p value been provided? 2.1: How well was the study done to minimise the risk of bias or confounding? CS: Can't say, NA: Not applicable

### 2.b Acupuncture

#### **Risk of Bias of RCT**

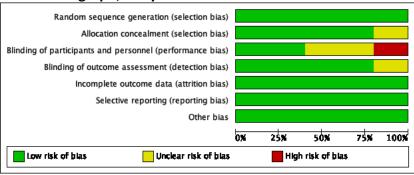


### Risk of bias summary, Acupuncture

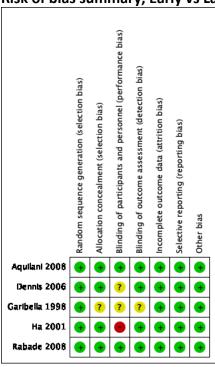
Bal 2007 7 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9
Chan 2012
Chang 2014, Ac ?
Chen 2016, Ac ? ? • • • • ? ? ? ? ? ? ? ? ? ? ? ? ?
Cheng 2014  Chu 2017, Ac  Fan 2007, Ac  Feng 2016  Han 2004  Huang 2008, Ac  Jla 2006  Jla 2006  Cheng 2014  Property of the company of the c
Chu 2017, Ac ?
Fan 2007, Ac ?
Feng 2016
Han 2004 Huang 2008, Ac Huang 2010 Jla 2006 Jln 2010, Acupu   Han 2004  Huang 2010  Representation of the company of the compa
Huang 2008, Ac ? ? ? ? ? ? ? ? ? Huang 2010 ?
Huang 2010  Jia 2006  Jin 2010, Acupu  7
Jia 2006 ?
Jin 2010, Acupu ? 🔴 🔴 ? ? ? ?
Kikuchi 2014 😝 😝 😯 🔞 ?
Llu 2000 ? ? ? ? ? ? ?
Llu 2004 ? 🔵 ? ? ? ?
Llu 2012, Ac ? 😝 🕤 ? ? ?
⊔µ 2019 <mark>? ⊜ ⊜ ? ? ?</mark>
Ma 2014 7 🙃 🙃 7 7 7
Ma 2015, Ac ? 😝 😝 ? ? ?
Meng 2015, Ac ? 6 6 7 7 7
Wu 2011 ? ? ? ? ? ? ?
XIa 2016, Ac 🕕 🛑 🛑 🕴 ? ? ?
Yin 2013 ? • • ? ? ?
Zheng 2011, Ac ? • ? ? ? ? ?
Zhou 2013 7 0 0 7 7 7

#### 3. Nutritional Interventions

#### Risk of bias graph, Early vs Late oral nutrition

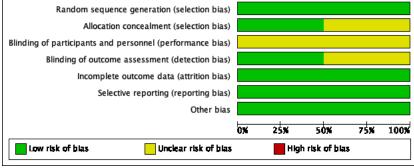


### Risk of bias summary, Early vs Late oral nutrition

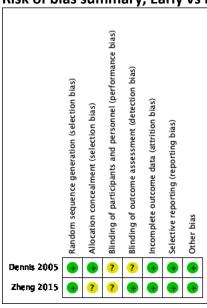


Risk of Bias of RCT



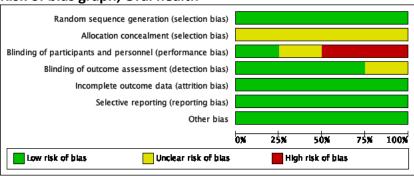


### Risk of bias summary, Early vs Late Enteral or Parenteral Nutrition

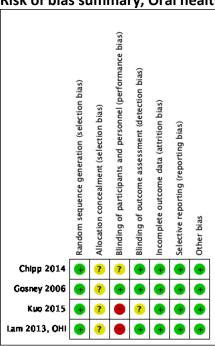


### 4. Oral Health Interventions

Risk of bias graph, Oral health



### Risk of bias summary, Oral health



#### Risk of bias assessment of non-randomized studies using SIGN 50 checklist. Oral health

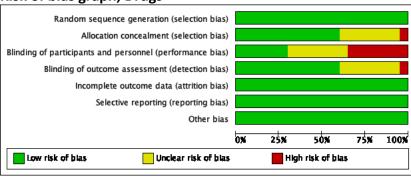
													•		
							li li	nternal	/alidity	,					Overall
Author	Conduct of study		Selecti	on of s	ubjects	3			Asses	sment			Confounding	Analysis	ROB
	1.1	1.2						1.8	1.9	1.10	1.11	1.12	1.13	1.14	2.1
Murray 2018	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Sørensen 2013	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Wagner 2016	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Talley 2015	Yes	CS	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	No	Yes	Acceptable

1.1: The study addresses an appropriate and clearly focused question; 1.2: The two groups being studied are selected from source populations that are comparable in all respects other than the factor under investigation; 1.3: The study indicates how many of the people asked to take part did so, in each of the groups being studied; 1.4. The likelihood that some eligible subjects might have the outcome at the time of enrolment is assessed and taken into account in the analysis; 1.5: What percentage of individuals or clusters recruited into each arm of the study dropped out before the study was completed; 1.6: Comparison is made between full participants and those lost to follow up, by exposure status; 1.7: The outcomes are clearly defined; 1.8: The assessment of outcome is made blind to exposure status. If the study is retrospective this may not be applicable; 1.9: Where blinding was not possible, there is some recognition that knowledge of exposure status could have influenced the assessment of outcome; 1.10: The method of assessment of exposure is reliable; 1.11: Evidence from other sources is used to demonstrate that the method of outcome assessment is valid and reliable; 1.12: Exposure level or prognostic factor is assessed more than once; 1.13: The main potential confounders are identified and taken into account in the design and analysis; 1.14: Have confidence intervals/p value been provided? 2.1: How well was the study done to minimise the risk of bias or confounding?

CS: Can't say, NA: Not applicable

### 5. Pharmacological Interventions

### Risk of bias graph, Drugs



Risk of bias summary, Drugs

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias
Arai 2003, Cabergoline	•	?	?	?	•	•	•
Arai 2003, imidapril	•	?	?	?	•	•	•
Chamorro 2005, Antibio	•	•	•	•	•	•	•
Chen 2017a	•	?	•	•	•	•	•
De Faico 1998, Antibio	•	?	?	?	•	•	•
Ebihara 2005, Capsakin	•	?	•	?	•	•	•
Ebihara 2006, Pepper oil	•	?	•	•	•	•	•
Harms 2008, Antbio	•	?	•	•	•	•	•
Kaira 2015, Antibio	•	•	?	•	•	•	•
Kanda 2004, Amant+imidapril	•	•	?	?	•	•	•
Lee 2015, ACE	•	•	•	•	•	•	•
Nakagawa 1999, Amantadine	•	•	?	?	•	•	•
Ohkubo 2004, Progress	•	•	•	•	•	•	•
Perez 1998, Nifedipine	•	•	•	•	•	•	•
Rofes 2014, Piperine	•	•	•	•	•	•	•
Schwarz 2008, Antibio	•	•	•	•	•	•	•
Ulm 2017, Antioblotics	•	•	•	•	•	•	•
Warusevitane 2015, metoci	•	•	•	•	•	•	•
Westendorp 2015, Antibio	•	•	•	•	•	•	•
Yusuf 2008, Profess-Telmi	•	•	?	?	•	•	•

Risk of bias assessment of non-randomized studies using SIGN 50 checklist, Drugs

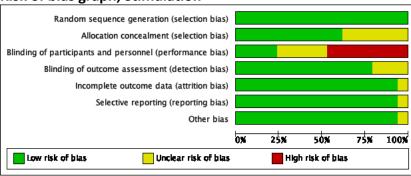
							I	nternal	validity	,					Overall
Author	Conduct of study	:	Selecti	on of s	ubjects	5			Asses	sment			Confounding	Analysis	ROB
	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	1.10	1.11	1.12	1.13	1.14	2.1
Arai 2005	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Arai 2001	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Arai 1998	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Arai 2000	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Arai 1998	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Cuifang 2010	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Ebihara 1993	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Ebihara 2010	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Harda 2006	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable
Rofes 2013	Yes	Yes	NA	Yes	NA	NA	Yes	No	CS	Yes	Yes	NA	Yes	Yes	Acceptable

1.1: The study addresses an appropriate and clearly focused question; 1.2: The two groups being studied are selected from source populations that are comparable in all respects other than the factor under investigation; 1.3: The study indicates how many of the people asked to take part did so, in each of the groups being studied; 1.4. The likelihood that some eligible subjects might have the outcome at the time of enrolment is assessed and taken into account in the analysis; 1.5: What percentage of individuals or clusters recruited into each arm of the study dropped out before the study was completed; 1.6: Comparison is made between full participants and those lost to follow up, by exposure status; 1.7: The outcomes are clearly defined; 1.8: The assessment of outcome is made blind to exposure status. If the study is retrospective this may not be applicable; 1.9: Where blinding was not possible, there is some recognition that knowledge of exposure status could have influenced the assessment of outcome; 1.10: The method of assessment of exposure is reliable; 1.11: Evidence from other sources is used to demonstrate that the method of outcome assessment is valid and reliable; 1.12: Exposure level or prognostic factor is assessed more than once; 1.13: The main potential confounders are identified and taken into account in the design and analysis; 1.14: Have confidence intervals/p value been provided? 2.1: How well was the study done to minimise the risk of bias or confounding?

CS: Can't say, NA: Not applicable

### 6. Neurostimulation

### Risk of bias graph, Stimulation



### Risk of bias summary, Stimulation

September   Sept								
Arreola 2018a  Bath 2016  Bulow 2008  Du 2016, rTMS, 3H  Dziewas 2018  Guillén-Solà 2017  Jayasekeran 2010, PES  Khedr 2009, rTMS  Khedr 2010, rTMS  Khedr 2010, rTMS  Ko 2016, tDCS  Kumar 2011  Lee 2014, NMES  LI 2015, VitalStim vs TT  Lim 2009  Lim 2014, NMES  Meng 2017, NMESa  Michou 2014, PES  Park 2016, rTMS  Park 2016, rTMS  Shigematsu 2013, tDCS  Singh 2006 PES  Suntrup-Krueger 2018  Terre 2015, NMES  Vasant 2016, PES  Xia 2011, Vitalstim  Yang 2012, tDCS  Lim 2012, tDCS  Lim 2017, SES  Vasant 2016, PES  Xia 2011, Vitalstim  Yang 2012, tDCS  Lim 2012, tDCS  Lim 2014, NMES  Lim 2015, PES  Lim 2016, PES  Xia 2011, Vitalstim  Yang 2012, tDCS  Lim 2014, NMES  Lim 2015, PES  Lim 2016, PES  Xia 2011, Vitalstim  Yang 2012, tDCS  Lim 2014, Vitalstim  Yang 2012, tDCS  Lim 2016, pES  Xia 2011, Vitalstim  Yang 2012, tDCS  Lim 2018, tDCS  Lim 2016, pES  Lim 2017, SES  Lim 2017, Vitalstim  Yang 2012, tDCS  Lim 2018, tDCS  Lim 2018, tDCS  Lim 2018, tDCS  Lim 2011, Vitalstim  Yang 2012, tDCS  Lim 2018, tDCS  Lim 2019, tDCS  Lim 2018, tDCS  Lim 2018, tDCS  Lim 2019, tDCS  Lim 201			_		_			
Bath 2016  Bulow 2008  Du 2016, rTMS, 3H  Dziewas 2018  Guillén-Solà 2017  Jayasekeran 2010, PES  Khedr 2009, rTMS  Khedr 2010, rTMS  Khedr 2010, rTMS  Ko 2016, tDCS  Kumar 2011  Lee 2014, NMES  LI 2015, VhtalStim vs TT  Lim 2009  LIm 2014, NMES  Meng 2017, NMESa  Michou 2014, PES  Park 2016, rTMS  Park 2016, rTMS  Shigematsu 2013, tDCS  Singh 2006 PES  Suntrup-Krueger 2018  Terre 2015, NMES  Vasant 2016, PES  Xia 2011, Vitalstim  Yang 2012, tDCS  Zeng 2018  Targ 2018  Targ 2018  Targ 2018  Targ 2018  Targ 2017, NMES  Targ 2017, NMES  Targ 2017, NMES  Targ 2017, NMES  Targ 2018, NMES  Targ 2017, SES  Targ 2018, NMES  Targ 2018, NM	Ahn 2017, tDCS	•	?	•	•	•	•	•
Bulow 2008  Du 2016, rTMS, 3H  Dziewas 2018  Guillén-Solà 2017  Jayasekeran 2010, PES  Khedr 2009, rTMS  Khedr 2010, rTMS  Khedr 2011, rTMS  Ko 2016, tDCS  Kumar 2011  Lee 2014, NMES  LI 2015, VitalStim vs TT  Lim 2009  Lim 2014, NMES  Meng 2017, NMESa  Mikhou 2014, PES  Park 2013, rTMS  Park 2016, rTMS  Shigematsu 2013, tDCS  Singh 2006 PES  Suntrup-Krueger 2016, PES  Suntrup-Krueger 2016  Terre 2015, NMES  Umay 2017, SES  Vasant 2016, PES  Xia 2011, Vitalstim  Yang 2012, tDCS  A B B B B B B B B B B B B B B B B B B		⊢		?			_	?
Du 2016, rTMS, 3H  Dziewas 2018  Guillén-Solà 2017  Jayasekeran 2010, PES  Khedr 2009, rTMS  Khedr 2010, rTMS  Khedr 2011, rTMS  Ko 2016, tDCS  Kumar 2011  Lee 2014, NMES  LI 2015, VitalStim vs TT  Lim 2009  Lim 2014, NMES  Meng 2017, NMESa  Mikhou 2014, PES  Park 2013, rTMS  Park 2016, rTMS  Shigematsu 2013, tDCS  Singh 2006 PES  Sproson 2018, NMES  Suntrup-Krueger 2018  Terre 2015, NMES  LI 2017, SES  Vasant 2016, PES  Vasant 2016, PES  Vasant 2016, PES  Ala 2011, Vitalstim  Yang 2012, tDCS  LIm 2017, SES  LI 2011, Vitalstim  Yang 2012, tDCS  LIm 2016, PES  LIm 2017, SES  LImay 2011, Vitalstim  Yang 2012, tDCS  LImay 2018, tDCS  LImay 2018, tDCS  LImay 2018, tDCS  LImay 2017, SES  LImay 2017, SES  LImay 2017, SES  LImay 2017, SES  LImay 2012, tDCS  LImay 2018, tDCS  LImay 2017, SES  LImay 2012, tDCS  LImay 2018, tDCS  LImay 2017, SES  LImay 2012, tDCS  LImay 2018, tDCS  LImay 2012, tDCS  LImay 2018,		•	•		•	•	•	•
Dziewas 2018 Guillén-Solà 2017 Jayasekeran 2010, PES Khedr 2009, rTMS Khedr 2010, rTMS Khedr 2010, rTMS Kim 2011 rTMS Ko 2016, tDCS Kumar 2011 Lee 2014, NMES LI 2015, VitalStim vs TT LIm 2009 Lim 2014, NMES Meng 2017, NMESa Mikhou 2014, PES Park 2013, rTMS Park 2016, rTMS Shigematsu 2013, tDCS Singh 2006 PES Suntrup-Krueger 2018 Terre 2015, NMES Vasant 2016, PES Vasant 2016, PES Vasant 2016, PES Xia 2011, Vitalstim Yang 2012, tDCS Zeng 2018  Terre 2018, NMES Tay 2016, PES Tay 2017, SES Tay 2016, PES Tay 2017, SES Tay 2017, SES Tay 2018, NMES Tay 201		$\vdash$		•				
Guillén-Solà 2017  Jayasekeran 2010, PES  Khedr 2009, rTMS  Khedr 2010, rTMS  Kim 2011 rTMS  Ko 2016, tDCS  Kumar 2011  Lee 2014, NMES  Li 2015, VitalStim vs TT  Lim 2009  Lim 2014, NMES  Meng 2017, NMESa  Michou 2014, PES  Park 2016, rTMS  Park 2016, rTMS  Shigematsu 2013, tDCS  Singh 2006 PES  Suntrup-Krueger 2016  Terre 2015, NMES  Umay 2017, SES  Vasant 2016, PES  Xia 2011, Vitalstim  Yang 2012, tDCS  A B B B B B B B B B B B B B B B B B B		$\vdash$		•	_	_	_	-
Jayasekeran 2010, PES  Khedr 2009, rTMS  Khedr 2011, rTMS  Kim 2011 rTMS  Ko 2016, tDCS  Kumar 2011  Lee 2014, NMES  Li 2015, VitalStim vs TT  Lim 2009  Lim 2014, NMES  Meng 2017, NMESa  Mikhou 2014, PES  Park 2013, rTMS  Park 2016, rTMS  Shigematsu 2013, tDCS  Singh 2006 PES  Sproson 2018, NMES  Suntrup-Krueger 2018  Terre 2015, NMES  Umay 2017, SES  Vasant 2016, PES  Xia 2011, Vitalstim  Yang 2012, tDCS  Zeng 2018  Park 2016, PES  Ala 2016, PES  Ala 2017, SES  Ala 2017, NMESA  Ala 2018, MAES  Ala 2019,		$\vdash$	_	•	_	_	_	-
Khedr 2009, rTMS  Khedr 2010, rTMS  William 2011 rTMS  Ko 2016, tDCS  Kumar 2011  Lee 2014, NMES  Li 2015, VitalStim vs TT  Lim 2009  Lim 2014, NMES  Meng 2017, NMESa  Mikhou 2014, PES  Park 2013, rTMS  Park 2016, rTMS  Shigematsu 2013, tDCS  Singh 2006 PES  Sproson 2018, NMES  Suntrup-Krueger 2018  Terre 2015, NMES  Vasant 2016, PES  Vasant 2016, PES  Xia 2011, Vitalstim  Yang 2012, tDCS  Lim 2009  Lim 2014, PES  Lim 2009  Lim 2014, PES  Lim 2009  Lim 2017, SES  Lim 2016, PES  Lim 2016, PES  Lim 2017, SES  Lim 2017, Vitalstim  Yang 2012, tDCS  Lim 2018		E		•				-
Khedr 2010, rTMS  KIM 2011 rTMS  Q	-	H		•		_	_	-
Kim 2011 rTMS  Ko 2016, tDCS  Kumar 2011  Lee 2014, NMES  Li 2015, VitalStim vs TT  Lim 2009  Lim 2014, NMES  Meng 2017, NMESa  Mikhou 2014, PES  Park 2013, rTMS  Park 2016, NMES  Park 2016, rTMS  Shigematsu 2013, tDCS  Singh 2006 PES  Sproson 2018, NMES  Suntrup-Krueger 2015, PES  Suntrup-Krueger 2016  Terre 2015, NMES  Umay 2017, SES  Umay 2017, SES  Vasant 2016, PES  Xia 2011, Vitalstim  Yang 2012, tDCS  Zeng 2018  Park 2016, PES  A		H			-	_	-	-
Ko 2016, tDCS  Kumar 2011  Lee 2014, NMES  H		-	-	2	-	_	_	-
Kumar 2011       + + + + + + + + + + + + + + + + + + +		=				_	_	_
Lee 2014, NMES  LI 2015, VitalStim vs TT  Lim 2009  Lim 2014, NMES  Meng 2017, NMESa  Mikhou 2014, PES  Park 2013, rTMS  Park 2016, NMES  Park 2016, rTMS  Shigematsu 2013, tDCS  Singh 2006 PES  Sproson 2018, NMES  Suntrup-Krueger 2015, PES  Suntrup-Krueger 2016  Terre 2015, NMES  Umay 2017, SES  Vasant 2016, PES  Xia 2011, Vitalstim  Yang 2012, tDCS  Lim 2009  1		=				_		
Lim 2015, VitalStim vs TT  Lim 2009  Lim 2014, NMES  Meng 2017, NMESa  Michou 2014, PES  Park 2013, rTMS  Park 2016, NMES  Park 2016, rTMS  Shigematsu 2013, tDCS  Singh 2006 PES  Sproson 2018, NMES  Suntrup-Krueger 2015, PES  Suntrup-Krueger 2018  Terre 2015, NMES  Umay 2017, SES  Vasant 2016, PES  Xta 2011, Vitalstim  Yang 2012, tDCS  Lim 2009  2		H			_	_	_	-
Lim 2009 Lim 2014, NMES Meng 2017, NMESa Michou 2014, PES Park 2013, rTMS Park 2016, NMES Park 2016, rTMS Shigematsu 2013, tDCS Singh 2006 PES Sproson 2018, NMES Suntrup-Krueger 2018 Terre 2015, NES Umay 2017, SES Vasant 2016, PES Xia 2011, Vitalstim Yang 2012, tDCS Fig. Singh 2006 PES Companies of the companie		H		•		_		-
Lim 2014, NMES  Meng 2017, NMESa  Mikhou 2014, PES  Park 2013, rTMS  Park 2016, NMES  Park 2016, NMES  Park 2016, rTMS  Shigematsu 2013, tDCS  Singh 2006 PES  Sproson 2018, NMES  Suntrup-Krueger 2015, PES  Suntrup-Krueger 2018  Terre 2015, NMES  Umay 2017, SES  Vasant 2016, PES  Xia 2011, Vitalstim  Yang 2012, tDCS  Zeng 2018		H		?		_		-
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Park 2013, rTMS  Park 2016, NMES  Park 2016, rTMS  Shigematsu 2013, tDCS  Singh 2006 PES  Sproson 2018, NMES  Suntrup-Krueger 2015, PES  Suntrup-Krueger 2018  Terre 2015, NMES  Umay 2017, SES  Vasant 2016, PES  Xia 2011, Vitalstim  Yang 2012, tDCS  Zeng 2018  Park 2016, NMES  Park 2016, PES  Park 2016	Michou 2014, PES	$\vdash$		?		_	_	
Park 2016, rTMS	Park 2013, rTMS	•	•	•	•	•	•	-
Shigematsu 2013, tDCS  Singh 2006 PES  Sproson 2018, NMES  \$	Park 2016, NMES	_		_	•	•	_	
Singh 2006 PES Sproson 2018, NMES Suntrup-Krueger 2015, PES Suntrup-Krueger 2018 Terre 2015, NMES Umay 2017, SES Vasant 2016, PES XIa 2011, Vitalstim Yang 2012, tDCS Zeng 2018  **Terre 2018 **Terre 2015, NMES **Terre 2016, PES **Terre 2016,	Park 2016, rTMS	•	•	•	•	•	•	•
Sproson 2018, NMES	Shigematsu 2013, tDCS	•	•	•	•	•	•	•
Suntrup-Krueger 2015, PES  Suntrup-Krueger 2018  Terre 2015, NMES  Umay 2017, SES  Vasant 2016, PES  XIa 2011, Vitalstim  Yang 2012, tDCS  Zeng 2018	Singh 2006 PES	•	•	?	?	•	•	•
Suntrup-Krueger 2018  Terre 2015, NMES  Umay 2017, SES  Vasant 2016, PES  XIa 2011, Vitalstim  Yang 2012, tDCS  Zeng 2018	Sproson 2018, NMES	•	•	•	•	•	•	•
Terre 2015, NMES	Suntrup-Krueger 2015, PES	•	•	•	•	•	•	•
Umay 2017, SES	Suntrup-Krueger 2018	•	•	•	•	•	•	•
Vasant 2016, PES	Terre 2015, NMES	•	?	•	•	•	•	•
XIa 2011, Vitalstim  Yang 2012, tDCS  Zeng 2018  2		_	•	•	•	•	•	•
Yang 2012, tDCS		<u> </u>		•	•	•	•	•
Zeng 2018		÷	_	•	_	_	_	_
	_	<u> </u>		•	_	_	_	_
Zhang 2016, NMES 😛 🕜 🤻 😲 🕕 🕕	_	H				_	-	-
	Zhang 2016, NMES	•	?	?	?	•	•	•

### **Supplement 6: GRADE profiles**

### Epidemiology

			Certainty asse	essment			№ of p	atients	Ef	fect		
№ of studie s	Study design	Risk of bias	Inconsistenc y	Indirectnes s	Imprecisio n	Other consideration s	Dysphagia	No Dysphagia	Relativ e (95% CI)	Absolut e (95% CI)	Certainty	Importance
Overall	Mortality											
22	observation al studies	not seriou s	serious ª	not serious	not serious	very strong association	28314/14257 0 (19.9%)	9737/558898 (1.7%)	OR 7.73 (4.68 to 12.76)	103 more per 1,000 (from 59 more to 167 more)	⊕⊕⊕ MODERATE	CRITICAL
mRS 0-1	1											
2	observation al studies	not seriou s	serious ª	not serious	not serious	publication bias strongly suspected very strong association <sup>b</sup>	150/2514 (6.0%)	927/3068 (30.2%)	OR 0.20 (0.11 to 0.35)	fewer per 1,000 (from 257 fewer to 171 fewer)	ФФО О Low	CRITICAL
Pneumo	onia											
33	observation al studies	not seriou s	serious ª	not serious	not serious	very strong association	35157/15631 2 (22.5%)	15345/61086 7 (2.5%)	OR 7.45 (6.01 to 9.24)	136 more per 1,000 (from 109 more to 167 more)	⊕⊕⊕ MODERATE	CRITICAL
Malnutri	ition											
9	observation al studies	not seriou s	serious <sup>a</sup>	not serious	not serious	publication bias strongly suspected strong association °	218/952 (22.9%)	349/2842 (12.3%)	OR 3.49 (1.82 to 6.69)	205 more per 1,000 (from 80 more to 361 more)	⊕⊖⊖ O VERY LOW	CRITICAL
Aspirati	on		•		·							
1	observation al studies	not seriou s	not serious	not serious	not serious	publication bias strongly suspected strong association <sup>b</sup>	217/2457 (8.8%)	26/2687 (1.0%)	OR 9.91 (6.58 to 14.95)	79 more per 1,000 (from 51 more to 118 more)	ФФО О Low	CRITICAL

Length of stay - Hospital

			Certainty asse	essment			Nº of p	atients	Ef	fect		
№ of studie s	Study design	Risk of bias	Inconsistenc y	Indirectnes s	Imprecisio n	Other consideration s	Dysphagia	No Dysphagia	Relativ e (95% CI)	Absolut e (95% CI)	Certainty	Importance
16	observation al studies	not seriou s	serious <sup>a</sup>	not serious	not serious	publication bias strongly suspected °	141159	556455	-	MD 4.72 higher (3.53 higher to 5.91 higher)	⊕○○ O VERY LOW	IMPORTAN T
Swallow	ving functions	•							•			
2	observation al studies	not seriou s	not serious	not serious	not serious	publication bias strongly suspected strong association °	102	200	-	SMD 2.71 lower (3.04 lower to 2.38 lower)	⊕⊕○ ○ Low	IMPORTAN T

CI: Confidence interval; OR: Odds ratio; MD: Mean difference

### **Explanations**

a. 12 ≥ 75%
b. Wide confidence intervals
c. ≤ 8 studies for this outcome

#### Dysphagia compared to No Dysphagia for Stroke

Patient or population: Stroke Setting:

Intervention: Dysphagia Comparison: No Dysphagia

		osolute effects*		Nº of	Containty of the	
Outcomes	Risk with No Dysphagia	Risk with Dysphagia	Relative effect (95% CI)	participants (studies)	Certainty of the evidence (GRADE)	Comments
Overall Mortality	17 per 1,000	<b>121 per 1,000</b> (77 to 185)	<b>OR 7.73</b> (4.68 to 12.76)	701468 (22 observational studies)	⊕⊕⊕○ MODERATE ª	
mRS 0-1	302 per 1,000	<b>80 per 1,000</b> (45 to 132)	<b>OR 0.20</b> (0.11 to 0.35)	5582 (2 observational studies)	⊕⊕⊖⊖ LOW a,b	
Pneumonia	25 per 1,000	<b>161 per 1,000</b> (134 to 192)	<b>OR 7.45</b> (6.01 to 9.24)	767179 (33 observational studies)	⊕⊕⊕⊜ MODERATE ª	
Malnutrition	123 per 1,000	<b>328 per 1,000</b> (203 to 484)	<b>OR 3.49</b> (1.82 to 6.69)	3794 (9 observational studies)	⊕○○○ VERY LOW a,c	
Aspiration	10 per 1,000	<b>88 per 1,000</b> (60 to 127)	<b>OR 9.91</b> (6.58 to 14.95)	5144 (1 observational study)	ФФОО LOW <sup>ь</sup>	
Length of stay - Hospital	The mean length of stay - Hospital was <b>0</b>	MD <b>4.72 higher</b> (3.53 higher to 5.91 higher)	-	697614 (16 observational studies)	⊕○○○ VERY LOW a,c	
Swallowing functions	-	SMD <b>2.71</b> lower (3.04 lower to 2.38 lower)	-	302 (2 observational studies)	Ф⊕⊖⊖	

<sup>\*</sup>The risk in the intervention group (and its 95% confidence interval) is based on the assumed risk in the comparison group and the relative effect of the intervention (and its 95% CI).

CI: Confidence interval; OR: Odds ratio; MD: Mean difference; SMD: Standardised mean difference

#### **GRADE Working Group grades of evidence**

High certainty: We are very confident that the true effect lies close to that of the estimate of the effect

Moderate certainty: We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different

Low certainty: Our confidence in the effect estimate is limited: The true effect may be substantially different from the estimate of the effect

Very low certainty: We have very little confidence in the effect estimate. The true effect is likely to be substantially different from the estimate of effect

- a. I2 ≥ 75%
- b.  $\leq$  2 studies to report this outcome
- c. Publication bias suspected

### Screening

### Screening compared to No screening

			Certainty asse	essment			Nº of p	atients	Ef	fect		
№ of studie s	Study design	Risk of bias	Inconsistenc y	Indirectnes s	Imprecisio n	Other consideration s	Screening	No screening	Relativ e (95% CI)	Absolut e (95% CI)	Certainty	Importance
Mortalit	у											
8	observation al studies	not seriou s	serious <sup>a</sup>	not serious	serious <sup>b</sup>	publication bias strongly suspected °	6192/70974 (8.7%)	3217/15994 (20.1%)	OR 0.59 (0.25 to 1.38)	72 fewer per 1,000 (from 142 fewer to 57 more)	⊕⊖⊖ O VERY LOW	CRITICAL
Pneumo	onia											
12	observation al studies	not seriou s	serious <sup>a</sup>	not serious	not serious	none	25413/35710 2 (7.1%)	17537/17954 8 (9.8%)	OR 0.55 (0.36 to 0.83)	41 fewer per 1,000 (from 60 fewer to 15 fewer)	⊕⊖⊖ O VERY LOW	CRITICAL
Length	of stay in hospit	tal										
5	observation al studies	not seriou s	serious <sup>a</sup>	not serious	serious <sup>b</sup>	publication bias strongly suspected <sup>c</sup>	14512	6493	-	MD 0.02 higher (2.22 lower to 2.26 higher)	⊕○○ O VERY LOW	IMPORTAN T
Tube - N	lasogastric tube	insertion										
3	observation al studies	not seriou s	not serious	not serious	serious <sup>b</sup>	publication bias strongly suspected °	117/265 (44.2%)	102/194 (52.6%)	OR 0.86 (0.51 to 1.45)	38 fewer per 1,000 (from 165 fewer to 91 more)	⊕⊖⊖ O VERY LOW	NOT IMPORTAN T

 $\textbf{CI:} \ \, \textbf{Confidence interval;} \ \, \textbf{OR:} \ \, \textbf{Odds ratio;} \ \, \textbf{MD:} \ \, \textbf{Mean difference}$ 

a. I2 ≥ 75%
b. Wide confidence intervals
c. ≤ 8 studies for this outcome

#### Screening compared to No screening for Dysphagia after stroke

Patient or population: Dysphagia after stroke

Setting:

Intervention: Screening Comparison: No screening

Outcomes		osolute effects* % CI)	Relative effect	№ of	Certainty of the evidence	Comments
Outcomes	Risk with No screening	Risk with Screening	(95% CI)	participants (studies)	(GRADE)	Comments
Mortality	201 per 1,000	<b>129 per 1,000</b> (59 to 258)	<b>OR 0.59</b> (0.25 to 1.38)	86968 (8 observational studies)	⊕○○○ VERY LOW a,b,c	
Pneumonia	98 per 1,000	<b>56 per 1,000</b> (38 to 82)	<b>OR 0.55</b> (0.36 to 0.83)	536650 (12 observational studies)	⊕○○○ VERY LOW <sup>a</sup>	
Length of stay in hospital	The mean length of stay in hospital was <b>0</b>	MD <b>0.02 higher</b> (2.22 lower to 2.26 higher)	-	21005 (5 observational studies)	⊕○○○ VERY LOW a,b,c	
Tube - Nasogastric tube insertion	526 per 1,000	<b>488 per 1,000</b> (361 to 617)	<b>OR 0.86</b> (0.51 to 1.45)	459 (3 observational studies)	⊕○○○ VERY LOW b,c	

<sup>\*</sup>The risk in the intervention group (and its 95% confidence interval) is based on the assumed risk in the comparison group and the relative effect of the intervention (and its 95% CI).

CI: Confidence interval; OR: Odds ratio; MD: Mean difference

#### **GRADE Working Group grades of evidence**

High certainty: We are very confident that the true effect lies close to that of the estimate of the effect

Moderate certainty: We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different

Low certainty: Our confidence in the effect estimate is limited: The true effect may be substantially different from the estimate of the effect

Very low certainty: We have very little confidence in the effect estimate. The true effect is likely to be substantially different from the estimate of effect

#### **Explanations**

a. I2 ≥ 75%

b. Wide confidence intervals

c. ≤ 8 studies for this outcome

### **Early Screening compared to Late Screening**

			Certainty asse	essment			Nº of p	atients	Ef	fect		
№ of studie s	Study design	Risk of bias	Inconsistenc y	Indirectnes s	Imprecisio n	Other consideration s	Early screening	Late screening	Relativ e (95% CI)	Absolut e (95% CI)	Certainty	Importance
Mortality	/											
7	observation al studies	not seriou s	serious ª	not serious	not serious	publication bias strongly suspected <sup>b</sup>	11606/8001 4 (14.5%)	14961/6429 3 (23.3%)	OR 0.62 (0.43 to 0.91)	74 fewer per 1,000 (from 117 fewer to 16 fewer)	⊕⊖⊖ O VERY LOW	CRITICAL
mRS - 4	-5											,
1	observation al studies	not seriou s	not serious	not serious	not serious	publication bias strongly suspected <sup>b</sup>	731/2647 (27.6%)	259/662 (39.1%)	OR 0.59 (0.50 to 0.71)	116 fewer per 1,000 (from 148 fewer to 78 fewer)	⊕○○ ○ VERY LOW	CRITICAL
Pneumo	nia											
10	observation al studies	not seriou s	serious <sup>a</sup>	not serious	not serious	publication bias strongly suspected strong association °	5863/61967 (9.5%)	5305/34400 (15.4%)	OR 0.45 (0.35 to 0.58)	78 fewer per 1,000 (from 94 fewer to 59 fewer)	⊕⊖⊖ O VERY LOW	CRITICAL
Length o	of stay in hospit	al										
6	observation al studies	not seriou s	serious ª	not serious	not serious	publication bias strongly suspected <sup>b</sup>	24176	31909	-	MD 2.27 lower (3.12 lower to 1.43 lower)	⊕○○ ○ VERY LOW	IMPORTAN T
QOL												
1	observation al studies	not seriou s	not serious	not serious	serious <sup>d</sup>	publication bias strongly suspected <sup>b</sup>	1/89 (1.1%)	0/49 (0.0%)	OR 1.68 (0.07 to 41.97)	0 fewer per 1,000 (from 0 fewer to 0 fewer)	⊕○○ O VERY LOW	IMPORTAN T
Feeding	tube - Nasogas	tric tube										
2	observation al studies	not seriou s	not serious	not serious	serious <sup>d</sup>	publication bias strongly suspected <sup>b</sup>	22/58 (37.9%)	46/88 (52.3%)	OR 0.52 (0.26 to 1.04)	160 fewer per 1,000 (from 301 fewer to 10 more)	⊕⊖⊖ ⊝ VERY LOW	NOT IMPORTAN T

CI: Confidence interval; OR: Odds ratio; MD: Mean difference

#### Early screening compared to Late screening for Dysphagia after stroke

Patient or population: Dysphagia after stroke

Setting:

**Intervention**: Early screening **Comparison**: Late screening

Outcomes		osolute effects* % CI)	Relative effect	Nº of	Certainty of the	Comments
Outcomes	Risk with Late screening	Risk with Early screening	(95% CI)	participants (studies)	evidence (GRADE)	Comments
Mortality	233 per 1,000	<b>158 per 1,000</b> (115 to 216)	<b>OR 0.62</b> (0.43 to 0.91)	144307 (7 observational studies)	⊕○○○ VERY LOW a,b	
mRS - 4-5	391 per 1,000	<b>275 per 1,000</b> (243 to 313)	<b>OR 0.59</b> (0.50 to 0.71)	3309 (1 observational study)	⊕○○○ VERY LOW <sup>b</sup>	
Pneumonia	154 per 1,000	<b>76 per 1,000</b> (60 to 96)	<b>OR 0.45</b> (0.35 to 0.58)	96367 (10 observational studies)	⊕○○○ VERY LOW a,c	
Length of stay in hospital	The mean length of stay in hospital was <b>0</b>	MD <b>2.27 lower</b> (3.12 lower to 1.43 lower)	-	56085 (6 observational studies)	⊕⊖⊖⊖ VERY LOW a,b	
QOL	0 per 1,000	<b>0 per 1,000</b> (0 to 0)	<b>OR 1.68</b> (0.07 to 41.97)	138 (1 observational study)	⊕⊖⊖⊖ VERY LOW b,d	
Feeding tube - Nasogastric tube	523 per 1,000	<b>363 per 1,000</b> (222 to 533)	<b>OR 0.52</b> (0.26 to 1.04)	146 (2 observational studies)	⊕⊖⊖⊖ VERY LOW b,d	

<sup>\*</sup>The risk in the intervention group (and its 95% confidence interval) is based on the assumed risk in the comparison group and the relative effect of the intervention (and its 95% CI).

CI: Confidence interval; OR: Odds ratio; MD: Mean difference

#### **GRADE Working Group grades of evidence**

High certainty: We are very confident that the true effect lies close to that of the estimate of the effect

Moderate certainty: We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different

Low certainty: Our confidence in the effect estimate is limited: The true effect may be substantially different from the estimate of the effect

Very low certainty: We have very little confidence in the effect estimate: The true effect is likely to be substantially different from the estimate of effect

- a. I2 ≥ 75%
- b.  $\leq 7$  studies to report this outcome
- c. Asymmetry of the Funnel plot
- d. Wide confidence intervals

### 3. Assessment

### Early compared to Late Assessment

			Certainty asse	essment					
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Impact	Certainty	Importance
Pneumo	nia								
2	observational studies	not serious	not serious	not serious	not serious	publication bias strongly suspected <sup>a</sup>	Bray 2017: 24,542 patients  -60% less with Early compared to Late assessment  OR: 0.60 (0.40-0.78) at < 6 hr vs 6-24 hr, p < 0.001  OR: 0.40 (0.16-0.59) at < 6 hr vs 24-48 hr, p < 0.001  Dhufaigh 2017: 135 patients  12.8 vs 26.5%, OR: 0.41 (0.17, 0.99), p < 0.05	⊕⊖⊖⊖ VERY LOW	CRITICAL
Dysphag	gia improvement								·
1	observational studies	not serious	not serious	not serious	not serious	publication bias strongly suspected <sup>a</sup>	1.5 vs 0.6 in Early vs Late assessment	⊕⊖⊖⊖ VERY LOW	IMPORTANT

CI: Confidence interval

### **Explanations**

a. Two or less studies for this outcome

### **Clinical Assessment compared to Instrumental Assessment**

			Certainty asse	ssment			Nº of	patients	Ef	fect		
№ of studie s	Study design	Risk of bias	Inconsistenc y	Indirectnes s	Imprecisio n	Other consideration s	Clinical Bedside	Instrumen t	Relativ e (95% CI)	Absolut e (95% CI)	Certainty	Importance
Mortality	,											
1	observationa I studies	not seriou s	not serious	not serious	serious a	publication bias strongly suspected <sup>b</sup>	23/220 (10.5% )	16/220 (7.3%)	OR 1.49 (0.76 to 2.90)	32 more per 1,000 (from 16 fewer to 113 more)	⊕⊖⊖ O VERY LOW	CRITICAL
Pneumo	nia											_
1	observationa I studies	not seriou s	not serious	not serious	not serious	publication bias strongly suspected strong association <sup>b</sup>	27/220 (12.3% )	14/220 (6.4%)	OR 2.06 (1.05 to 4.04)	59 more per 1,000 (from 3 more to 152 more)	ФФ Low	CRITICAL
LOS												
1	observationa I studies	not seriou s	not serious	not serious	not serious	publication bias strongly suspected <sup>b</sup>	220	220	•	MD 6.33 lower (9.67 lower to 2.99 lower)	⊕○○ O VERY LOW	IMPORTAN T

CI: Confidence interval; OR: Odds ratio; MD: Mean difference

- Explanations
  a. Wide confidence intervals
  b. One study to report this outcome

#### **Clinical Assessment compared to Instrumental Assessment**

Patient or population: Stroke

Setting:

Intervention: Clinical Bedside Comparison: Instrument

		osolute effects* % CI)	Dolotivo offost	<b>№</b> of	Certainty of the	
Outcomes	Risk with Instrument	Risk with Clinical Bedside	Relative effect (95% CI)	participants (studies)	evidence (GRADE)	Comments
Mortality	73 per 1,000	<b>105 per 1,000</b> (56 to 185)	<b>OR 1.49</b> (0.76 to 2.90)	440 (1 observational study)	⊕○○○ VERY LOW a,b	
Pneumonia	64 per 1,000	<b>123 per 1,000</b> (67 to 215)	<b>OR 2.06</b> (1.05 to 4.04)	440 (1 observational study)	ФФ○О LOW b	
LOS	The mean LOS was <b>0</b>	MD <b>6.33 lower</b> (9.67 lower to 2.99 lower)	-	440 (1 observational study)	⊕○○○ VERY LOW <sup>b</sup>	

<sup>\*</sup>The risk in the intervention group (and its 95% confidence interval) is based on the assumed risk in the comparison group and the relative effect of the intervention (and its 95% CI).

CI: Confidence interval; OR: Odds ratio; MD: Mean difference

#### GRADE Working Group grades of evidence

High certainty: We are very confident that the true effect lies close to that of the estimate of the effect

Moderate certainty: We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different

Low certainty: Our confidence in the effect estimate is limited. The true effect may be substantially different from the estimate of the effect

Very low certainty: We have very little confidence in the effect estimate. The true effect is likely to be substantially different from the estimate of effect

- a. Wide confidence intervals
- b. One study to report this outcome

### Instrumental assessment with FEES compared to VFSS

			Certainty asse	essment			Nº of pat	ients	Ef	fect		
№ of studie s	Study design	Risk of bias	Inconsistenc y	Indirectnes s	Imprecisio n	Other consideration s	instrumenta   assessment with VFSS	FEES	Relativ e (95% CI)	Absolut e (95% CI)	Certainty	Importance
Pneumo	nia											
1	observationa I studies	not seriou s	not serious	not serious	serious a	publication bias strongly suspected <sup>b</sup>	7/24 (29.2%)	1/21 (4.8%)	OR 8.24 (0.92 to 73.79)	244 more per 1,000 (from 4 fewer to 739 more)	⊕ O VERY LOW	CRITICAL
Complic	ations - PEG	•						•	•			
1	observationa I studies	not seriou s	not serious	not serious	not serious	publication bias strongly suspected strong association b	2/78 (2.6%)	17/61 (27.9% )	OR 0.07 (0.02 to 0.31)	252 fewer per 1,000 (from 271 fewer to 172 fewer)	ФФСО	NOT IMPORTAN T

CI: Confidence interval; OR: Odds ratio

- a. Wide confidence intervals b. One study to support the outcome

### Instrumental assessment with VFSS compared to FEES

Patient or population: Dysphagia after stroke

Setting:

Intervention: instrumental assessment with VFSS

Comparison: FEES

		osolute effects* % CI)		News	O delete ettle	
Outcomes	Risk with FEES			№ of participants (studies)	Certainty of the evidence (GRADE)	Comments
Pneumonia	48 per 1,000	<b>292 per 1,000</b> (44 to 787)	<b>OR 8.24</b> (0.92 to 73.79)	45 (1 observational study)	⊕○○○ VERY LOW a,b	
Complications - PEG	279 per 1,000	<b>26 per 1,000</b> (8 to 107)	<b>OR 0.07</b> (0.02 to 0.31)	139 (1 observational study)	⊕⊕⊖⊖ Low b	

<sup>\*</sup>The risk in the intervention group (and its 95% confidence interval) is based on the assumed risk in the comparison group and the relative effect of the intervention (and its 95% CI).

CI: Confidence interval; OR: Odds ratio

#### **GRADE Working Group grades of evidence**

High certainty: We are very confident that the true effect lies close to that of the estimate of the effect

Moderate certainty: We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different

Low certainty: Our confidence in the effect estimate is limited: The true effect may be substantially different from the estimate of the effect

Very low certainty: We have very little confidence in the effect estimate. The true effect is likely to be substantially different from the estimate of effect

- a. Wide confidence intervals
- b. One study to support the outcome

### Complementary assessments in addition to clinical standard assessment (i.e. spirometry, EMG) compared to standard clinical assessment

			Certainty asse	essment			Nº of pati	ents	Ef	fect		
№ of studie s	Study design	Risk of bias	Inconsistenc y	Indirectnes s	Imprecisio n	Other consideration s	complementary assessments to clinical assessmstandar d clinical assessment ents (i.e. spirometry, EMG)	standard clinical assessme nt	Relativ e (95% CI)	Absolut e (95% CI)	Certainty	Importanc e
Mortalit	у											
1	observation al studies	not seriou s	not serious	not serious	serious <sup>a</sup>	publication bias strongly suspected <sup>b</sup>	20/148 (13.5%)	32/163 (19.6%)	OR 0.64 (0.35 to 1.18)	fewer per 1,000 (from 118 fewer to 27 more)	⊕○○ ○ VERY LOW	
Pneumo	onia											
1	observation al studies	not seriou s	not serious	not serious	serious <sup>a</sup>	publication bias strongly suspected <sup>b</sup>	38/148 (25.7%)	35/163 (21.5%)	OR 1.26 (0.75 to 2.14)	42 more per 1,000 (from 45 fewer to 154 more)	⊕⊖⊖ ⊝ VERY LOW	
Length	of stay			•	•			•	•			
1	observation al studies	not seriou s	not serious	not serious	serious <sup>a</sup>	publication bias strongly suspected <sup>b</sup>	148	163	-	MD 1 higher (0.16 lower to 2.16 higher)	⊕○○ ○ VERY LOW	
FOIS												
1	observation al studies	not seriou s	not serious	not serious	serious <sup>a</sup>	publication bias strongly suspected <sup>b</sup>	148	163	-	MD 0.2 higher (0.08 lower to 0.48 higher)	⊕○○ O VERY LOW	

CI: Confidence interval; OR: Odds ratio; MD: Mean difference

- Wide Confidence intervals
   B. Single study to report this outcome

# Complementary assessments in addition to clinical standard assessment (i.e. spirometry, EMG) compared to standard clinical assessment for Dysphagia after stroke

Patient or population: Dysphagia after stroke

Setting:

Intervention: complementary assessments to clinical assessmstandard clinical assessment ents (i.e. spirometry, EMG)

Comparison: standard clinical assessment

	Anticipated abs	solute effects* (95% CI)				
Outcomes	Risk with standard clinical assessment	Risk with complementary assessments to clinical assessmstandard clinical assessment ents (i.e. spirometry, EMG)	Relative effect (95% CI)	№ of participants (studies)	Certainty of the evidence (GRADE)	Comments
Mortality	196 per 1,000	<b>135 per 1,000</b> (79 to 224)	<b>OR 0.64</b> (0.35 to 1.18)	311 (1 observational study)	⊕○○○ VERY LOW a,b	
Pneumonia	215 per 1,000	<b>256 per 1,000</b> (170 to 369)	<b>OR 1.26</b> (0.75 to 2.14)	311 (1 observational study)	⊕○○○ VERY LOW a,b	
Length of stay	The mean length of stay was <b>0</b>	MD <b>1 higher</b> (0.16 lower to 2.16 higher)	-	311 (1 observational study)	⊕○○○ VERY LOW a,b	
FOIS	The mean FOIS was <b>0</b>	MD <b>0.2 higher</b> (0.08 lower to 0.48 higher)	-	311 (1 observational study)	⊕○○○ VERY LOW a,b	

<sup>\*</sup>The risk in the intervention group (and its 95% confidence interval) is based on the assumed risk in the comparison group and the relative effect of the intervention (and its 95% CI).

CI: Confidence interval; OR: Odds ratio; MD: Mean difference

#### **GRADE Working Group grades of evidence**

High certainty: We are very confident that the true effect lies close to that of the estimate of the effect

Moderate certainty: We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different

Low certainty: Our confidence in the effect estimate is limited: The true effect may be substantially different from the estimate of the effect

Very low certainty: We have very little confidence in the effect estimate: The true effect is likely to be substantially different from the estimate of effect

- a. Wide Confidence intervals
- b. Single study to report this outcome

### 4. Treatment

### **4.1 Dietary Interventions**

#### **TEXTURE MODIFICATION**

Author(s):
Question: Texture modification compared to Control in Dysphagia after stroke Setting:
Bibliography:

Certainty assessment						№ of patients		Effect				
№ of studie s	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Texture modification	Control	Relative (95% CI)	Absolute (95% CI)	Certainty	Importance
Mortality												
1	randomise d trials	not seriou s	not serious	not serious	serious ª	publication bias strongly suspected <sup>b</sup>	37/204 (18.1%)	23/102 (22.5%)	RR 0.80 (0.51 to 1.28)	45 fewer per 1,000 (from 110 fewer to 63 more)	ФФС Low	CRITICAL
Rankin ≥	:3											_
1	randomise d trials	not seriou s	not serious	not serious	serious <sup>a</sup>	publication bias strongly suspected <sup>b</sup>	103/204 (50.5%)	49/102 (48.0%)	RR 1.05 (0.82 to 1.34)	24 more per 1,000 (from 86 fewer to 163 more)	ФФС	CRITICAL
Pneumo	nia								•			
1	randomise d trials	not seriou s	not serious	not serious	not serious	publication bias strongly suspected <sup>b</sup>	54/204 (26.5%)	48/102 (47.1%)	RR 0.56 (0.41 to 0.77)	207 fewer per 1,000 (from 278 fewer to 108 fewer)	⊕⊕⊕⊖ MODERATE	CRITICAL
Function	al swallowing	ı						I	I	I		1
1	randomise d trials	not seriou s	not serious	not serious	not serious	publication bias strongly suspected <sup>b</sup>	93/204 (45.6%)	33/102 (32.4%)	RR 1.41 (1.03 to 1.94)	133 more per 1,000 (from 10 more to 304 more)	⊕⊕⊕⊖ MODERATE	IMPORTANT
Length of stay in hospital												
1	randomise d trials	not seriou s	not serious	not serious	serious <sup>a</sup>	publication bias strongly suspected <sup>b</sup>	204	102	-	MD 2.25 lower (4.66 lower to 0.16 higher)	ФФС	IMPORTANT

CI: Confidence interval; RR: Risk ratio; MD: Mean difference

- a. Wide confidence intervals
- b. One study to report this outcome

#### Texture modification compared to Control in Dysphagia after stroke

Patient or population: Dysphagia after stroke

Settina:

Intervention: Texture modification

Comparison: Control

		osolute effects* % CI)	Relative effect	№ of	Certainty of the		
Outcomes	Risk with Control	Risk with Texture modification	(95% CI)	participants (studies)	evidence (GRADE)	Comments	
Mortality	225 per 1,000	<b>180 per 1,000</b> (115 to 289)	<b>RR 0.80</b> (0.51 to 1.28)	306 (1 RCT)	⊕⊕⊖⊖ LOW a,b		
Rankin ≥3	480 per 1,000	<b>504 per 1,000</b> (394 to 644)	<b>RR 1.05</b> (0.82 to 1.34)	306 (1 RCT)	⊕⊕⊖⊖ LOW a,b		
Pneumonia	471 per 1,000	<b>264 per 1,000</b> (193 to 362)	<b>RR 0.56</b> (0.41 to 0.77)	306 (1 RCT)	⊕⊕⊕⊖ MODERATE b		
Functional swallowing	324 per 1,000	<b>456 per 1,000</b> (333 to 628)	<b>RR 1.41</b> (1.03 to 1.94)	306 (1 RCT)	⊕⊕⊕⊜ MODERATE Þ		
Length of stay in hospital	The mean length of stay in hospital was <b>0</b>	MD <b>2.25 lower</b> (4.66 lower to 0.16 higher)	-	306 (1 RCT)	⊕⊕⊖⊖ LOW a,b		

<sup>\*</sup>The risk in the intervention group (and its 95% confidence interval) is based on the assumed risk in the comparison group and the relative effect of the intervention (and its 95% CI).

CI: Confidence interval; RR: Risk ratio; MD: Mean difference

#### **GRADE Working Group grades of evidence**

High certainty: We are very confident that the true effect lies close to that of the estimate of the effect

Moderate certainty: We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different

Low certainty: Our confidence in the effect estimate is limited: The true effect may be substantially different from the estimate of the effect

Very low certainty: We have very little confidence in the effect estimate: The true effect is likely to be substantially different from the estimate of effect

- a. Wide confidence intervals
- b. One study to report this outcome

### **FLUID THICKENING**

Author(s):
Question: Fluid thickening compared to Control in Dysphagia after stroke Setting:
Bibliography:

Certainty assessment						№ of patients		Effect				
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Fluid thickening	Control	Relative (95% CI)	Absolute (95% CI)	Certainty	Importance
Pneumonia												
3	randomised trials	not serious	not serious	not serious	serious a	publication bias strongly suspected <sup>b</sup>	0/35 (0.0%)	13/65 (20.0%)	<b>RR 0.19</b> (0.03 to 1.40)	162 fewer per 1,000 (from 194 fewer to 80 more)	ФФС	CRITICAL
Dysphag	jia											
1	randomised trials	not serious	not serious	not serious	not serious	publication bias strongly suspected <sup>b</sup>	6/18 (33.3%)	39/46 (84.8%)	<b>RR 0.40</b> (0.20 to 0.77)	509 fewer per 1,000 (from 678 fewer to 195 fewer)	⊕⊕⊕ MODERATE	IMPORTANT
LOS in F	LOS in Hospital, days											
1	randomised trials	not serious	not serious	not serious	not serious	publication bias strongly suspected <sup>b</sup>	18	46	-	MD <b>9.58 lower</b> (15.41 lower to 3.76 lower)	⊕⊕⊕ MODERATE	IMPORTANT
Tests - Albumin												
1	randomised trials	not serious	not serious	not serious	serious a	publication bias strongly suspected <sup>b</sup>	18	46	-	MD 0.3 higher (3.94 lower to 4.55 higher)	ФФСС	IMPORTANT

CI: Confidence interval; RR: Risk ratio; MD: Mean difference

- a. Wide confidence intervals b.  $\leq 3$  studies to report this outcome

#### Fluid thickening compared to Control in Dysphagia after stroke

Patient or population: Dysphagia after stroke

Setting:

**Intervention**: Fluid thickening **Comparison**: Control

		osolute effects* % CI)	Relative effect	Nº of	Certainty of the	
Outcomes	Risk with Control	Risk with Fluid thickening	(95% CI)	participants (studies)	evidence (GRADE)	Comments
Pneumonia	200 per 1,000	<b>38 per 1,000</b> (6 to 280)	<b>RR 0.19</b> (0.03 to 1.40)	100 (3 RCTs)	⊕⊕⊖⊖ LOW a,b	
Dysphagia	848 per 1,000	<b>339 per 1,000</b> (170 to 653)	<b>RR 0.40</b> (0.20 to 0.77)	64 (1 RCT)	⊕⊕⊕⊜ MODERATE Þ	
LOS in Hospital, days	The mean LOS in Hospital, days was <b>0</b>	MD <b>9.58 lower</b> (15.41 lower to 3.76 lower)	-	64 (1 RCT)	⊕⊕⊕○ MODERATE Þ	
Tests - Albumin	The mean tests - Albumin was 0	MD <b>0.3 higher</b> (3.94 lower to 4.55 higher)	-	64 (1 RCT)	⊕⊕⊖⊖ LOW a,b	

<sup>\*</sup>The risk in the intervention group (and its 95% confidence interval) is based on the assumed risk in the comparison group and the relative effect of the intervention (and its 95% CI).

CI: Confidence interval; RR: Risk ratio; MD: Mean difference

#### **GRADE Working Group grades of evidence**

High certainty: We are very confident that the true effect lies close to that of the estimate of the effect

Moderate certainty: We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different

Low certainty: Our confidence in the effect estimate is limited. The true effect may be substantially different from the estimate of the effect

Very low certainty: We have very little confidence in the effect estimate. The true effect is likely to be substantially different from the estimate of effect

### **Explanations**

a. Wide confidence intervals

b. ≤ 3 studies to report this outcome

# **4.2 Behavioural Interventions**

Author(s):
Question: Behavioural compared to Control in Dysphagia after stroke
Setting:
Bibliography:

Bibliogra			Certainty ass	essment			Nº of pat	tients	Ef	fect		
№ of studie s	Study design	Risk of bias	Inconsistenc y	Indirectnes s	Imprecisio n	Other consideration s	Behavioura I	Control	Relativ e (95% CI)	Absolut e (95% CI)	Certainty	Importance
Mortality	1											
3	randomise d trials	not seriou s	serious ª	not serious	serious <sup>b</sup>	publication bias strongly suspected °	41/271 (15.1%)	25/234 (10.7% )	RR 1.47 (0.32 to 6.78)	50 more per 1,000 (from 73 fewer to 618 more)	⊕○○ ○ VERY LOW	CRITICAL
mRS, ≥3	1											
1	randomise d trials	not seriou s	not serious	not serious	serious <sup>b</sup>	publication bias strongly suspected °	103/204 (50.5%)	49/102 (48.0% )	RR 1.05 (0.82 to 1.34)	24 more per 1,000 (from 86 fewer to 163 more)	ФФС	CRITICAL
Pneumo	nia											
6	randomise d trials	not seriou s	not serious	not serious	not serious	publication bias strongly suspected °	69/375 (18.4%)	74/302 (24.5% )	RR 0.57 (0.43 to 0.75)	105 fewer per 1,000 (from 140 fewer to 61 fewer)	⊕⊕⊕⊖ MODERATE	CRITICAL
Dysphag	gia, improveme	nt					•		•			
16	randomise d trials	not seriou s	serious ª	not serious	not serious	none	235	205	-	MD 1.09 higher (0.7 higher to 1.47 higher)	⊕⊕⊕ MODERATE	IMPORTAN T
Length o	of stay										1	
1	randomise d trials	not seriou s	not serious	not serious	serious <sup>b</sup>	publication bias strongly suspected °	204	102	-	MD 2.2 lower (4.61 lower to 0.21 higher)	ФФСО	IMPORTAN T
QOL, Ch	ange											
1	randomise d trials	not seriou s	not serious	not serious	serious <sup>b</sup>	publication bias strongly suspected °	8	8	-	SMD 0.58 higher (0.43 lower to 1.58 higher)	⊕⊕⊖⊖ Low	IMPORTAN T

CI: Confidence interval; RR: Risk ratio; MD: Mean difference; SMD: Standardised mean difference

- a. I2 ≥ 65% b. Wide confidence intervals c. ≤ 7 studies to report this outcome

### Behavioural compared to Control in Dysphagia after stroke

Patient or population: Dysphagia after stroke

Setting:

Intervention: Behavioural Comparison: Control

0.1		bsolute effects*	Relative effect	Nº of	Certainty of the	0
Outcomes	Risk with Control	Risk with Behavioural	(95% CI)	participants (studies)	evidence (GRADE)	Comments
Mortality	107 per 1,000	<b>157 per 1,000</b> (34 to 724)	<b>RR 1.47</b> (0.32 to 6.78)	505 (3 RCTs)	⊕⊖⊖⊖ VERY LOW a,b,c	
mRS, ≥3	480 per 1,000	<b>504 per 1,000</b> (394 to 644)	<b>RR 1.05</b> (0.82 to 1.34)	306 (1 RCT)	⊕⊕⊜ LOW b,c	
Pneumonia	245 per 1,000	<b>140 per 1,000</b> (105 to 184)	<b>RR 0.57</b> (0.43 to 0.75)	677 (6 RCTs)	⊕⊕⊕⊜ MODERATE °	
Dysphagia, improvement	The mean dysphagia, improvement was <b>0</b>	MD <b>1.09 higher</b> (0.7 higher to 1.47 higher)	-	440 (16 RCTs)	⊕⊕⊕○ MODERATE ª	
Length of stay	The mean length of stay was <b>0</b>	MD <b>2.2 lower</b> (4.61 lower to 0.21 higher)	-	306 (1 RCT)	⊕⊕⊖⊖ LOW b,c	
QOL, Change		SMD 0.58 higher (0.43 lower to 1.58 higher)	-	16 (1 RCT)	⊕⊕⊖⊖ LOW b.c	

<sup>\*</sup>The risk in the intervention group (and its 95% confidence interval) is based on the assumed risk in the comparison group and the relative effect of the intervention (and its 95% CI).

CI: Confidence interval; RR: Risk ratio; MD: Mean difference; SMD: Standardised mean difference

#### **GRADE Working Group grades of evidence**

High certainty: We are very confident that the true effect lies close to that of the estimate of the effect

Moderate certainty: We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different

Low certainty: Our confidence in the effect estimate is limited: The true effect may be substantially different from the estimate of the effect

Very low certainty: We have very little confidence in the effect estimate: The true effect is likely to be substantially different from the estimate of effect

- a. I2 ≥ 65%
- b. Wide confidence intervals
- c.  $\leq$  7 studies to report this outcome

## **ACUPUNCTURE**

Author(s):
Question: Acupuncture compared to Control in Dysphagia after stroke Setting:
Bibliography:

Bibliogr			Certainty ass	essment			Nº of pa	tients	Ef	fect		
№ of studie s	Study design	Risk of bias	Inconsistenc y	Indirectnes s	Imprecisio n	Other consideration s	Acupunctur e	Control	Relativ e (95% CI)	Absolut e (95% CI)	Certainty	Importance
Pneumo	nia											
1	randomise d trials	seriou s <sup>a</sup>	serious <sup>b</sup>	not serious	serious °	publication bias strongly suspected <sup>d</sup>	2/60 (3.3%)	5/60 (8.3%)	RR 0.40 (0.08 to 1.98)	50 fewer per 1,000 (from 77 fewer to 82 more)	⊕⊖⊖ O VERY LOW	CRITICAL
Dyaphag	gia at end											
23	randomise d trials	seriou S <sup>a</sup>	not serious	not serious	not serious	none	234/1169 (20.0%)	399/100 8 (39.6%)	RR 0.51 (0.41 to 0.63)	fewer per 1,000 (from 234 fewer to 146 fewer)	⊕⊕⊕ MODERATE	IMPORTAN T
Quality	of life											_
1	randomise d trials	not seriou s	not serious	not serious	not serious	publication bias strongly suspected <sup>d</sup>	60	60	-	MD 32 higher (24.99 higher to 39.01 higher)	⊕⊕⊕⊜ MODERATE	IMPORTAN T
Nasal fe	eding tube rem	noval										
1	randomise d trials	seriou S <sup>a</sup>	not serious	not serious	not serious	publication bias strongly suspected <sup>d</sup>	34/38 (89.5%)	18/36 (50.0%)	RR 1.79 (1.27 to 2.53)	395 more per 1,000 (from 135 more to 765 more)	ФФ Low	NOT IMPORTAN T

CI: Confidence interval; RR: Risk ratio; MD: Mean difference

# **Explanations**

a. Not assessed due to lack of information b.12 = 69% c. Wide confidence intervals d. 1 study to report this outcome

### Acupuncture compared to Control in Dysphagia after stroke

Patient or population: Dysphagia after stroke

Setting:

Intervention: Acupuncture Comparison: Control

Outcomes		osolute effects* % CI)	Relative effect	Nº of	Certainty of the	Comments
Outcomes	Risk with Control	Risk with Acupuncture	(95% CI)	participants (studies)	evidence (GRADE)	Comments
Pneumonia	83 per 1,000	<b>33 per 1,000</b> (7 to 165)	<b>RR 0.40</b> (0.08 to 1.98)	120 (1 RCT)	⊕⊖⊖⊖ VERY LOW a,b,c,d	
Dyaphagia at end	408 per 1,000	<b>208 per 1,000</b> (184 to 237)	<b>RR 0.51</b> (0.45 to 0.58)	1993 (21 RCTs)	⊕⊕⊖⊖ LOW a,d	
Quality of life	The mean quality of life was <b>0</b>	MD <b>32 higher</b> (24.99 higher to 39.01 higher)	-	120 (1 RCT)	⊕⊕⊕○ MODERATE d	
Nasal feeding tube removal	500 per 1,000	<b>895 per 1,000</b> (635 to 1,000)	RR 1.79 (1.27 to 2.53)	74 (1 RCT)	⊕⊕⊜⊖ LOW a,d	

<sup>\*</sup>The risk in the intervention group (and its 95% confidence interval) is based on the assumed risk in the comparison group and the relative effect of the intervention (and its 95% CI).

CI: Confidence interval; RR: Risk ratio; MD: Mean difference

#### GRADE Working Group grades of evidence

High certainty: We are very confident that the true effect lies close to that of the estimate of the effect

Moderate certainty: We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different

Low certainty: Our confidence in the effect estimate is limited: The true effect may be substantially different from the estimate of the effect

Very low certainty: We have very little confidence in the effect estimate: The true effect is likely to be substantially different from the estimate of effect

- a. Not assessed due to lack of information
- b. I2 = 69%
- c. Wide confidence intervals
- d. 1 study to report this outcome

# **4.3 Nutritional Interventions EARLY VS LATE NUTRITION**

Author(s):
Question: Early nutrition compared to Late nutrition in Dysphagia after stroke Setting:
Bibliography:

			Certainty ass	essment			Nº of p	atients	Eff	ect		
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Early nutrition	Late nutrition	Relative (95% CI)	Absolute (95% CI)	Certainty	Importance
Mortality	'											
4	randomised trials	not serious	not serious	not serious	serious a	publication bias strongly suspected <sup>b</sup>	255/2172 (11.7%)	272/2165 (12.6%)	<b>RR 0.88</b> (0.57 to 1.37)	15 fewer per 1,000 (from 54 fewer to 46 more)	ФФС	CRITICAL
Pneumo	nia											
1	randomised trials	not serious	not serious	not serious	serious <sup>a</sup>	publication bias strongly suspected <sup>b</sup>	130/2016 (6.4%)	116/2007 (5.8%)	RR 1.12 (0.88 to 1.42)	7 more per 1,000 (from 7 fewer to 24 more)	ФФСО	CRITICAL
mRS 0, 1	1											
1	randomised trials	not serious	not serious	not serious	serious a	publication bias strongly suspected <sup>b</sup>	472/2016 (23.4%)	472/2007 (23.5%)	RR 1.00 (0.89 to 1.11)	0 fewer per 1,000 (from 26 fewer to 26 more)	ФФСС	CRITICAL
Length o	of stay in hospi	tal						ı				
4	randomised trials	not serious	not serious	not serious	serious <sup>a</sup>	publication bias strongly suspected <sup>b</sup>	2145	2144	-	MD 0.93 higher (1.05 lower to 2.91 higher)	<b>⊕⊕</b> ○○ Low	IMPORTANT
Weight								•		•		
4	randomised trials	not serious	not serious	not serious	not serious	publication bias strongly suspected <sup>b</sup>	153	162	-	MD 1.03 higher (0.17 higher to 1.89 higher)	⊕⊕⊕ MODERATE	IMPORTANT

CI: Confidence interval; RR: Risk ratio; MD: Mean difference

# **Explanations**

a. Wide confidence intervalsb. ≤ 4 studies to report this outcome

### Early nutrition compared to Late nutrition in Dysphagia after stroke

Patient or population: Dysphagia after stroke

Setting:

Intervention: Early nutrition Comparison: Late nutrition

Outcomes		osolute effects*	Relative effect	Nº of	Certainty of the	Comments
Outcomes	Risk with Late nutrition	Risk with Early nutrition	(95% CI)	participants (studies)	evidence (GRADE)	Comments
Mortality	126 per 1,000	<b>111 per 1,000</b> (72 to 172)	<b>RR 0.88</b> (0.57 to 1.37)	4337 (4 RCTs)	⊕⊕⊖ LOW a,b	
Pneumonia	58 per 1,000	<b>65 per 1,000</b> (51 to 82)	<b>RR 1.12</b> (0.88 to 1.42)	4023 (1 RCT)	⊕⊕⊖⊖ LOW a,b	
mRS 0, 1	235 per 1,000	<b>235 per 1,000</b> (209 to 261)	<b>RR 1.00</b> (0.89 to 1.11)	4023 (1 RCT)	⊕⊕⊖ LOW a,b	
Length of stay in hospital	The mean length of stay in hospital was <b>0</b>	MD <b>0.93 higher</b> (1.05 lower to 2.91 higher)	-	4289 (4 RCTs)	⊕⊕⊖⊖ LOW a,b	
Weight	The mean weight was <b>0</b>	MD <b>1.03 higher</b> (0.17 higher to 1.89 higher)	-	315 (4 RCTs)	⊕⊕⊕⊜ MODERATE b	

<sup>\*</sup>The risk in the intervention group (and its 95% confidence interval) is based on the assumed risk in the comparison group and the relative effect of the intervention (and its 95% CI).

CI: Confidence interval; RR: Risk ratio; MD: Mean difference

#### **GRADE Working Group grades of evidence**

High certainty: We are very confident that the true effect lies close to that of the estimate of the effect

Moderate certainty: We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different

Low certainty: Our confidence in the effect estimate is limited: The true effect may be substantially different from the estimate of the effect

Very low certainty: We have very little confidence in the effect estimate. The true effect is likely to be substantially different from the estimate of effect

- a. Wide confidence intervals
- b. ≤ 4 studies to report this outcome

## **EARLY ENTERAL OR PARENTRAL NUTRITION VS RESTRICITVE**

Author(s):
Question: Early enteral or parenteral nutrition compared to Control for Dysphagia after stroke Setting:
Bibliography:

			Certainty ass	essment			Nº of pa	ntients	Eff	ect		
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Early enteral or parenteral nutrition	Control	Relative (95% CI)	Absolute (95% CI)	Certainty	Importance
Mortality	'											
1	randomised trials	not serious	not serious	not serious	serious <sup>a</sup>	publication bias strongly suspected <sup>b</sup>	182/429 (42.4%)	207/430 (48.1%)	<b>RR 0.88</b> (0.76 to 1.02)	58 fewer per 1,000 (from 116 fewer to 10 more)	ФФС	CRITICAL
Pneumo	nia											
2	randomised trials	not serious	not serious	not serious	serious <sup>a</sup>	publication bias strongly suspected <sup>a</sup>	143/504 (28.4%)	148/501 (29.5%)	RR 0.97 (0.80 to 1.17)	9 fewer per 1,000 (from 59 fewer to 50 more)	ФФОО	CRITICAL
mRS 0, 1	l											
2	randomised trials	not serious	not serious	not serious	serious <sup>a</sup>	publication bias strongly suspected <sup>b</sup>	28/495 (5.7%)	34/486 (7.0%)	<b>RR 0.84</b> (0.36 to 1.94)	11 fewer per 1,000 (from 45 fewer to 66 more)	ФФО Low	CRITICAL
Malnutri	tion						l .					
1	randomised trials	not serious	not serious	not serious	not serious	publication bias strongly suspected <sup>b</sup>	19/70 (27.1%)	28/58 (48.3%)	<b>RR 0.56</b> (0.35 to 0.90)	212 fewer per 1,000 (from 314 fewer to 48 fewer)	⊕⊕⊕⊖ MODERATE	CRITICAL
Length o	of stay in hospit	tal										
1	randomised trials	not serious	not serious	not serious	serious <sup>a</sup>	publication bias strongly suspected <sup>b</sup>	429	430	-	MD 1 higher (6.24 lower to 8.24 higher)	ФФС	IMPORTANT

CI: Confidence interval; RR: Risk ratio; MD: Mean difference

a. Wide confidence intervals b.  $\leq$  2 studies to report this outcome

### Early enteral or parenteral nutrition compared to Control for Dysphagia after stroke

Patient or population: Dysphagia after stroke

Setting:

Intervention: Early enteral or parenteral nutrition

Comparison: Control

		esolute effects* % CI)		News	October 18th	
Outcomes	Risk with Control	Risk with Early enteral or parenteral nutrition	Relative effect (95% CI)	№ of participants (studies)	Certainty of the evidence (GRADE)	Comments
Mortality	481 per 1,000	<b>424 per 1,000</b> (366 to 491)	<b>RR 0.88</b> (0.76 to 1.02)	859 (1 RCT)	⊕⊕⊖⊖ LOW a,b	
Pneumonia	295 per 1,000	<b>287 per 1,000</b> (236 to 346)	<b>RR 0.97</b> (0.80 to 1.17)	1005 (2 RCTs)	⊕⊕⊖⊖ LOW a	
mRS 0, 1	70 per 1,000	<b>59 per 1,000</b> (25 to 136)	<b>RR 0.84</b> (0.36 to 1.94)	981 (2 RCTs)	⊕⊕⊖⊖ LOW a,b	
Malnutrition	483 per 1,000	<b>270 per 1,000</b> (169 to 434)	<b>RR 0.56</b> (0.35 to 0.90)	128 (1 RCT)	⊕⊕⊕⊖ MODERATE b	
Length of stay in hospital	The mean length of stay in hospital was <b>0</b>	MD <b>1 higher</b> (6.24 lower to 8.24 higher)	-	859 (1 RCT)	⊕⊕⊖⊖ LOW a,b	

<sup>\*</sup>The risk in the intervention group (and its 95% confidence interval) is based on the assumed risk in the comparison group and the relative effect of the intervention (and its 95% CI).

CI: Confidence interval; RR: Risk ratio; MD: Mean difference

#### **GRADE Working Group grades of evidence**

High certainty: We are very confident that the true effect lies close to that of the estimate of the effect

Moderate certainty: We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different

Low certainty: Our confidence in the effect estimate is limited: The true effect may be substantially different from the estimate of the effect

Very low certainty: We have very little confidence in the effect estimate: The true effect is likely to be substantially different from the estimate of effect

- a. Wide confidence intervals
- b.  $\leq 2$  studies to report this outcome

# **4.4 Oral Health Interventions**

Author(s):
Question: Oral health compared to Control in Dysphagia after stroke Setting:
Bibliography:

Bibliogi	Bibliography:											
			Certainty asse	essment			Nº of ∣	patients	Ef	fect		
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Oral health	Control	Relative (95% CI)	Absolute (95% CI)	Certainty	Importance
Mortality	/											
1	randomised trials	not serious	not serious	not serious	serious <sup>a</sup>	publication bias strongly suspected <sup>b</sup>	9/103 (8.7%)	14/100 (14.0%)	RR 0.62 (0.28 to 1.38)	53 fewer per 1,000 (from 101 fewer to 53 more)	ФФО Low	CRITICAL
Pneumo	nia											
4	randomised trials	not serious	not serious	not serious	serious <sup>a</sup>	publication bias strongly suspected <sup>b</sup>	1/159 (0.6%)	7/125 (5.6%)	RR 0.14 (0.02 to 1.11)	48 fewer per 1,000 (from 55 fewer to 6 more)	ФФСО	CRITICAL
OHAT a	nd Oral Index											
4	randomised trials	not serious	serious °	not serious	serious <sup>a</sup>	publication bias strongly suspected <sup>b</sup>	125	92	-	SMD 1.13 SD lower (2.41 lower to 0.14 higher)	⊕⊖⊖⊖ VERY LOW	IMPORTANT
FOIS							l					
1	randomised trials	not serious	not serious	not serious	not serious	publication bias strongly suspected <sup>b</sup>	25	18	-	MD 2.3 higher (1.7 higher to 2.9 higher)	⊕⊕⊕ MODERATE	IMPORTANT
Length o	l of stay in hospita	l					<u> </u>	<u> </u>	<u>Į</u>			
2	observational studies	not serious	not serious	not serious	not serious	publication bias strongly suspected <sup>b</sup>	109	91	-	MD <b>3.21</b> lower (5.26 lower to 1.16 lower)	⊕⊖⊖⊖ VERY LOW	IMPORTANT
Nasogas	stric tube	1		1	1		ı	ı	1			
1	randomised trials	not serious	not serious	not serious	not serious	publication bias strongly suspected <sup>b</sup>	12/29 (41.4%)	22/22 (100.0%)	RR 0.43 (0.28 to 0.65)	570 fewer per 1,000 (from 720 fewer to 350 fewer)	⊕⊕⊕⊖ MODERATE	NOT IMPORTANT

CI: Confidence interval; RR: Risk ratio; SMD: Standardised mean difference; MD: Mean difference

- a. Wide confidence intervals b.  $\leq$  4 studies to report this outcome c. 12 = 94%

### Oral health compared to Control in Dysphagia after stroke

Patient or population: Dysphagia after stroke

Setting:

Intervention: Oral health Comparison: Control

0.1		osolute effects*	Relative effect	Nº of	Certainty of the	0
Outcomes	Risk with Control	Risk with Oral health	(95% CI)	participants (studies)	evidence (GRADE)	Comments
Mortality	140 per 1,000	<b>87 per 1,000</b> (39 to 193)	<b>RR 0.62</b> (0.28 to 1.38)	203 (1 RCT)	⊕⊕⊖⊖ LOW a,b	
Pneumonia	56 per 1,000	8 per 1,000 (1 to 62)	<b>RR 0.14</b> (0.02 to 1.11)	284 (4 RCTs)	⊕⊕⊖⊖ LOW a,b	
OHAT and Oral Index	÷	SMD 1.13 SD lower (2.41 lower to 0.14 higher)	-	217 (4 RCTs)	⊕⊖⊖⊖ VERY LOW a,b,c	
FOIS	The mean FOIS was <b>0</b>	MD <b>2.3 higher</b> (1.7 higher to 2.9 higher)	-	43 (1 RCT)	⊕⊕⊕⊖ MODERATE b	
Length of stay in hospital	The mean length of stay in hospital was <b>0</b>	MD <b>3.21 lower</b> (5.26 lower to 1.16 lower)	-	200 (2 observational studies)	⊕○○○ VERY LOW <sup>b</sup>	
Nasogastric tube	1,000 per 1,000	<b>430 per 1,000</b> (280 to 650)	<b>RR 0.43</b> (0.28 to 0.65)	51 (1 RCT)	⊕⊕⊕⊖ MODERATE Þ	

<sup>\*</sup>The risk in the intervention group (and its 95% confidence interval) is based on the assumed risk in the comparison group and the relative effect of the intervention (and its 95% CI).

CI: Confidence interval; RR: Risk ratio; SMD: Standardised mean difference; MD: Mean difference

### **GRADE Working Group grades of evidence**

High certainty: We are very confident that the true effect lies close to that of the estimate of the effect

Moderate certainty: We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different

Low certainty: Our confidence in the effect estimate is limited. The true effect may be substantially different from the estimate of the effect

Very low certainty: We have very little confidence in the effect estimate. The true effect is likely to be substantially different from the estimate of effect

## **Explanations**

a. Wide confidence intervals

b.  $\leq$  4 studies to report this outcome

c. I2 = 94%

# 4.5 Pharmacological Interventions

Author(s): Question: Pharmacology compared to Control for Dysphagia after stroke Setting: Bibliography:

	aphy:		Certainty ass	essment			№ of pat	ients	Ef	fect		
№ of studie s	Study design	Risk of bias	Inconsistenc y	Indirectnes s	Imprecisio n	Other consideration s	Pharmacolog y	Control	Relativ e (95% CI)	Absolut e (95% CI)	Certainty	Importance
Mortality	1											
13	randomise d trials	not seriou s	serious a	not serious	serious <sup>b</sup>	none	690/5364 (12.9%)	701/537 9 (13.0%)	RR 0.94 (0.76 to 1.16)	8 fewer per 1,000 (from 31 fewer to 21 more)	ФФСО	CRITICAL
Pneumo	nia											
11	randomise d trials	not seriou s	serious °	not serious	not serious	none	365/5334 (6.8%)	443/533 6 (8.3%)	RR 0.83 (0.73 to 0.94)	fewer per 1,000 (from 22 fewer to 5 fewer)	⊕⊕⊕⊖ MODERATE	CRITICAL
mRS 4-6	1											
3	randomise d trials	not seriou s	not serious	not serious	serious <sup>b</sup>	publication bias strongly suspected <sup>d</sup>	409/1410 (29.0%)	429/141 5 (30.3%)	RR 0.93 (0.85 to 1.03)	21 fewer per 1,000 (from 45 fewer to 9 more)	ФФ Low	CRITICAL
Swallow	ing											
1	randomise d trials	not seriou s	not serious	not serious	not serious	publication bias strongly suspected <sup>d</sup>	20/30 (66.7%)	11/30 (36.7%)	RR 1.82 (1.07 to 3.10)	301 more per 1,000 (from 26 more to 770 more)	⊕⊕⊕⊜ MODERATE	IMPORTAN T
Length o	of stay									ı		
4	randomise d trials	not seriou s	serious °	not serious	serious °	publication bias strongly suspected <sup>d</sup>			-	MD 0.82 lower (6.84 lower to 5.21 higher)	⊕○○ O VERY LOW	IMPORTAN T
Quality of	of life, usual ac	tivities										
1	randomise d trials	not seriou s	not serious	not serious	serious <sup>b</sup>	publication bias strongly suspected <sup>d</sup>	349/409 (85.3%)	364/424 (85.8%)	RR 0.99 (0.94 to 1.05)	9 fewer per 1,000 (from 52 fewer to 43 more)	ФФОО	IMPORTAN T

- a. 12 = 55%b. Wide confidence internals c.  $12 \ge 65\%$ d.  $\le 7$  studies to report this outcome e. Wide confidence intervals

### Pharmacology compared to Control for Dysphagia after stroke

Patient or population: Dysphagia after stroke

Setting:

Intervention: Pharmacology Comparison: Control

Outcomes		osolute effects*	Relative effect	Nº of	Certainty of the	Community
Outcomes	Risk with Control	Risk with Pharmacology	(95% CI)	participants (studies)	evidence (GRADE)	Comments
Mortality	130 per 1,000	<b>123 per 1,000</b> (99 to 151)	<b>RR 0.94</b> (0.76 to 1.16)	10743 (13 RCTs)	⊕⊕⊖ LOW a,b	
Pneumonia	83 per 1,000	<b>69 per 1,000</b> (61 to 78)	<b>RR 0.83</b> (0.73 to 0.94)	10670 (11 RCTs)	⊕⊕⊕⊖ MODERATE °	
mRS 4-6	303 per 1,000	<b>282 per 1,000</b> (258 to 312)	<b>RR 0.93</b> (0.85 to 1.03)	2825 (3 RCTs)	⊕⊕⊖⊖ LOW b,d	
Swallowing	367 per 1,000	<b>667 per 1,000</b> (392 to 1,000)	<b>RR 1.82</b> (1.07 to 3.10)	60 (1 RCT)	⊕⊕⊕⊖ MODERATE d	
Length of stay	The mean length of stay was <b>0</b>	MD <b>0.82 lower</b> (6.84 lower to 5.21 higher)	-	(4 RCTs)	⊕○○○ VERY LOW c,d,e	
Quality of life, usual activities	858 per 1,000	<b>850 per 1,000</b> (807 to 901)	<b>RR 0.99</b> (0.94 to 1.05)	833 (1 RCT)	⊕⊕⊖⊖ LOW b,d	

<sup>\*</sup>The risk in the intervention group (and its 95% confidence interval) is based on the assumed risk in the comparison group and the relative effect of the intervention (and its 95% CI).

CI: Confidence interval; RR: Risk ratio; MD: Mean difference

#### **GRADE Working Group grades of evidence**

High certainty: We are very confident that the true effect lies close to that of the estimate of the effect

Moderate certainty: We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different

Low certainty: Our confidence in the effect estimate is limited. The true effect may be substantially different from the estimate of the effect

Very low certainty: We have very little confidence in the effect estimate: The true effect is likely to be substantially different from the estimate of effect

- a. I2 = 55%
- b. Wide confidence internals
- c. I2 ≥ 65%
- $d. \le 7$  studies to report this outcome
- e. Wide confidence intervals

# **4.6 Neurostimulation Interventions**

Author(s):
Question: Neurostimulation compared to Control in Dysphagia after stroke
Setting:
Bibliography:

Bibliogr	aphy:											
Certainty assessment						№ of patients		Effect				
№ of studie s	Study design	Risk of bias	Inconsistenc y	Indirectnes s	Imprecisio n	Other consideration s	Neurostimulatio n	Control	Relativ e (95% CI)	Absolut e (95% CI)	Certainty	Importance
Mortality, PES - 3 months												
4	randomise d trials	not seriou s	not serious	not serious	serious a	publication bias strongly suspected <sup>b</sup>	19/139 (13.7%)	13/120 (10.8% )	RR 1.17 (0.60 to 2.29)	18 more per 1,000 (from 43 fewer to 140 more)	⊕⊕○ ○ Low	CRITICAL
mRS												
4	randomise d trials	not seriou s	serious °	not serious	not serious	publication bias strongly suspected <sup>b</sup>	122	93	-	MD 0.68 lower (1.22 lower to 0.13 lower)	⊕⊕O O Low	CRITICAL
Pneumonia												
5	randomise d trials	not seriou s	not serious	not serious	serious a	publication bias strongly suspected <sup>b</sup>	22/186 (11.8%)	32/181 (17.7% )	RR 0.70 (0.45 to 1.09)	53 fewer per 1,000 (from 97 fewer to 16 more)	⊕⊕○ ○ Low	CRITICAL
OVERAL	L, Dysphagia,	Improvem	ent	•	•	•	•	•				
44	randomise d trials	not seriou s	serious <sup>d</sup>	not serious	not serious	none	820	621	-	SMD 88 SD higher (0.64 higher to 1.12 higher)	⊕⊕⊕⊜ MODERATE	CRITICAL
LOS												
4	randomise d trials	not seriou s	not serious	not serious	serious <sup>e</sup>	publication bias strongly suspected <sup>b</sup>	137	114	-	MD 1.19 lower (7.35 lower to 4.97 higher)	⊕⊕○ ○ Low	IMPORTAN T
QoL, An	xiety, Depress	ion - Swall	owing QoL, Char	nge								
3	randomise d trials	not seriou s	not serious	not serious	not serious	publication bias strongly suspected <sup>b</sup>	67	39	-	MD 18.02 higher (11.41 higher to 24.63 higher)	⊕⊕⊕⊖ MODERATE	IMPORTAN T

CI: Confidence interval; RR: Risk ratio; MD: Mean difference; SMD: Standardised mean difference

# **Explanations**

- a. Few events and wide confidence intervals
- b. Seven or less studies to support this outcome
- c. I2 = 62%
- d. I2 = ≥75%
- e. Wide confidence intervals

#### Summary of findings:

### Neurostimulation compared to Control in Dysphagia after stroke

Patient or population: Dysphagia after stroke

Setting:

Intervention: Neurostimulation Comparison: Control

Outcomes	•	olute effects* (95% CI)	Relative effect	№ of participants	Certainty of the evidence	Comments		
Outcomes	Risk with Control	Risk with Neurostimulation	(95% CI)	(studies)	(GRADE)	Confinents		
Mortality, PES - 3 months	108 per 1,000	<b>127 per 1,000</b> (65 to 248)	<b>RR 1.17</b> (0.60 to 2.29)	259 (4 RCTs)	⊕⊕⊖⊖ LOW a,b			
mRS	The mean mRS was <b>0</b>	MD <b>0.68 lower</b> (1.22 lower to 0.13 lower)	-	215 (4 RCTs)	⊕⊕⊖⊖ LOW b,c			
Pneumonia	177 per 1,000	<b>124 per 1,000</b> (80 to 193)	<b>RR 0.70</b> (0.45 to 1.09)	367 (5 RCTs)	⊕⊕⊖⊖ LOW a,b			
OVERALL, Dysphagia, Improvement	-	SMD 88 SD higher (0.64 higher to 1.12 higher)	-	1441 (44 RCTs)	⊕⊕⊕⊜ MODERATE d			
LOS	The mean LOS was <b>0</b>	MD <b>1.19 lower</b> (7.35 lower to 4.97 higher)	-	251 (4 RCTs)	⊕⊕⊜ LOW b,e			
QoL, Anxiety, Depression - Swallowing QoL, Change	The mean qoL, Anxiety, Depression - Swallowing QoL, Change was <b>0</b>	MD <b>18.02 higher</b> (11.41 higher to 24.63 higher)	-	106 (3 RCTs)	⊕⊕⊕○ MODERATE Þ			

<sup>\*</sup>The risk in the intervention group (and its 95% confidence interval) is based on the assumed risk in the comparison group and the relative effect of the intervention (and its 95% CI).

CI: Confidence interval; RR: Risk ratio; MD: Mean difference; SMD: Standardised mean difference

#### **GRADE Working Group grades of evidence**

High certainty: We are very confident that the true effect lies close to that of the estimate of the effect

Moderate certainty: We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different

Low certainty: Our confidence in the effect estimate is limited: The true effect may be substantially different from the estimate of the effect

Very low certainty: We have very little confidence in the effect estimate: The true effect is likely to be substantially different from the estimate of effect

- a. Few events and wide confidence intervals b. Seven or less studies to support this outcome c. 12 = 62% d.  $12 = \ge 75\%$  e. Wide confidence intervals