

Heat and moisture exchangers (HMEs) and heated humidifiers (HHs) in adult critically ill patients:

a systematic review, meta-analysis and meta-regression of randomized controlled trials

Maria Vargas, Critical Care (2017)

引言人:呼吸治療技術長 謝慧觀106.8.1



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CRITICAL CARE ISSN: 1466-609X BIOMED CENTRAL LTD 236 GRAYS INN RD, FLOOR 6, LONDON WC1X 8HL, ENGLAND ENGLAND				2016	Graph	Graph 5.358	Cites	Graph	
0010300	mai table of Contents	Go to building iss		2015	16,428	4,950	4.537	5.406	
				2014	13,898	4.476	4.152	5.140	
		-		2013	12,822	5.035	4.367	5.411	
JCR Im	pact Factor			2012	10,657	4.718	4.421	5.248	
JCR	CRITICAL CA			2011	8,639	4.607	4.246	4.975	
Year -	Rank	Quartile	JIF	2010	7 261	4 595	3.871	4 963	
2015	5/27	01	83.333	2010	1,201	4.000	0.011	4.000	
2013	5/27	01	83 333	2009	5,771	4.931	4.137	5.035	
2012	5/27	Q1	83.333	2008	4,522	4.553	4.034	4.700	
2011	5/26	Q1	82.692	2007	2 225	2.024	2,062	1 100	
2010	4/23	Q1	84.783	2007	3,335	3.034	3.003	4,120	
2009	4/22	Q1	84.091	2006	1,943	3.116	2.554	Not A	
2008	4/21	Q1	83.333	2005	1 744	2 932	2 219	Not A	
2007	4/19	Q1	81.579	2000	1,211	2.002			
2000	5/18	02	75 000	2004	766	3.214	2.825	Not A	
2003	3/17	01	85 294	2003	454	1,911	1,767	Not A	
2003	6/16	02	65.625	2002	000	0.070	0.004	Net 4	
2002	11/17	Q3	38.235	2002	228	0.876	0.804	NOT A	
2001	12/17	Q3	32.353	2001	124	0.701	0.643	Not A	



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Background

- to evaluate the effects of active heated humidifiers (HHs) and moisture exchangers (HMEs) in preventing
 - artificial airway occlusion
 - pneumonia
 - mortality
- in adult critically ill patients

加熱潮濕器heated humidifiers (HHs)





Taipei Medical University - Wan Fang Medical Center

熱與濕交換器Heat and moisture exchangers (HMEs) 人工鼻

・有些濕化器具有過濾功能HEPA







加熱潮濕器heated humidifiers (HHs) vs人工鼻exchangers (HMEs)

項目	加熱潮濕器	價格	人工鼻	價格
	1.加熱座(重覆使用)	65000元	人工鼻	30元
	2.管路(重覆使用)	880元	拋棄式管路	50元
	3. 加熱感溫線(重覆使用)	5700元		
	4. 管路內加熱線(重覆使用)	3850元		
	5. 蒸餾水	45元		
	6.加熱潮濕器(拋棄式)	190元		
	7. 消毒(中高層次消毒)	???		
更換 時間	更換管路 加熱潮濕器	每7天 每14天	人工鼻 拋棄式管路	每2天

III:???元/每2天

HME: 80元/每2天

📲 重小館周十周,苗荘館周山小

CONTRAINDICATION

Secretions; thick, copious, tenacious111

Long-term ventilation 5 12 13

Bronchopleuralcutaneous fistula^{1 2 8 12 14 15}

Incompetent or absent ET tube cuff^{1 2 8 14}

Expired V, less than 70% of the delivered V,1

Airway burns1216

Dehydration⁶¹⁷

Hypothermia1-3 11 12 15 17 18

Acute Respiratory Distress Syndrome (ARDS)1219

Asthma# 16 19

Atelectasis12

Chronic Obstructive Pulmonary Disease (COPD)13

Severe hypercapnia²⁰

Ventilation strategy; lung protective, low V, J 8 17

Ventilation strategy; high MV112

Weaning; difficult to wean^{2 10 12}

Airway hemorrhage/trauma691216

Nebulized medications; during delivery of aerosol treatments¹⁶⁷⁹

Pulmonary edema^{2 + 6 7}

Secretions; bloody14 10 12 14 15 18

Immunocompromised¹²

REASON FOR CONTRAINDICATION

INSUFFICIENT HUMIDIFICATION

Normal HME operation results in a net loss of moisture from the respiratory tract. Increases risk of mucus plugging and airway occlusion due to insufficient humidification

AIR LEAK

Causes leak that prevents exhaled heat and moisture entering the HME and reduces inspired humidity

LOW HME EFFICIENCY

HMEs return a portion of the exhaled heat and moisture. A reduced level of exhaled heat and moisture decreases HME efficiency

DEAD SPACE / RESISTANCE

HMEs increase dead space, resistance to flow and work of breathing; and reduce alveolar ventilation

HME OCCLUSION

Causes HME occlusion and subsequent increased resistance to flow, work of breathing and/or barotraumas; and reduced alveolar ventilation

INFECTION

Routine HME change increases risk of infection

步驟2: 系統性文獻回顧的品質如何?(FAITH) F - 研究是否找到 (Find) 所有的相關證據? P.2 Literature search

評讀結果: □是 □否 v不清楚

- We applied standard filters for the identification of RCTs using the **MEDLINE and PUBMED search engines** (from inception to **June 2014**), **using English language restrictions**.
- search included the following keywords: heat and moisture exchangers, heated humidifiers, airway humidification, artificial humidification, artificial airway occlusion, mortality, pneumonia and humans and randomized clinical trial.

Heat and moisture exchangers (HMEs)and heated humidifiers (HHs)⁺ in adult critically ill patients: a systematic review, meta-analysis and meta-regression of **randomized controlled trials**



步**驟 2:糸統性文獻回顧的品質如何?(FAITH)** A - 文獻是否經過嚴格評讀 (Appraisal) ?

評讀結果: ∨ 是 □否 □不清楚

- Quality assessment of these studies included:
 - (1) use of randomization sequence generation
 - (2) reporting and type of allocation concealment
 - 分派隱匿:保護隨機分派<mark>前</mark>的分派順序
 - (3) blinding
 - 維持盲性:保護隨機分派後的分派順序
 - (4) reporting of incomplete outcome data
 - (5) comparability of the groups at baseline
- Quality assessment is reported in Additional file 1.
- Two reviewers (MV and LB) independently used these criteria to evaluate trial quality.
- We solved any possible disagreement by consensus in consultation with two other reviewers (GS and AE) if needed.



description of quality assessment for each included study.

H= high risk of bias L= low risk of bias U= uncertain risk of bias

	Random sequence generation	Allocation concealment	Blinding	Incomplete outcome data	Baseline characteristics
Oguz 2013	Random number list generated using Excel software L	Not described U	Not described U	Not described U	Imbalance in baseline characteristic (gender, smoking, chronic disease) and time of circuit changes H
Boots 2006	Predetermined list generated from a list of random numbers. L	Not described U	Blinding only CXR U	No lost to follow-up L	Imbalance in baseline characteristics (Length of MV) H
Lorente 2006	Random number list generated using Excel software L	Not described U	Not described U	16/120 lost to follow-up L	No imbalance in baseline characteristics L
Lacherade 2005	Computer generated randomization L	Not described U	Not described U	No lost to follow-up L	Imbalance in baseline characteristics (P/F ratio and immunocompromised pts) H
Diaz 2002	Random number list L	Sealed and consecutively numbered L	Not described U	No lost follow up H	Balance in baseline characteristics L
Memish 2001	Group balance was maintained within each block of 20 L	The randomization record was kept with the hospital biostatistician L	Not described U	155/398 lost follow up H	Imbalance in baseline characteristics (neurologic disease) H
Kollef 1998	Not described U	Opaque envelopes L	Blinding assessment L	Not described U	Balance in baseline characteristics L
Lucchetti 1998	Not described U	Not described U	Not described U	Not described U	Not described U



性文獻回顧的品質如何?(FAITH) nc 6 評讀結果: Ⅴ 是 □否 □不清楚

ing Medical Cente

18 RCTs included 2442 adult critically ill patients

Table 1 Main characteristics of the randomized controlled trials included in the meta-analysis (HME vs HH with heated and non-heated wire)

First Author/ year	Study design	Population	Age	Exclusion criteria	Number of patients (HME/HH)	Severity of illness	Characteristic of passive humidifier/ frequency of change	Active humidifier (HH)	TV/MV	Frequency of change of ventilator circuit	Diagnosis of VAP
Oğuz 2013 [83]	SC/RCT	General ICU with Intubation <24 hours	47.9 vs 44.5	Patients with Intubation >24 hours, pneumonia	18 vs 17	n.a.	HME replaced daily	HH	n.a.	na.	CXR infiltration
Boots 2006 [82]	SC/RCT	General ICU with MV >48 hours	59 vs 60	Patients presenting history (alrway hemorrhage, asthma, or alrway burns) suggested a need for HH	190 vs 191	APACHE II 20 vs 20	Hygroscopic HME with a bacterial viral filter/24 hours	Hot-water humidification with a heated wire in both inspiratory and expiratory circuit limbs (DHW) or the inspiratory limb only (SHW)	n.a.	Every new patients	CPIS ≥6 Tracheal suction
Lorente 2006 [81]	SC/RCT	ICU with patients expected to require mechanical ventilation for >5 days	-56 vs 55	Age <18 years, HIV, WBC <1000 cells/ mm ³ solid or hematological tumor and immunosuppressive therapy	53 vs 51	APACHE II 18.11/ 18.72	HME: Edith Flex (Datex-Ohmeda) changed at 48-hour interval	MR 850 * (Fisher & Paykel Health Care Ltd, Auckland, New Zealand) and the Aerodyne 2000*servo-controlled humidifiers with wire-heated circuits without water traps and with an autofeed chamber to refiil the chamber with water	n.a.	No routine change of ventilator circuit	Tracheal aspirate
Lacherade 2005 [80]	MC/ BCT	5 ICUs located in two French university-affiliated teaching hospitals Medical, Surgical, Neurosurgical requiring MV s48 bours	55.2 vs 54.7	Contraindications to the use of an HMEF or of an HH, patients admitted after cardiac arrest, patients already enrolled in a clinical trial and patients	185 vs 184	SAPS II 45.4 vs 49.3	DAR Hygrobac filter device (Tyco Healthcare/Nelicor, Pleasanton, CA, USA (changed at 48 hours interval)	The MR730 device (Fisher & Paykel Healthcare Ltd, Auckland, New Zealand). Heated wire	n.a.	Changed for every new patient	Invasive respiratory secretion samplings cultured quantitatively, using a protected telescoping catheter or BAL
		5 TO FILLES		with early decision of treatment	S	C:s	ingle trial	center			
				withdrawal were not included	Ν	IC : ı	nore trial (center			
Diaz 2002 [79]	SC/RCT	Intubated patients	61 vs 66	Previous pulmonary disease, hypothermia, pulmonary secretion or low expiratory volume	23 vs 20	na.	HME	нн	n.a.	na	n.a.

步驟2: 系統性文獻回顧的品質如何?(FAITH)^{WarFargMadical Center} T - 作者是否以表格和圖表「總結」(total up)試驗結果?

評讀結果: Ⅴ 是 □否 □不清楚

Artificial airway occlusion

Studies Estimate (95% C.I.) Hote Hit Kirkegaard 1987 5.000 (0.260, 96.127) 2/15 0/15 Martin 1990 17.469 (1.021, 298.035) 6/31 0/42 Misset 1991 1.733 (0.345, 8.707) 4/30 2/26 Roustan 1992 21.036 (1.253, 353.184) 9/55 0/61 Dreyfuss 1995 3.435 (0.143, 82.813) 1/61 0/70 Braneon 1896 1.100 (0.022, 54.407) 0/49 0/54 Vilatane 1996 3.187 (0.068, 27.577) 3/16 1/17 Boots 1997 0.977 (0.020, 48.099) 0/42 0/41 Hurri 1997 0.317 (0.013, 7.615) 0/59 1/56 Kirton 1997 0.143 (0.007, 2.740) 0/140 3/140 Kollef 1998 0.902 (0.018, 45.194) 0/163 0/147 Luccheti 1908 13.562 (0.745, 246.762) 3/15 0/30 Lacherade 2005 0.199 (0.023, 1.686) 1/185 5/184 boots 2006 1.005 (0.020, 50.402) 0/190 0/191 Overall 1.653 (0.792, 4.33					Favors HME	AR Favors HH
Studies Estimate (95% C.I.) IME IMI Kirkegaard 1987 5.000 (0.260, 96.127) 2/15 0/15 Mastin 1990 17.469 (1.021, 298.935) 6/31 0/42 Miaset 1991 1.733 (0.345, 8.707) 4/30 2/26 Roustan 1992 21.036 (1.253, 353.184) 9/55 0/61 Dreyfusa 1995 3.435 (0.143, 82.813) 1/61 0/70 Branson 1996 1.100 (0.022, 54.407) 0/49 0/54 Vilatane 1996 3.187 (0.368, 27.577) 3/16 1/17 Boots 1997 0.977 (0.024, 48.099) 0/42 0/41 Hurri 1997 0.317 (0.013, 7.615) 0/59 1/56 Kirton 1997 0.143 (0.007, 2.740) 0/140 0/140 Kalter 1998 0.902 (0.018, 45.194) 0/163 0/147 Lucchett 1998 13.562 (0.745, 246.762) 3/15 0/30 Lacherade 2005 0.199 (0.023, 1.686) 1/185 5/184 boots 2006 1.005 (0.020, 50.402) 0/190 0/191	Tau==0.546; Q [df=13]= Test overall effect 2=2.5	=16.541; l*=21%; p=0.221 541; p=0.111		0.01	0.02 0.05 0.1 0.2 0.5	1 1.85 5 10 20 50 100 290 300
Studies Estimate (95% C.I.) IME IM Kirkegaard 1987 5.000 (0.260, 96.127) 2/15 0/15 Mertin 1990 17.469 (1.021, 298.935) 6/31 0/42 Misset 1991 1.733 (0.345, 8.707) 4/30 2/26 Roustan 1992 21.036 (1.253, 353.184) 9/55 0/61 Dreyfus 1995 3.435 (0.143, 82.813) 1/61 0/70 Branson 1996 1.100 (0.022, 54.407) 0/49 0/54 Vilatane 1996 3.187 (0.368, 27.577) 3/16 1/17 Boots 1997 0.977 (0.020, 48.099) 0/42 0/41 Hurri 1997 0.317 (0.013, 7.615) 0/59 1/56 Kirton 1987 0.143 (0.007, 2.740) 0/140 3/140 Kollef 1998 0.902 (0.018, 45.194) 0/163 0/147 Lucchetti 1998 13.562 (0.745, 246.762) 3/15 0/30 Lacherade 2005 0.199 (0.023, 1.686) 1/185 5/184 boots 2006 1.005 (0.020, 50.402) 0/190 0/191	Overall	1.853 (0.792, 4.	.338) 29/1051	12/1074	-	-
Studies Estimate (95% C.I.) HM Kirkegaard 1987 5.000 (0.260, 96.127) 2/15 0/15 Martin 1990 17.469 (1.021, 298.935) 6/31 0/42 Misset 1991 1.733 (0.345, 8.707) 4/30 2/26 Roustan 1982 21.036 (1.253, 353.184) 9/55	boots 2006	1.005 (0.020, 50.	402) 0/190	0/191		
Studies Estimate (95% C.I.) HME HM Kirkegaard 1987 5.000 (0.260, 96.127) 2/15 0/15 Martin 1990 17.469 (1.021, 298.935) 6/31 0/42 Misset 1991 1.733 (0.345, 8.707) 4/30 2/26 Floustan 1982 21.036 (1.253, 353.184) 9/55 0/61 Dreyfuas 1995 3.435 (0.143, 82.813) 1/61 0/70 Branson 1996 1.100 (0.022, 54.407) 0/49 0/54 Villatane 1996 3.187 (0.368, 27.577) 3/16 1/17 Boots 1997 0.977 (0.020, 48.099) 0/42 0/41 Hurni 1997 0.317 (0.013, 7.615) 0/59 1/56 Kirton 1997 0.143 (0.007, 2.740) 0/140 3/140 Kollef 1998 0.902 (0.018, 45.194) 0/163 0/147 Lucchetti 1998 13.562 (0.745, 246.762) 3/15 0/30	Lacherade 2005	0,199 (0.023, 1.	686) 1/185	5/184		
Studies Estimate (95% C.I.) IME IMI Kirkegaard 1987 5.000 (0.260, 96.127) 2/15 0/15 Martin 1990 17.469 (1.021, 298.935) 6/31 0/42 Misset 1991 1.733 (0.345, 8.707) 4/30 2/26 Roustan 1992 21.036 (1.253, 353.184) 9/55 0/61 Dreyfuss 1995 3.435 (0.143, 82.813) 1/61 0/70 Branson 1996 1.100 (0.022, 54.407) 0/49 0/54 Villatane 1996 3.187 (0.368, 27.577) 3/16 1/17 Boots 1997 0.977 (0.020, 48.099) 0/42 0/41 Hurni 1997 0.317 (0.013, 7.615) 0/59 1/56 Kirton 1997 0.143 (0.007, 2.740) 0/140 3/140 Kollef 1998 0.902 (0.018, 45.194) 0/163 0/147	Lucchetti 1998	13,562 (0,745, 246.	.762) 3/15	0/30		
Studies Estimate (95% C.I.) HME HM Kirkegaard 1987 5.000 (0.260, 96.127) 2/15 0/15 Martin 1990 17.469 (1.021, 298.935) 6/31 0/42 Misset 1991 1.733 (0.345, 8.707) 4/30 2/26 Roustan 1992 21.036 (1.253, 353.184) 9/55 0/61 Dreyfuss 1995 3.435 (0.143, 82.813) 1/61 0/70 Branson 1996 1.100 (0.022, 54.407) 0/49 0/54 Villatane 1996 3.187 (0.368, 27.577) 3/16 1/17 Boots 1997 0.977 (0.020, 48.099) 0/42 0/41 Hurni 1997 0.317 (0.013, 7.615) 0/59 1/56 Kirton 1997 0.143 (0.007, 2.740) 0/140 3/140	Kollef 1998	0.902 (0.018, 45.	194) 0/163	0/147		
Studies Estimate (95% C.I.) HME HM Kirkegaard 1987 5.000 (0.260, 96.127) 2/15 0/15 Martin 1990 17.469 (1.021, 298.935) 6/31 0/42 Misset 1991 1.733 (0.345, 8.707) 4/30 2/26 Roustan 1992 21.036 (1.253, 353.184) 9/55 0/61 Dreyfuss 1996 3.435 (0.143, 82.813) 1/61 0/70 Branson 1996 1.100 (0.022, 54.407) 0/49 0/54 Viliatane 1996 3.187 (0.368, 27.577) 3/16 1/17 Boots 1997 0.977 (0.020, 48.099) 0/42 0/41 Humi 1997 0.317 (0.013, 7.615) 0/59 1/56	Kirton 1997	0.143 (0.007, 2.	740) 0/140	3/140 +		
Studies Estimate (95% C.I.) HME HM Kirkegaard 1987 5.000 (0.260, 96.127) 2/15 0/15 Martin 1990 17.469 (1.021, 298.935) 6/31 0/42 Misset 1991 1.733 (0.345, 8.707) 4/30 2/26 Floustan 1992 21.036 (1.253, 353.184) 9/55 0/61 Dreyfuss 1995 3.435 (0.143, 82.813) 1/61 0/70 Branson 1996 1.100 (0.022, 54.407) 0/49 0/54 Villatane 1996 3.187 (0.368, 27.577) 3/16 1/17 Boots 1997 0.977 (0.020, 48.099) 0/42 0/41	Humi 1997	0.317 (0.013, 7.	615) 0/59	1/56		
Studies Estimate (95% C.I.) HME HM Kirkegaard 1987 5.000 (0.260, 96.127) 2/15 0/15 Martin 1990 17.469 (1.021, 298.935) 6/31 0/42 Misset 1991 1.733 (0.345, 8.707) 4/30 2/26 Roustan 1992 21.036 (1.253, 353.184) 9/55 0/61 Dreyfuss 1995 3.435 (0.143, 82.813) 1/61 0/70 Branson 1996 1.100 (0.022, 54.407) 0/49 0/54 Villatane 1996 3.187 (0.368, 27.577) 3/16 1/17	Boots 1997	0.977 (0.020, 48.	.099) 0/42	0/41		
Studies Estimate (95% C.I.) IME IM Kirkegaard 1987 5.000 (0.260, 96.127) 2/15 0/15 Martin 1990 17.469 (1.021, 298.935) 6/31 0/42 Misset 1991 1.733 (0.345, 8.707) 4/30 2/26 Roustan 1992 21.036 (1.253, 353.184) 9/55 0/61 Dreyfuss 1995 3.435 (0.143, 82.813) 1/61 0/70 Branson 1996 1.100 (0.022, 54.407) 0/49 0/54	Villatane 1996	3.187 (0.368, 27.	577) 3/16	1/17		
Studies Estimate (95% C.I.) IME	Branson 1996	1.100 (0.022, 54.	407) 0/49	0/54		
Studies Estimate (95% C.I.) IME IME IME Kirkegaard 1987 5.000 (0.260, 96.127) 2/15 0/15	Dreyfuss 1995	3.435 (0.143, 82.	.813) 1/61	0/70		
Studies Estimate (95% C.I.) INIL INI	Roustan 1992	21.036 (1.253, 353.	184) 9/55	0/61		
Studies Estimate (95% C.I.) HME HM Kirkegaard 1987 5.000 (0.260, 96.127) 2/15 0/15 Martin 1990 17.469 (1.021, 298.935) 6/31 0/42	Misset 1991	1.733 (0.345, 8.	707) 4/30	2/26		-
Studies Estimate (95% C.I.) HME HM Kirkegaard 1987 5.000 (0.260, 96.127) 2/15 0/15	Martin 1990	17.469 (1.021, 298.	.935) 6/31	0/42		
Studies Estimate (95% C.I.) HME HH	Kirkegaard 1987	5.000 (0.260, 96.	127) 2/15	0/15		- A11-54
Val State 1 August 1	Studies	Estimate (95% C.	I.) HME	HH		

Fig. 2 Artificial airway occlusion comparing the heat and moisture exchanger (HME) with the heated humidifier (HH). Weights: Kirkegaard 6.8%, Martin 7.1%, Misset 15.3%, Roustan 7.1%, Dreyfuss 5.9%, Branson 4.2%, Villafane 10.7%, Boots (2006) 4.2%, Hurni 5.9%, Kirton 6.6%, Kollef 4.1%, Lucchetti 6.9%, Lacherade 10.8%, boots (1997) 4.1%

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META-REGRESSION FOR ARTIFICIAL AIRWAY OCCLUSION

- No significant relationships were found between artificial airway
- occlusion and ICU LOS, % respiratory diagnoses, SAPS, APACHE II and age.





META-REGRESSION FOR PNEUMONIA

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versity - Wan Fang Medical Con

• No significant relationships were found between incidence of pneumonia and duration of MV, AIW occlusion/reintubation, ICU LOS, % respiratory diagnoses, SAPS, APACHE II and age.





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META-REGRESSION FOR MORTALITY

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• **No significant** relationships were found between mortality and duration of MV, VAP incidence, ICU LOS, AIW occlusion/reintubation, % respiratory diagnoses, SAPS, APACHE II and age.





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·萬芳醫學中心

Taipei Medical University - Wan Fang Medical Center



Fig. 3 Upper box artificial airway occlusion comparing the heat and moisture exchanger (HME) and the heated humidifier (HH) with heated wire. Weights: Branson 11%, Boots (1997) 11%, Kirton 19.2%, Kollef 11%, Lacherade 36.8% Boots (2006) 10.9%. Lower box artificial airway occlusion comparing HME and HH with non-heated wire. Weights: Kirkegaard 8.9%, Martin 9.7%, Misset 30%, Roustan 9.8%, Dreyfuss 7.7%, Villafane 16.8%, Humi 7.7%, Lucchetti 9.3%



Fig. 4 Incidence of pneumonia comparing the heat and moisture exchanger (HME) with the heated humidifier (HH). Weights: Martin 2.5%, Roustan 4.7%, Dreyfuss 5%, Branson 2.3%, Boots (1997) 5%, Kirton 8.6%, Kollef 9.1%, Memish 9.4%, Diaz 5.5%, Lacherade 19.5%, Lorente 8.4%, Boots (2006) 14.3%, Oguz 5.1%



incidence of pneumonia



Fig. 5 Upper panel: incidence of pneumonia comparing the heat and moisture exchanger (HME) and the heated humidifier (HH) with heated wire. Weights: Branson 5.7%, Boots (1997) 9.3%, Kirton 15%, Kollef 15.7%, Lachede 22%, Lorente 12.6%, Boots (2006) 19.7%. Lower panel incidence of pneumonia comparing HME and HH with non-heated wire. Weights: Martin 7.8%, Roustan 15.5%, Dreyfuss 16.7%, Memish 37.9%, Diaz 11.8%, Oguz 10.2%



Fig. 6 Upper panel mortality comparing the heat and moisture exchanger (HME) with the heated humidifier (HH), Weights: Kirkegaard1%, Martin 3.4%, Roustan 4.6%, Dreyfuss 5.4%, Boots (1997) 1.6%, Hurni 7.9%, Kollef 16.1%, Memish 14.5%, Diaz 2.6%, Lacherade 28.3%, Boots (2006) 14.4%. Middle panel mortality comparing HME and HH with heated wire. Weights: Boots (1997) 4%, Boots (2006) 28.9%, Kollef 27.9%, Lacherade 39.2%. Lower box mortality comparing HME and HH with non-heated wire. Weights: Diaz 6.2%, Dreyfuss 15.6%, Hurni 17.51%, Kirkegaard 3.1%, Martin 9.2%, Memish 34.9%, Roustan 13.5%

5

步驟2: 系統性文獻回顧的品質如何?(FAITH) H - 試驗的結果是否相近 - 異質性 (Heterogeneity)?

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評讀結果: v 是 □否 □不清楚

	I ²	P value
artificial airway occlusion	21%	0.221
HME vs HH with heated wire	0%	0.888
HME vs HH with non-heated wire	0%	0.474
incidence of pneumonia	27%	0.169
HME vs HH with heated wire	54%	0.042
HME vs HH with non-heated wire	0%	0.662
mortality	0%	0.745
HME vs HH with heated wire	0%	0.909
HME vs HH with non-heated wire	0%	0.512

Meta-regression analysis

- The effect size in the treatment group on artificial airway occlusion was influenced by the percentage of patients with pneumonia included in the study (β = -0.058 ;p = 0.027; favoring HMEs in studies with high prevalence of pneumonia)
- a trend was observed for the duration of MV (β = -0.108; p = 0.054; favoring HMEs in studies with longer MV time)
- No other significant associations with the effect size on any outcome measure were observed for the other clinical variables



臺北醫學大學

萬芳醫學中心

• Taipei Medical University - Wan Fang Medical Cen

步驟2: 系統性文獻回顧的品質如何?(FAITH)

臺北醫學大學·萬芳醫學中心

ing Medical Cente

T - 作者是否以表格和圖表「總結」 (total up) 試驗結果?

評讀結果: Ⅴ 是 □否 □不清楚

Primary outcome

- **incidence of artificial airway occlusion** was **not different** in patients treated with HMEs and HHs(RR = 1.853; **95% CI 0.792 4.338**).
- Artificial airway occlusion incidence was not different when comparing HMEs with HHs with heated wire (RR = 0.379; 95% CI 0.140 – 1.384)
- occlusion was higher with HMEs compared with HHs with non-heated wire (RR = 3.776; 95% CI 1.560 9.143)



Martin 7.1%, Misset 15.3%, Roustan 7.1%, Dreyfuss 5.9%, Branson 4.2%, Villafane 10.7%, Boots (2006) 4.2%, Humi 5.9%, Kirton 6.6%, Kollef 4.1%, Lucchetti 6.9%, Lacherade 10.8%, boots (1997) 4.1%

Secondary outcomes

- The incidence of pneumonia was not different in patients treated with HMEs and HHs (Fig. 4) (RR = 932;95% CI 0.730 1.190).
- Incidence of pneumonia was not different when comparing HMEs and HHs with heated wire (RR = 0.997; 95% CI 0.642 1.548), with significant inhomogeneity (I2 = 54%; p = 0.042) neither was it different with HHs with non-heated wire (RR = 0.756; 95% CI 0.479 1.193) (Fig. 5, lower panel).
- Mortality was not different in patients treated with HMEs and HHs (Fig. 6, upper panel) (RR = 1.023; 95% CI 0.878 1.192).
- Mortality was comparable in patients treated with HMEs and HHs with heated wire (RR = 0.947; 95% CI 0.723 1.241) (Fig. 6, middle panel).
- We did not find differences in mortality when comparing HMEs and HHs with non-heated wire (RR = 1.186; 95% CI 0.852 1.650) (Fig. 6, lower panel).



结	里	為	Æ	
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結果		有顯著差異	無顯著差異
人工呼吸道阻塞 reporting artificial airway occlusion			*
HME vs HH with heated wire(人工鼻	與加熱線管路)		*
HME vs HH with non heated wire()	工鼻與無加熱線管路)	*	
肺炎pneumonia			*
HME vs HH with heated wire(人工鼻	與加熱線管路)		*
HME vs HH with non heated wire()	工鼻與無加熱線管路)		*
死亡率 mortality			*
HME vs HH with heated wire(人工鼻	與加熱線管路)		*
HME vs HH with non heated wire()	工鼻與無加熱線管路)		*





系統性文獻回顧的品質

Level I

F - 研究是否找到 (Find) 所有的相關證據?				
A - 文獻是否經過嚴格評讀 (Appraisal)?				
I-是否只納入 (included) 具良好效度的文章?	yes			
T - 作者是否以表格和圖表「總結」 (total up) 試驗結果?	yes			
H - 試驗的結果是否相近 - 異質性 (Heterogeneity)?	yes			





Conclusions

- no significant difference between HMEs and HHs, artificial airway occlusion pneumonia mortality
- **no effect** of HHs **with** and **without** heated wire compared to HMEs
- A trend favoring HMEs was observed in studies including a high percentage of patients with
 - pneumonia diagnosis at admission
 - those with prolonged MV
- the choice of humidifiers should be made according to the clinical context
 - trying to avoid possible complications
 - reaching the appropriate performance at lower costs



加熱潮濕器heated humidifiers (HHs) vs人工鼻exchangers (HMEs)

項目	加熱潮濕器	價格	人工鼻	價格
	1.加熱座(重覆使用)	65000元	人工鼻	30元
	2.管路(重覆使用)	880元	拋棄式管路	50元
	3. 加熱感溫線(重覆使用)	5700元		
	4. 管路內加熱線(重覆使用)	3850元		
	5. 蒸餾水	45元		
	6.加熱潮濕器(拋棄式)	190元		
	7. 消毒(中高層次消毒)	???		
更換 時間	更換管路 加熱潮濕器	每7天 每14天	人工鼻 拋棄式管路	每2天

III:???元/每2天

HME: 80元/每2天



對病房使用呼吸器病人,為減少臨床人員加水次數, 呼吸器的潮濕加熱器,全面使用拋棄式密閉系統



開放系統需重複加水





密閉系統不需重複加水



綠(同意):23人 黃(需討論):10人 紅(不同意):0人



Thank you

