奇美醫療財團法人 奇美醫院
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Weaning from mechanical ventilator

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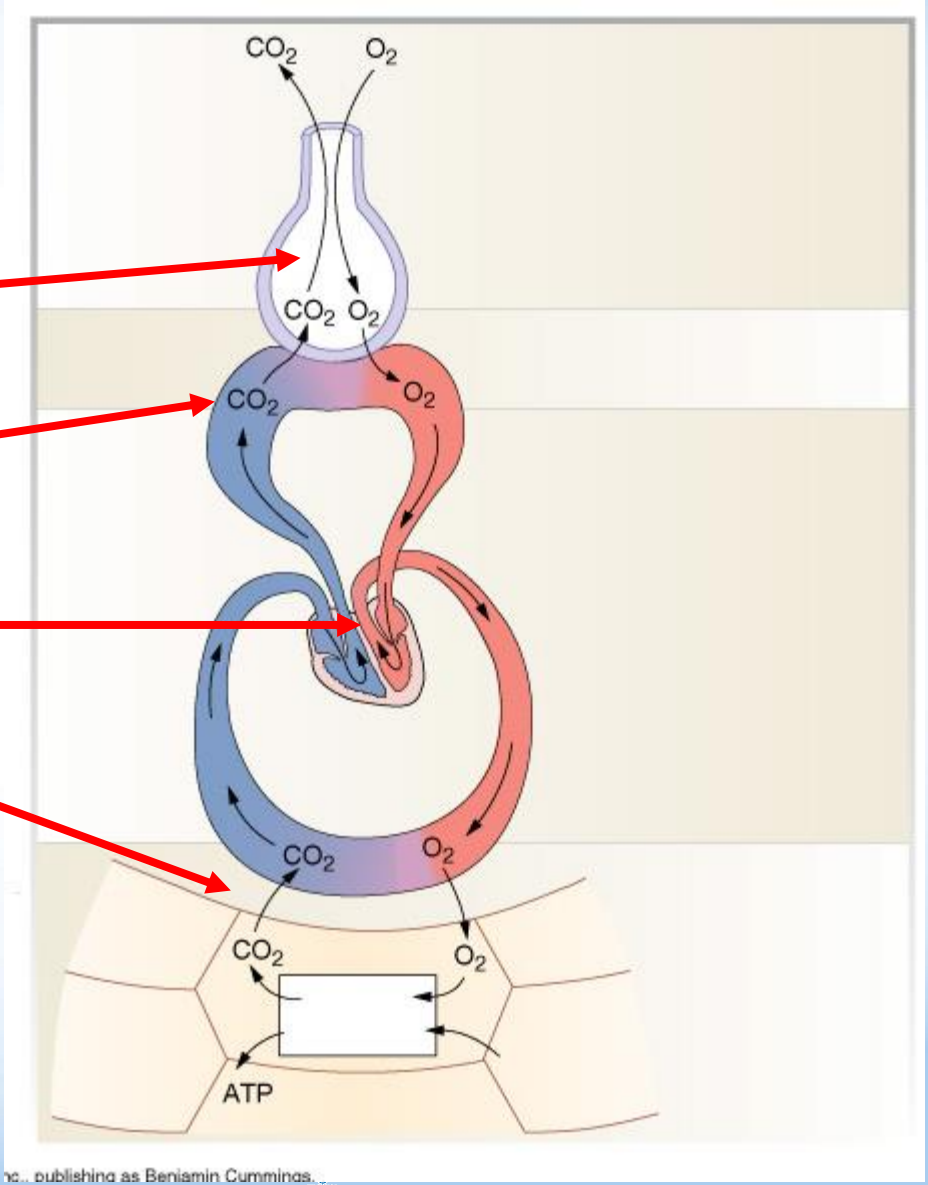
品質管理中心副主任

加護醫學部 陳欽明醫師

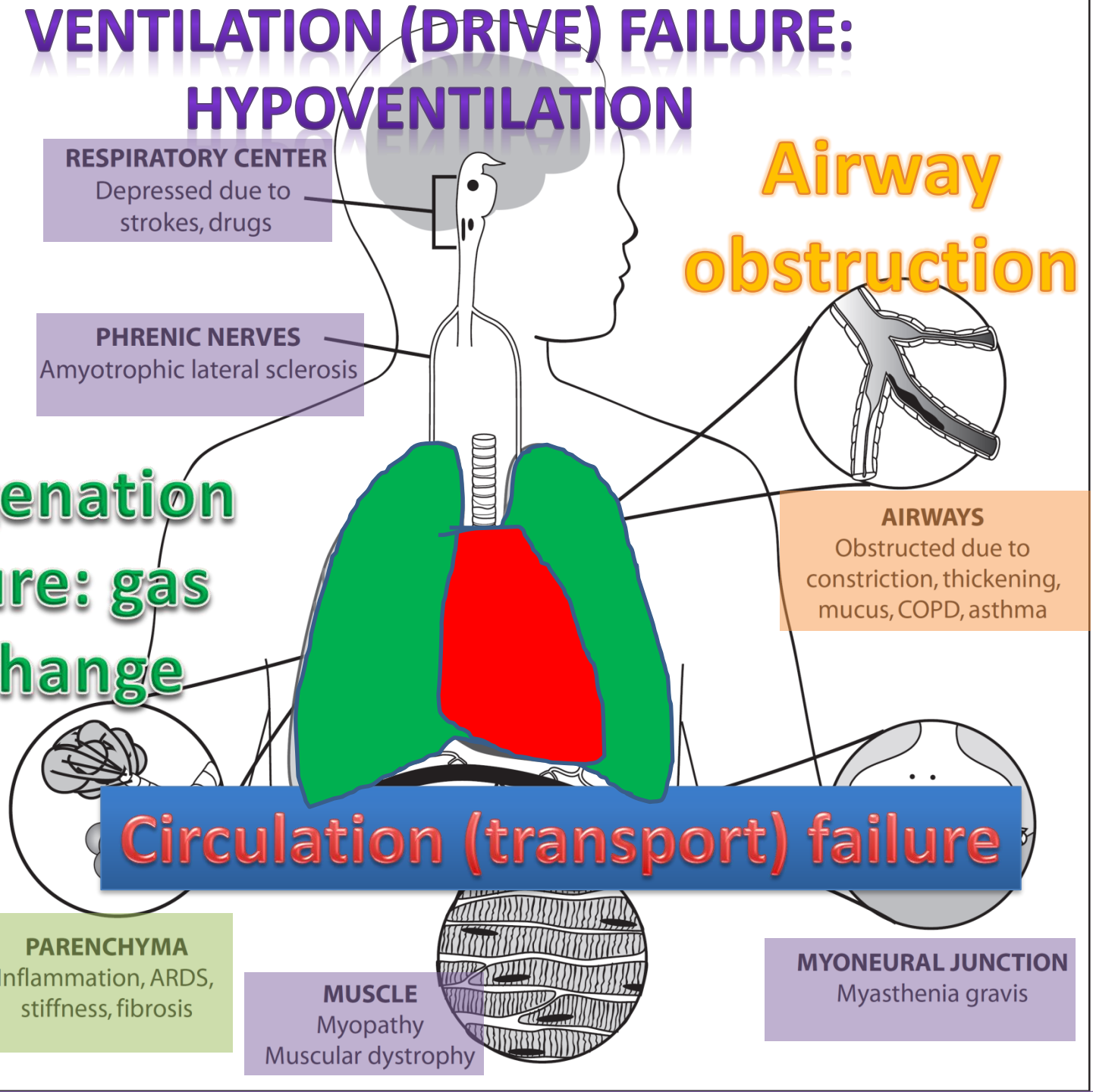
呼吸作用四步驟

Four steps

- Exchange between air and lungs
- Exchange between lungs and blood
- Transport in blood
- Exchange between blood & cells



VENTILATION (DRIVE) FAILURE: HYPOVENTILATION



RESPIRATORY CENTER
Depressed due to strokes, drugs

PHRENIC NERVES
Amyotrophic lateral sclerosis

Airway obstruction

AIRWAYS
Obstructed due to constriction, thickening, mucus, COPD, asthma

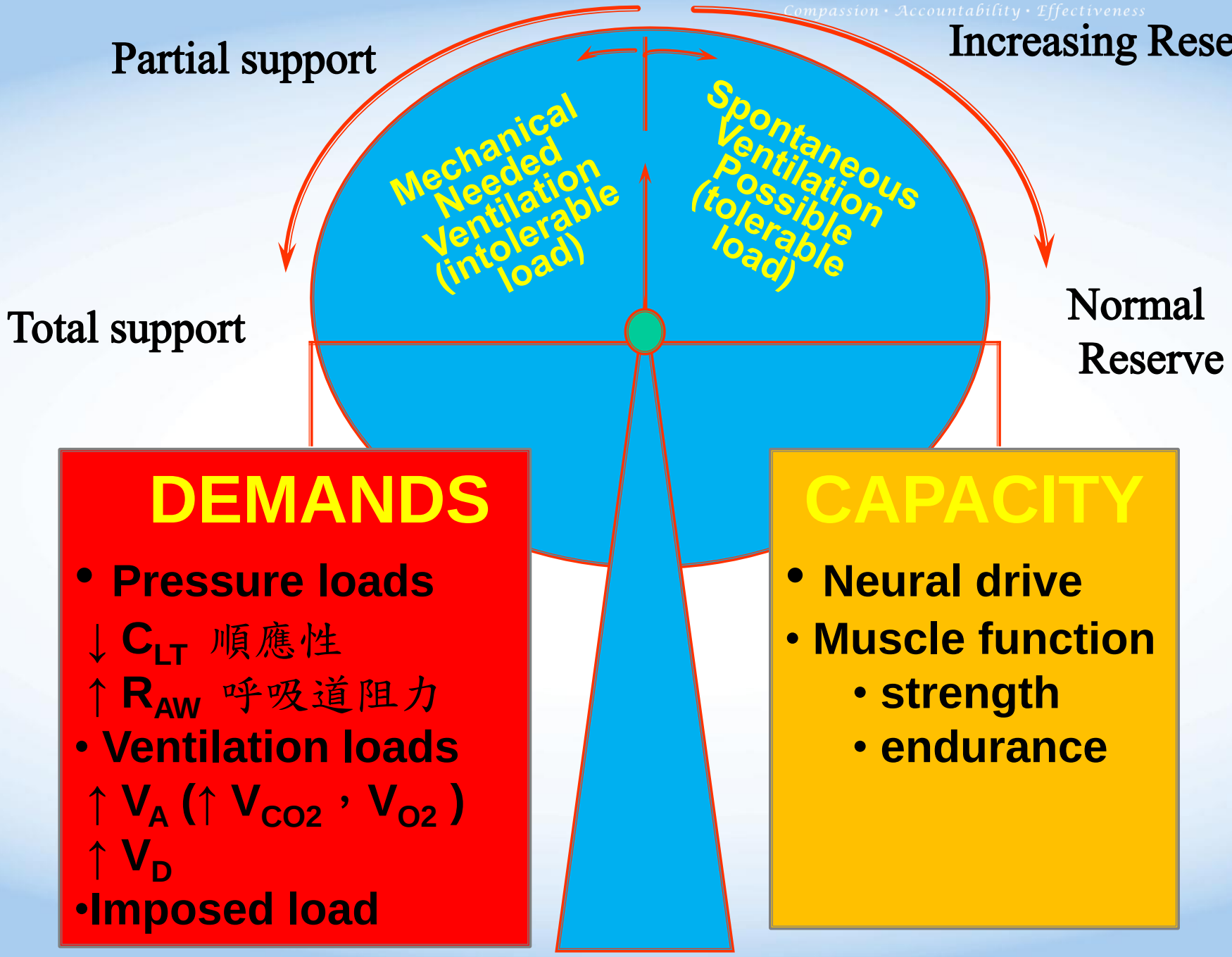
Oxygenation failure: gas exchange

Circulation (transport) failure

PARENCHYMA
Inflammation, ARDS, stiffness, fibrosis

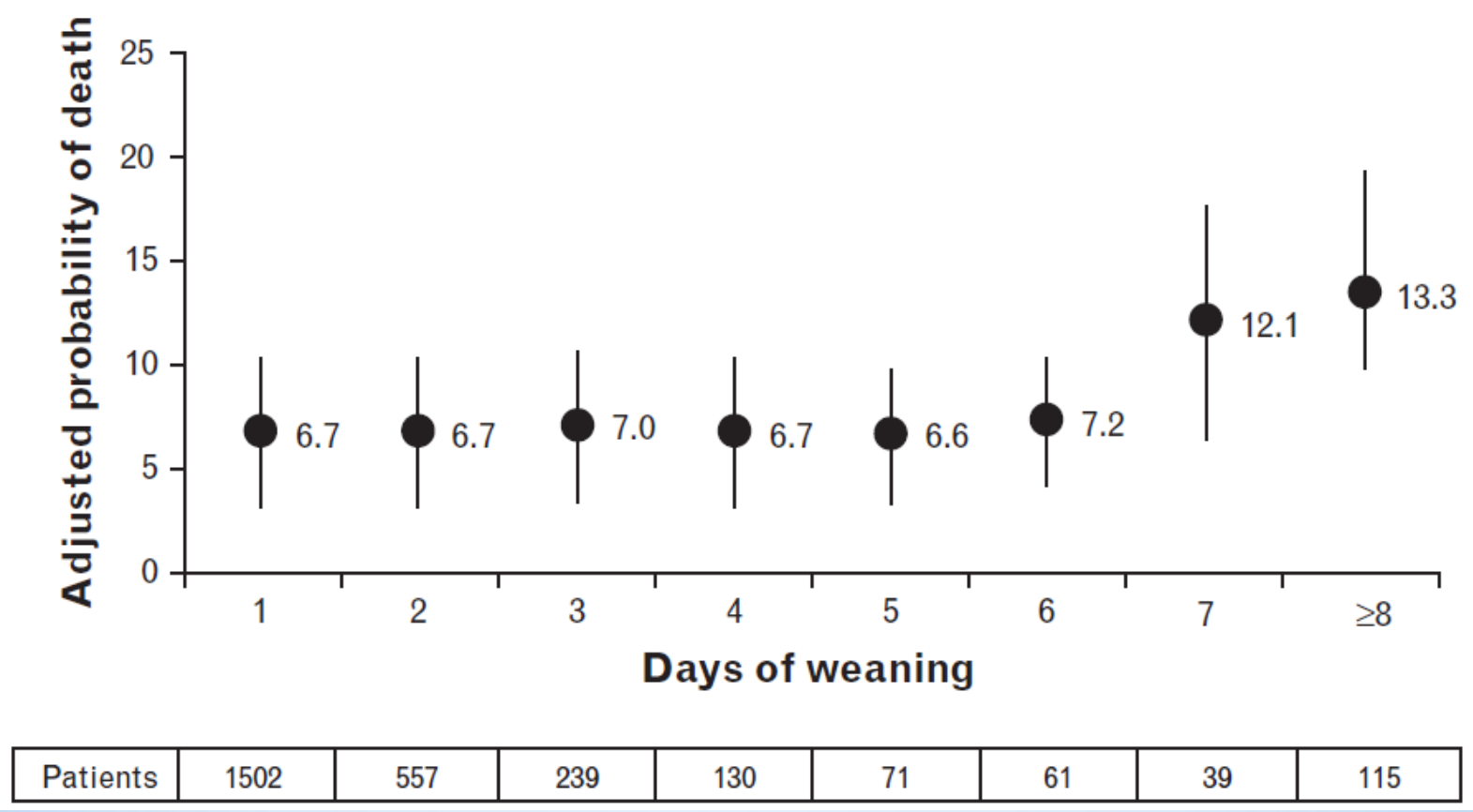
MUSCLE
Myopathy
Muscular dystrophy

MYONEURAL JUNCTION
Myasthenia gravis



Respir Care 2013;58(6):1074 –1082.

Days of weaning vs. ICU mortality



Patients	1502	557	239	130	71	61	39	115

Penuelas et al. Am J Respir Crit Care Med 2011; 184:430–437

Chen *et al. Critical Care* (2015) 19:354
DOI 10.1186/s13054-015-1071-x

CRITICAL CARE

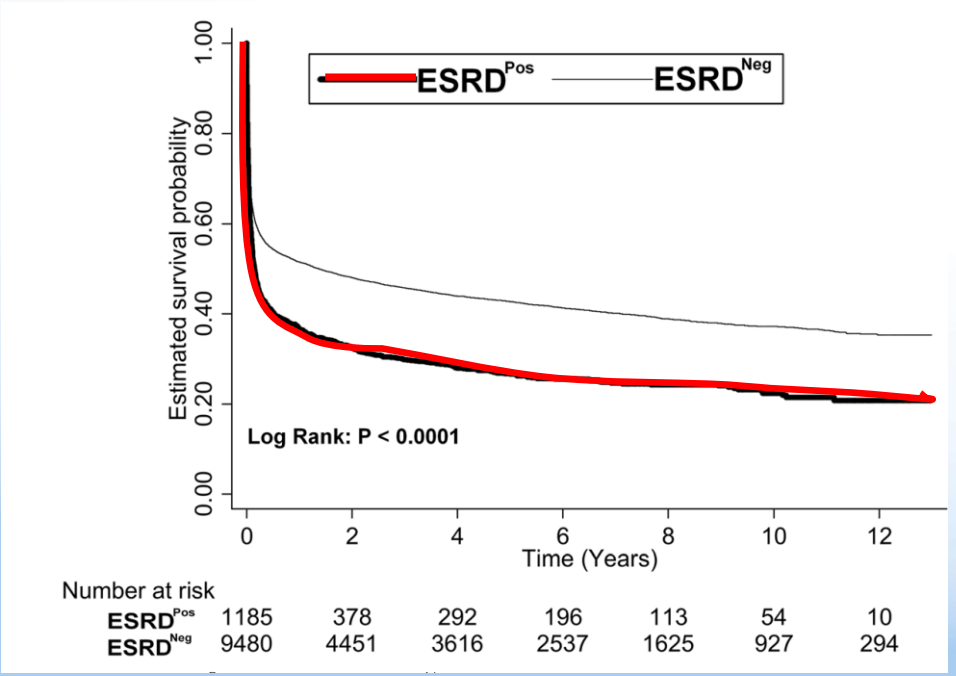
RESEARCH Open Access

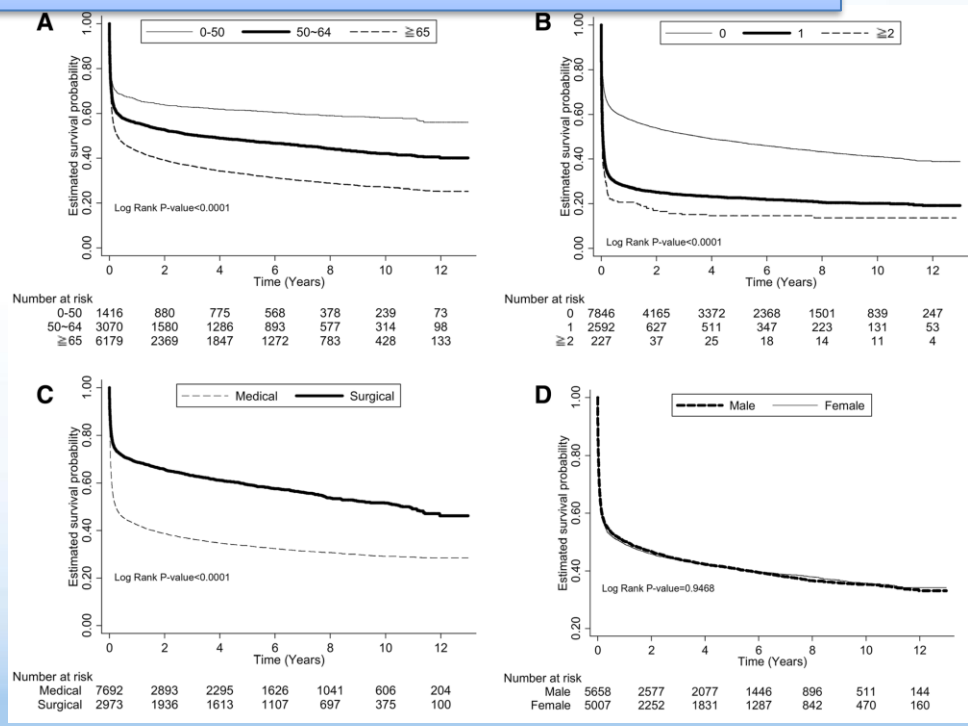
Effect of end-stage renal disease on long-term survival after a first-ever mechanical ventilation: a population-based study

Chin-Ming Chen[1,3,4*], Chih-Cheng Lai[7], Kuo-Chen Cheng[5,8], Shih-Feng Weng[2,6], Wei-Lun Liu[4,7] and Hsiu-Nien Shen[4,9*]

ESRD ↑ the mortality risk after a 1-MV, but long-term survival seemed similar

Elderly, **Medical pts**, **MOF** had a worse outcome





World Journal of Gastroenterology
World J Gastroenterol 2017 March 28; 23(12): 2201-2208
ORIGINAL ARTICLE

Retrospective Cohort Study

Chih-Cheng Lai, Chung-Han Ho, Kuo-Chen Cheng, Chien-Ming Chao, **Chin-Ming Chen**, Willy Chou

Effect of liver cirrhosis on long-term outcomes after acute respiratory failure: A population-based study

LC, especially **non-cryptogenic LC**, significantly ↑the risk of death after a 1-MV.

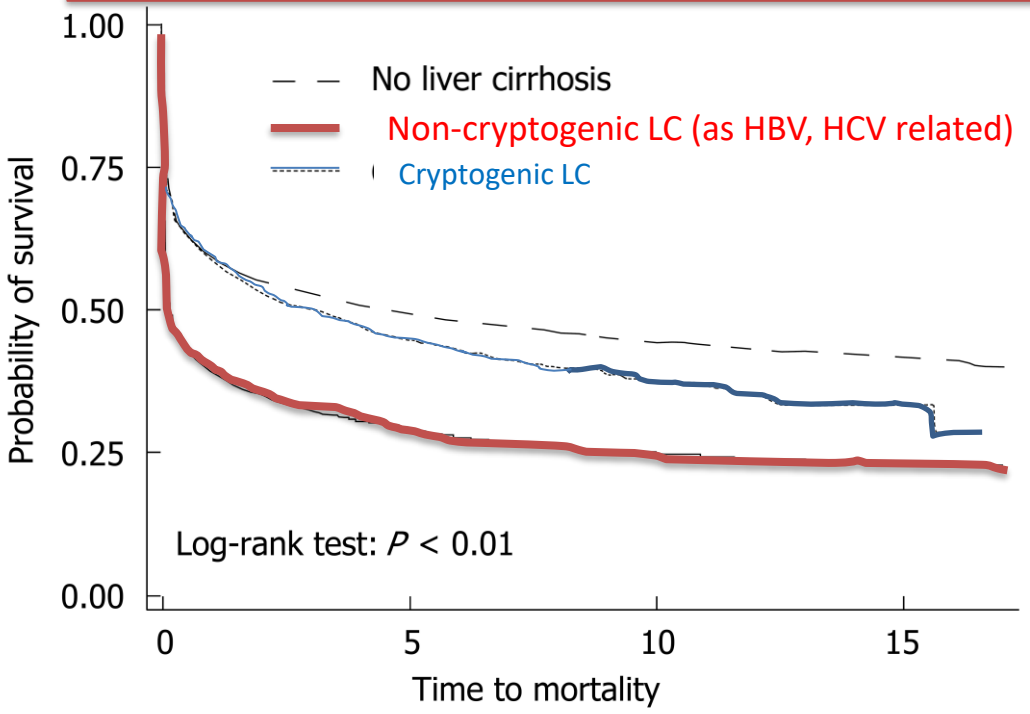
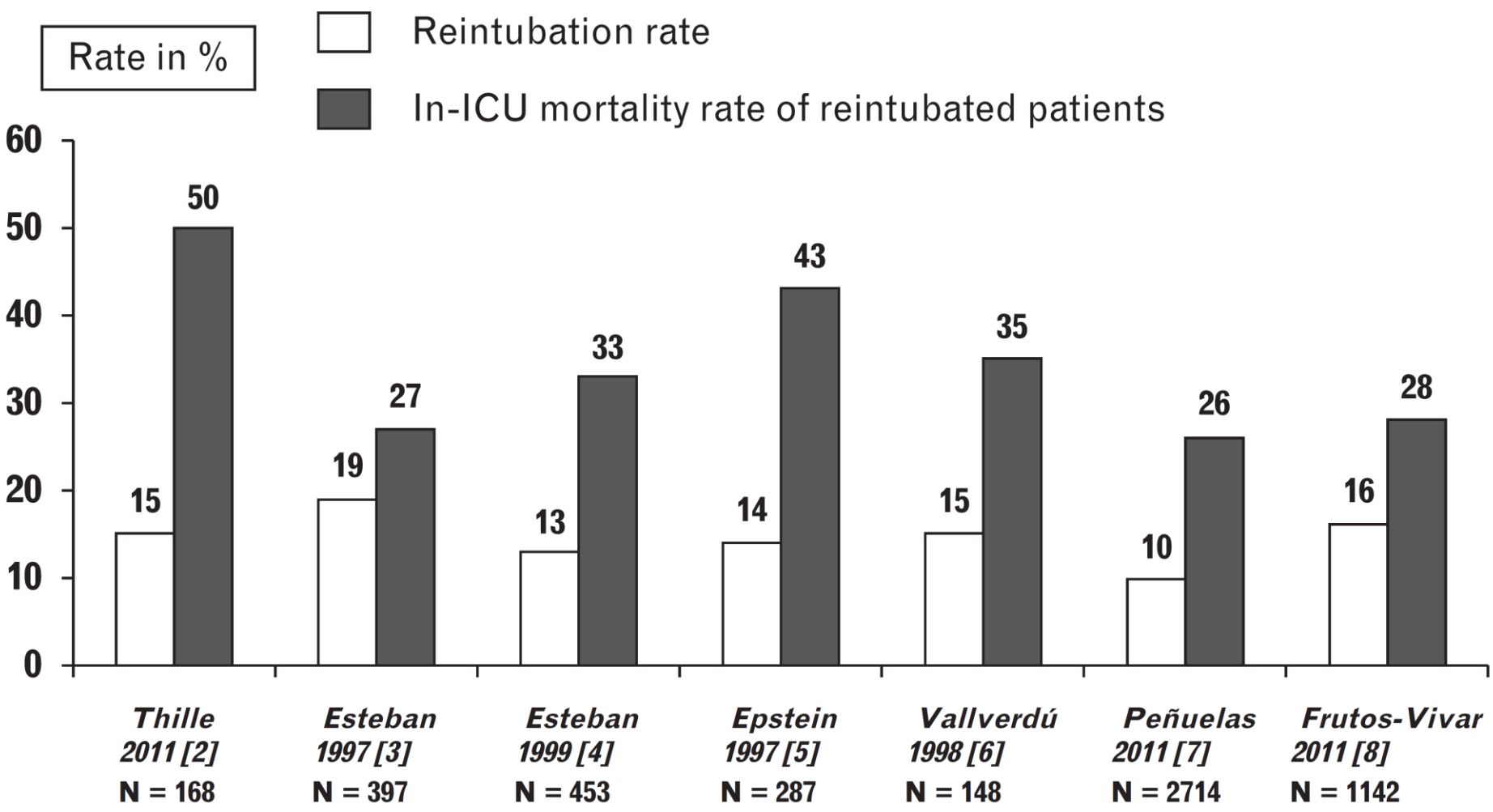


Table 2 Adjusted hazard ratios for mortality in patients after their 1st-ever mechanical ventilation *n* (%)

No. of deaths	LC[Pos] patients (*n* = 5551)	LC[Neg] patients (*n* = 11102)	Adjusted hazard ratio (95%CI)
Overall	3747 (67.50)	5902 (53.16)	1.38 (1.32-1.44)[a]
Age (yr)			
< 50	763 (13.75)	744 (6.70)	1.96 (1.76-2.18)[a]
50-64	911 (16.41)	1369 (12.33)	1.40 (1.29-1.53)[a]
65-79	1368 (24.64)	2458 (22.14)	1.24 (1.16-1.32)[a]
⩾ 80	705 (12.70)	1331 (11.99)	1.41 (1.04-1.25)[a]
Gender			
Male	2464 (44.39)	3770 (33.96)	1.42 (1.35-1.49)[a]
Female	1283 (23.11)	2132 (19.20)	1.30 (1.21-1.39)[a]
Department			
Surgical	255 (4.59)	595 (5.36)	1.32 (1.14-1.54)[a]
Medical	3492 (62.91)	5307 (47.80)	1.37 (1.31-1.43)[a]
Number of organ failures			
0	2074 (37.36)	4015 (36.16)	1.40 (1.33-1.47)[a]
1	1379 (24.84)	1691 (15.23)	1.26 (1.17-1.35)[a]
⩾ 2	294 (5.30)	196 (1.77)	1.16 (0.96-1.41)
Comorbidity			
DM	1374 (24.75)	2432 (21.91)	1.19 (1.12-1.28)[a]
HTN	1583 (28.52)	2851 (25.68)	1.15 (1.08-1.22)[a]
CAD	716 (12.90)	1276 (11.49)	1.17 (1.07-1.28)[a]
ESRD	488 (8.79)	920 (8.29)	1.19 (1.06-1.33)[a]
COPD	789 (14.21)	1459 (13.14)	1.15 (1.05-1.26)[a]
Cancer	972 (17.51)	1668 (15.02)	1.31 (1.21-1.42)[a]
Stroke	680 (12.25)	1261 (11.36)	1.16 (1.06-1.28)[a]
CHF	563 (10.14)	1002 (9.03)	1.21 (1.09-1.34)[a]
HBV	7 (0.13)	12 (0.11)	0.54 (0.11-2.57)
HCV	11 (0.20)	20 (0.18)	0.43 (0.14-1.28)

Weaning failure Vs. ICU mortality



Curr Opin Crit Care 2013, 19:57–64

Observational Study

Medicine

Medicine (2016) 95:41(e4852)

OPEN

Establishing predictors for successfully planned endotracheal extubation

Chih-Cheng Lai, MD[a], Chin-Ming Chen, MD[b,d], Shyh-Ren Chiang, MD[c,d], Wei-Lun Liu, MD[a], Shih-Feng Weng, PhD[e], Mei-I Sung, RT[c], Shu-Chen Hsing, RT[c], Kuo-Chen Cheng, MD[c,f,*]

6583 patients were enrolled and 403 patients (**6.1%**) had extubation **failures**.

The overall in-hospital **mortality rate** was **11.3%**.

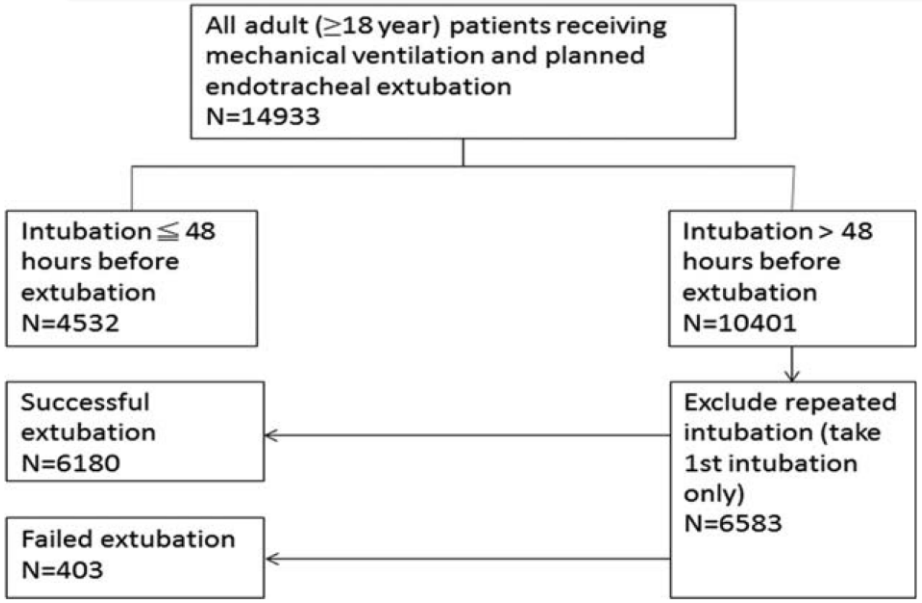


Figure 1. The algorithm of patients enrollment.

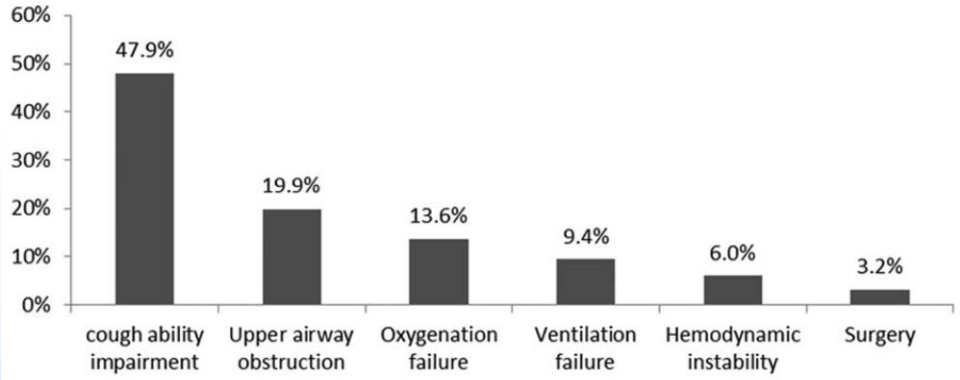
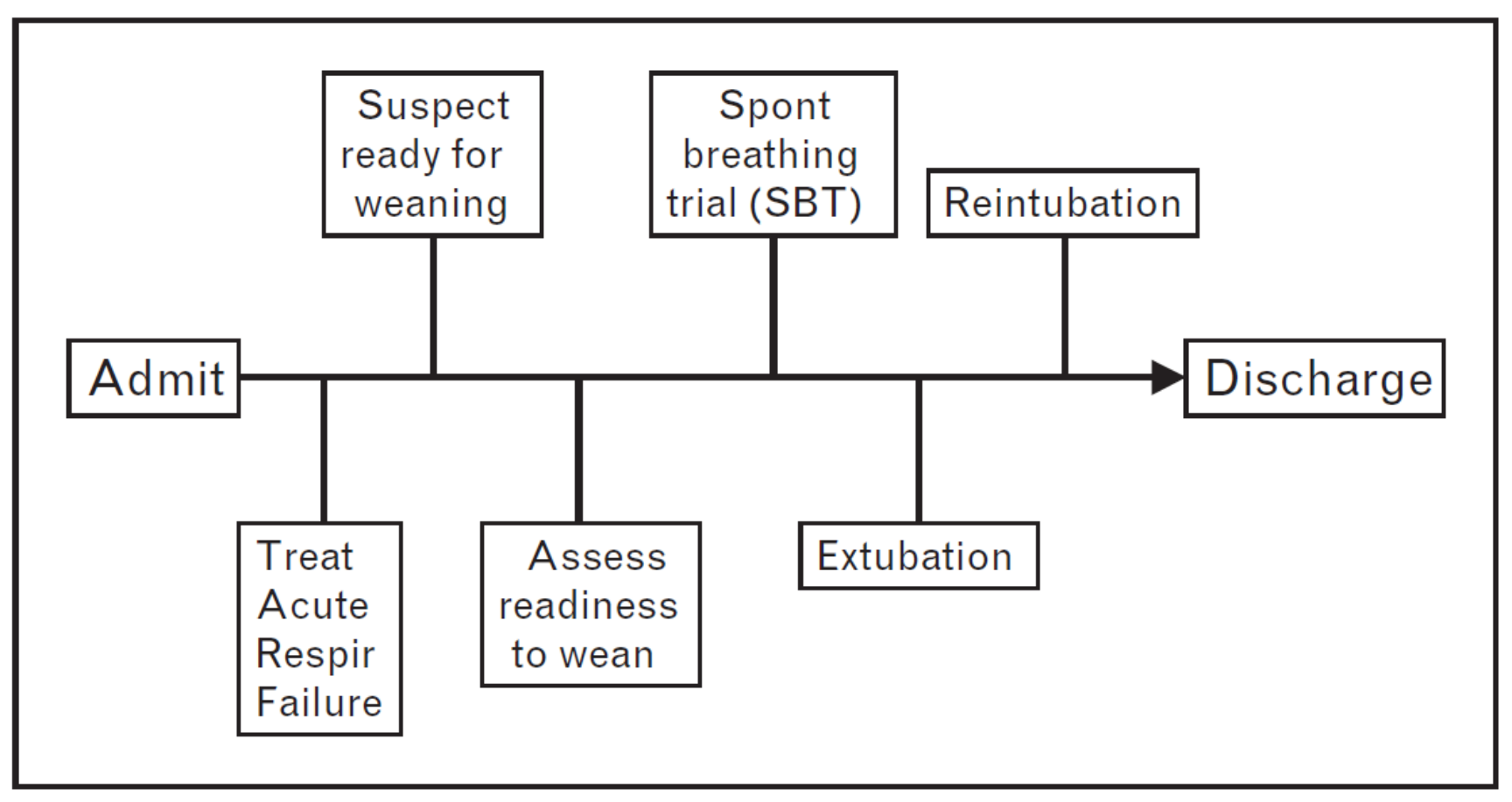


Figure 2. Reason for reintubation (n = 403).

Course of Mechanical Ventilation

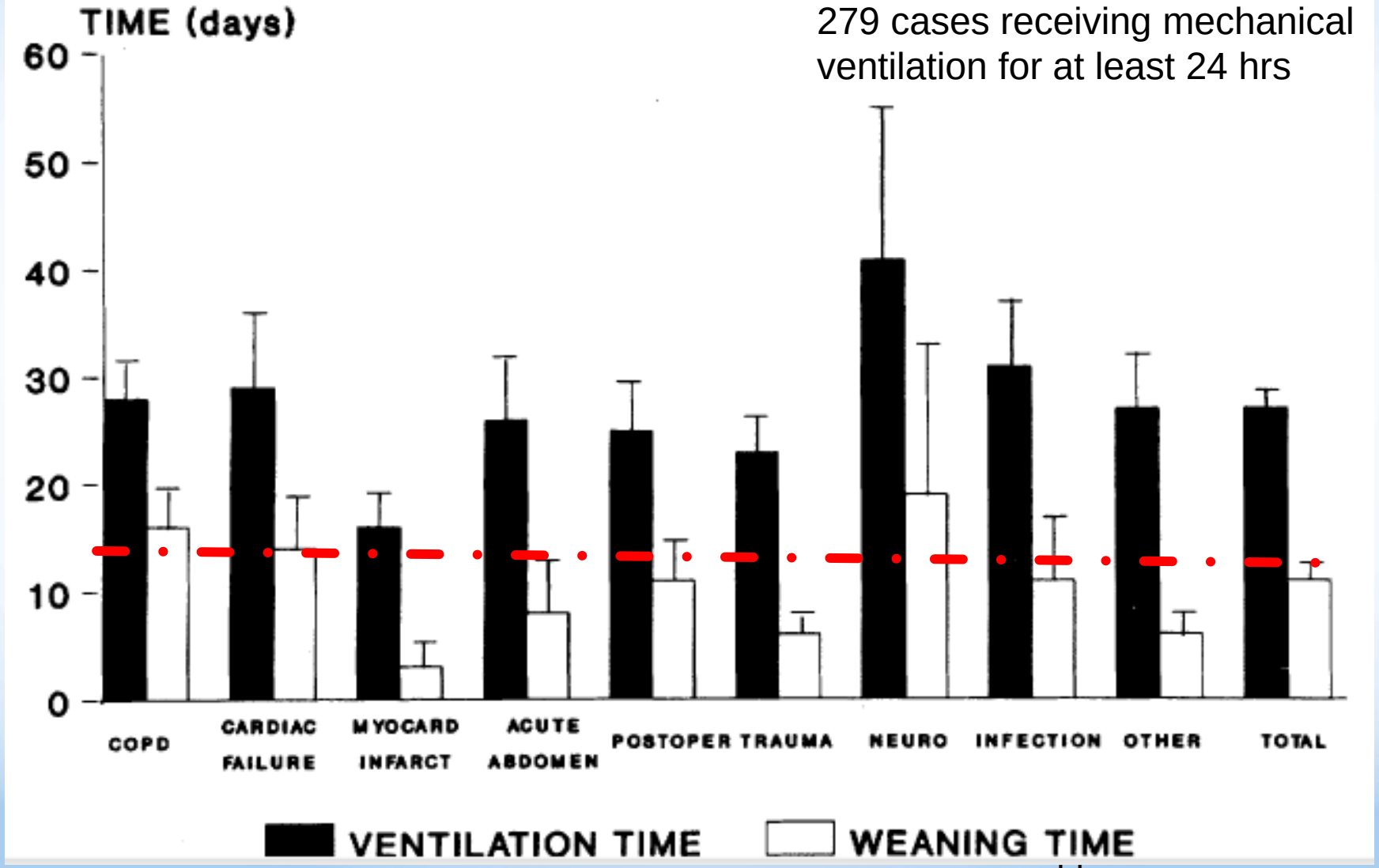


Curr Opin Crit Care 15:36–43

The weaning process occupying up to 50% of its total duration

Chest 1994; 106: 1188–1193

279 cases receiving mechanical ventilation for at least 24 hrs



Ventilator weaning

1. Treatment of cause of acute respiratory failure
2. Assess readiness to wean/ Spontaneous breathing trial (SBT: T-piece, low PSV, CPAP)
3. SBT trial comparison & how long?
4. Weaning Index /Protocol
5. Post-extubation: NIV/HFNC for Weaning? Steroids?
6. Weaning Experiences from Chi-Mei Medical Center

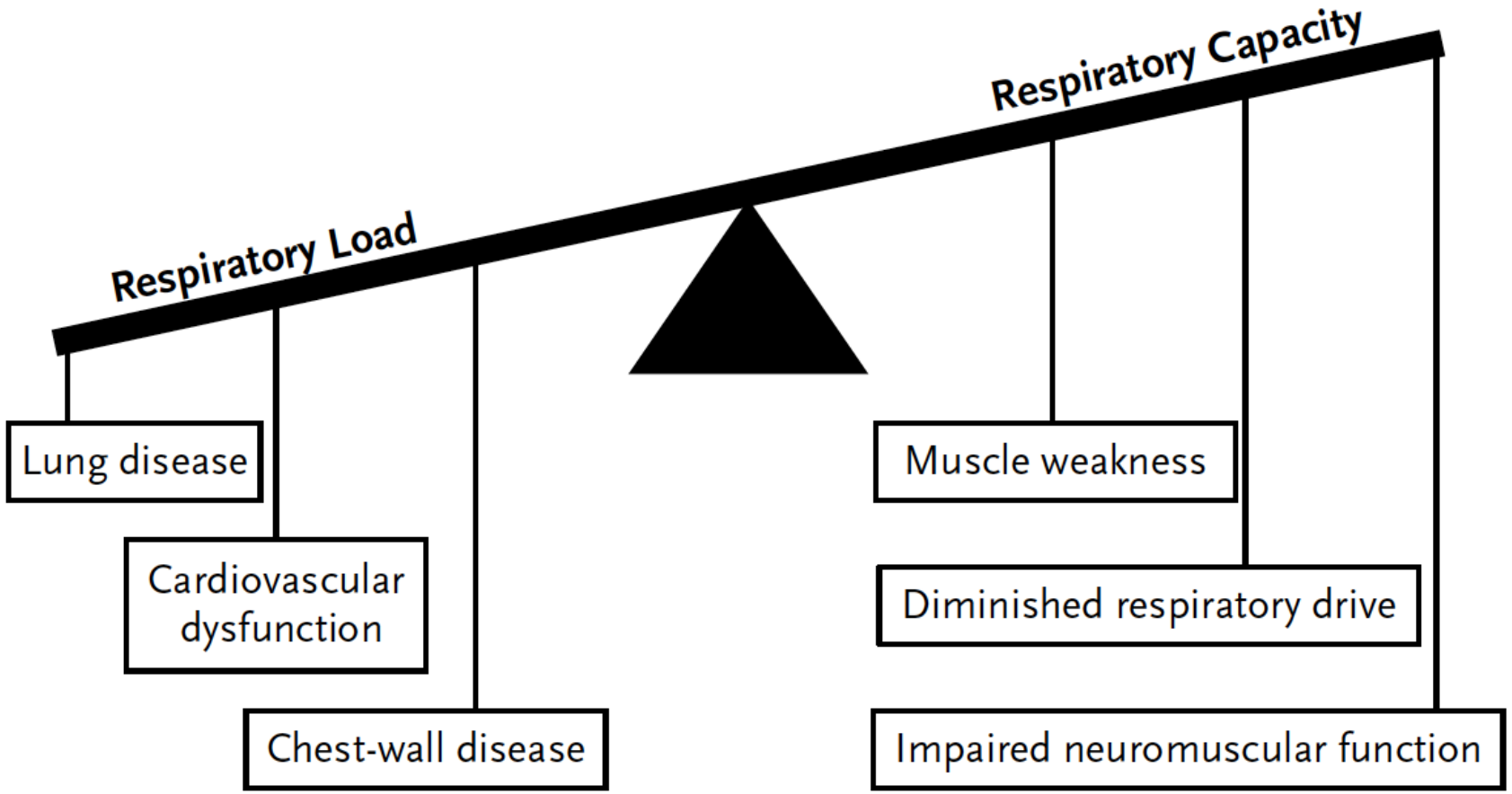


Figure 2. Pathologic States That Result in an Imbalance between Respiratory-Muscle Capacity and Respiratory Load.

Treatment strategies in ICU

- Possible infection survey & treatment
- Dynamic assessment of fluid responsiveness into EGDT
- Conservative fluid therapy
- Lung protective strategy in ARDS
- Light sedation
- Early mobilization

奇美醫療財團法人 奇美醫院
Chi Mei Medical Center

Treatment of cause of acute respiratory failure

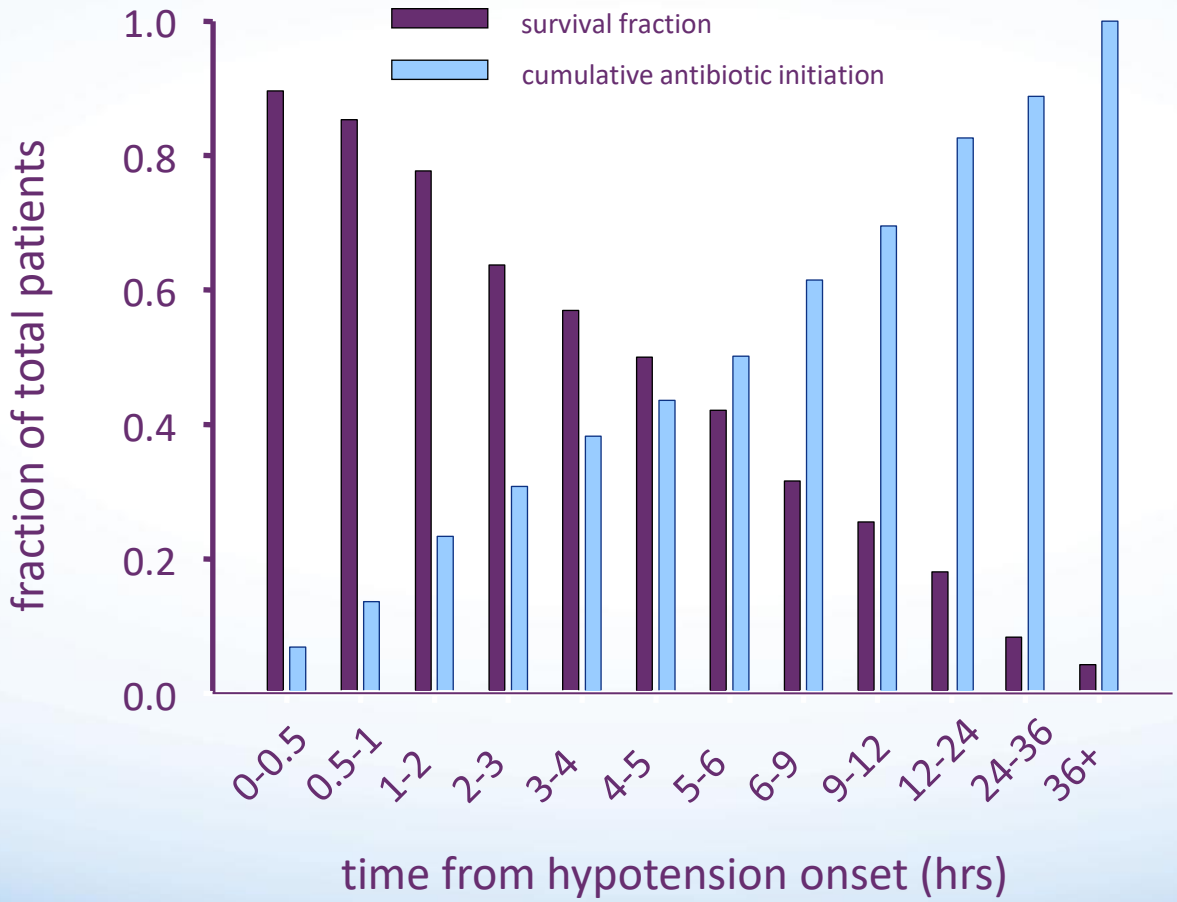
TO SAVE LIVES.....

Early identification

Early antibiotics

Early fluid resuscitation

Cumulative Initiation of Effective Antimicrobial Therapy and Survival in Septic Shock



Kumar et al. *CCM*. 2006:34:1589-96.

Incorporating Dynamic Assessment of Fluid Responsiveness Into Goal-Directed Therapy: A Systematic Review and Meta-Analysis

Study or Subgroup	Dynamic therapy Events	Total	Control Events	Total	Weight	Risk Ratio M-H, Random, 95% CI
Kapoor 2008	0	15	0	15		Not estimable
Goepfert 2013	0	50	0	50		Not estimable
Kumar 2016	0	30	0	30		Not estimable
Colantonio 2015	0	42	4	44	1.4%	0.12 [0.01, 2.10]
Scheeren 2013	0	32	2	32	1.3%	0.20 [0.01, 4.01]
Buettner 2009	0	40	1	40	1.1%	0.33 [0.01, 7.95]
Parke 2015	0	70	1	74	1.1%	0.35 [0.01, 8.50]
Lopes 2007	2	17	5	16	5.1%	0.38 [0.08, 1.67]
Richard 2015	7	30	14	30	20%	0.50 [0.24, 1.06]
Pearse 2015	28	368	42	366	54.7%	0.66 [0.42, 1.05]
Jhanji 2010	9	90	6	45	12.1%	0.75 [0.28, 1.98]
Mayer 2010	2	30	2	30	3.2%	1.00 [0.15, 6.64]
Total (95% CI)		**814**		**772**	**100.0%**	**0.59 [0.42, 0.83]**
Total events	48		77			

Heterogeneity: Tau² = 0.00; Chi² = 3.28, df = 8 (P = 0.92); I² = 0%

Test for overall effect: Z = 3.04 (P = 0.002)

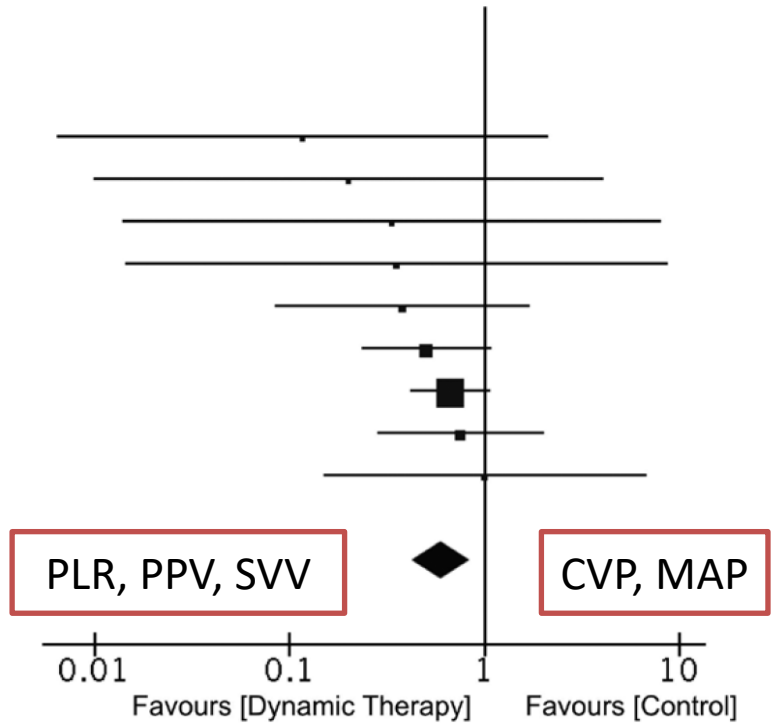


Figure 2. Effect of goal-directed fluid therapy guided by dynamic assessment of fluid responsiveness on mortality.

Crit Care Med 2017; 45:1538–1545

Systematic Review and Meta-Analysis

Medicine®

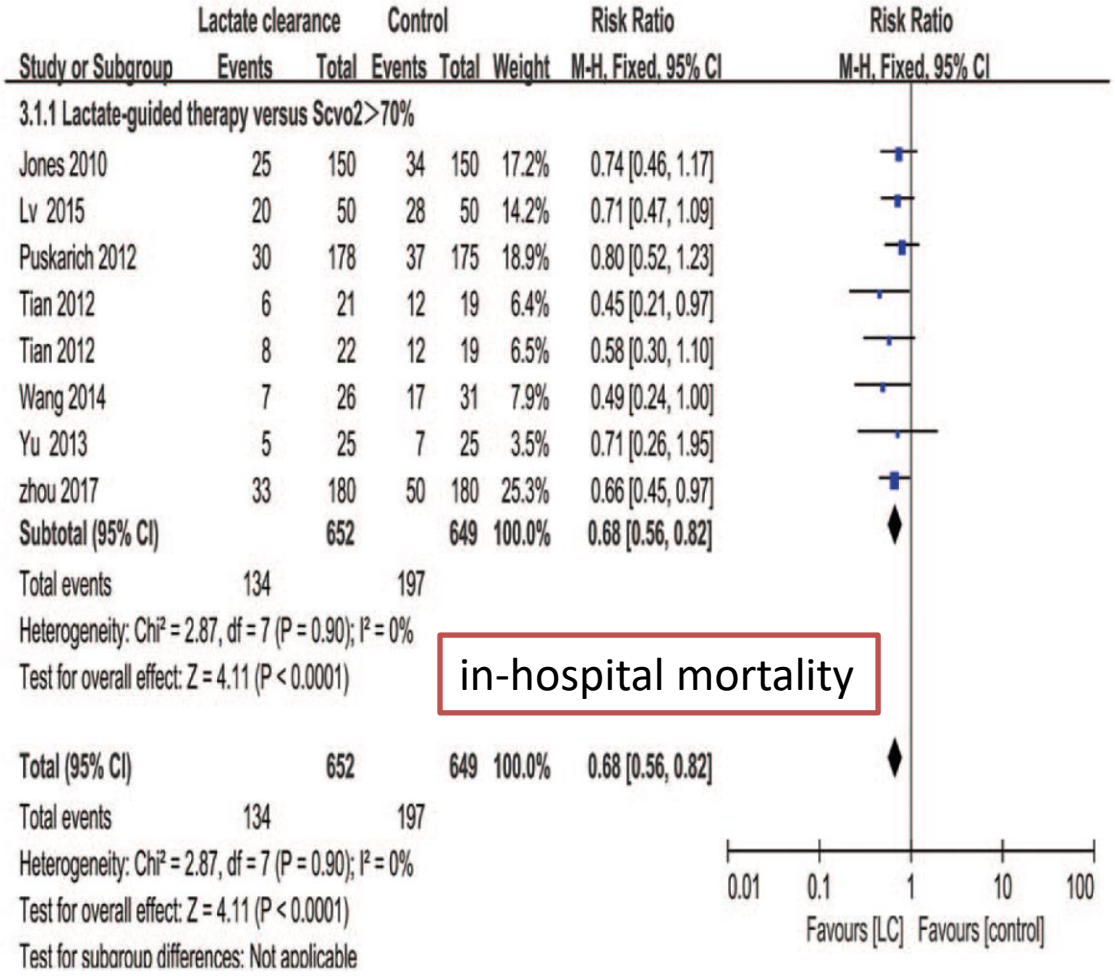
OPEN

Relative efficacy and safety of early lactate clearance-guided therapy resuscitation in patients with sepsis

A meta-analysis

Medicine (2019) 98:8(e14453)

lactate clearance (>10%/6h)
superior to ScvO2(>70%)



Contents lists available at SciVerse ScienceDirect

International Journal of Gerontology

journal homepage: www.ijge-online.com

Original Article

The Implementation of Sepsis Bundles on the Outcome of Patients With Severe Sepsis or Septic Shock in Intensive Care Units☆

Shu-Lien Chou [1], Khee-Siang Chan [1,2], Kuo-Chen Cheng [3,4,5], Willy Chou [1], Hui-Mei Hung [2], Chin-Ming Chen [1,2*]

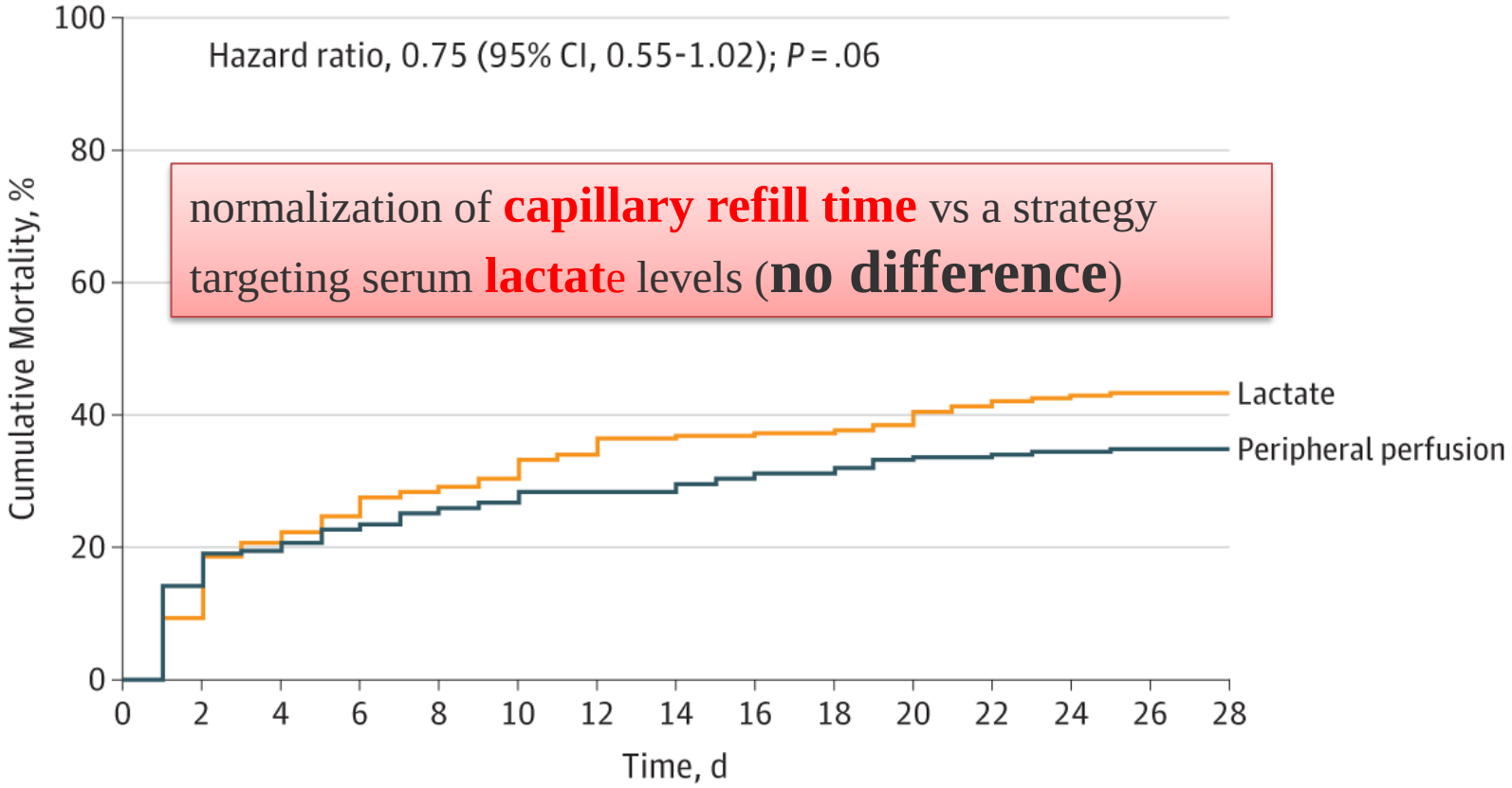
Items	Survivor(n=118)	Non-survivor(n=46)	p value†	OR (95% CI‡)	p value*
After Bundle intervention	**87(73.7%)**	**22(47.8%)**	**0.007**	**0.256(0.101~0.647)**	**0.004**
Lactate Clearance >10%	**92 (78%)**	**26 (56%)**	**0.006**	**0.340(0.132~0.873)**	**0.025**
Urinary tract infection	**42(35.6%)**	**5(10.9%)**	**0.002**	**0.280(0.084~0.938)**	**0.039**
APACHE II scores	21.5±7.7	28.3±8.1	<0.001		
TISS scores	27.0±6.9	31.8±8.9	0.002		
Coma scales					
Intra-abdominal infection	5(4.2%)	9(19.6%)	0.002		
Ventilator use	80(67.8%)	45(97.8%)	0.002		

改善嚴重敗血症或敗血性休克病人死亡:

乳酸清除>10%(ICU前後差距下降>10%)、執行套裝要素

From: **Effect of a Resuscitation Strategy Targeting Peripheral Perfusion Status vs Serum Lactate Levels on 28-Day Mortality Among Patients With Septic Shock: The ANDROMEDA-SHOCK Randomized Clinical Trial**

JAMA. 2019;321(7):654-664. doi:10.1001/jama.2019.0071



normalization of **capillary refill time** vs a strategy targeting serum **lactate** levels (**no difference**)

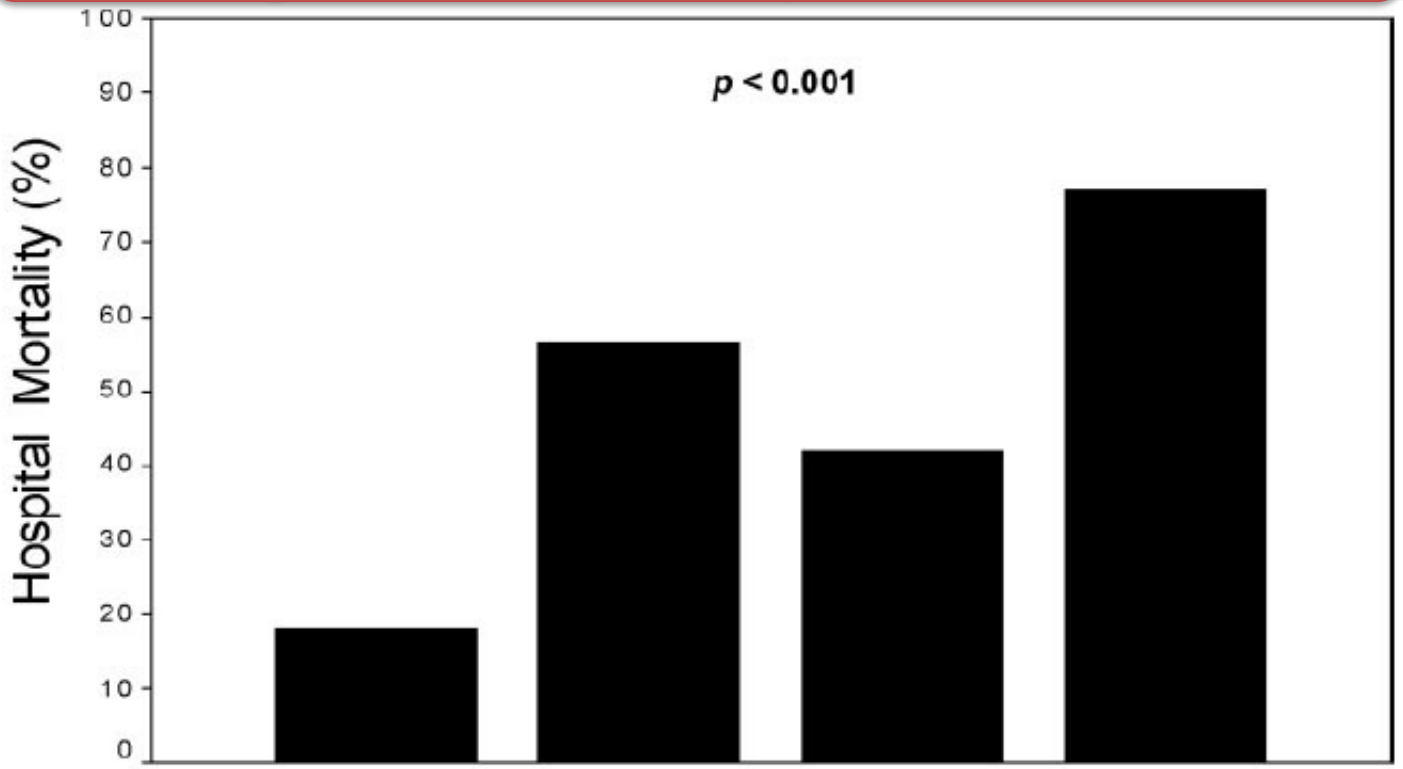
No. at risk

Lactate	212	192	168	160	152	148	140	135	134	133	130	124	122	120	120
Peripheral perfusion	212	182	171	164	159	155	152	152	148	146	142	141	139	138	138

The Importance of Fluid Management in Acute Lung Injury Secondary to Septic Shock

CHEST 2009; 136:102–109

Both **early goal-directed** and **late conservative** fluid management can influence patient outcomes



JOURNAL OF MEDICAL MICROBIOLOGY

RESEARCH ARTICLE

Chao *et al.*, *Journal of Medical Microbiology* 2017;66:1421–1428

DOI 10.1099/jmm.0.000593

MICROBIOLOGY SOCIETY

Outcomes of patients with severe influenza infection admitted to intensive care units: a retrospective study in a medical centre

Chien-Ming Chao,[1] Chih-Cheng Lai,[1] Khee-Siang Chan,[2] Kuo-Chen Cheng,[3,4] Willy Chou,[5] Kuo-Shu Yuan[6,7] and Chin-Ming Chen[2,5,*]

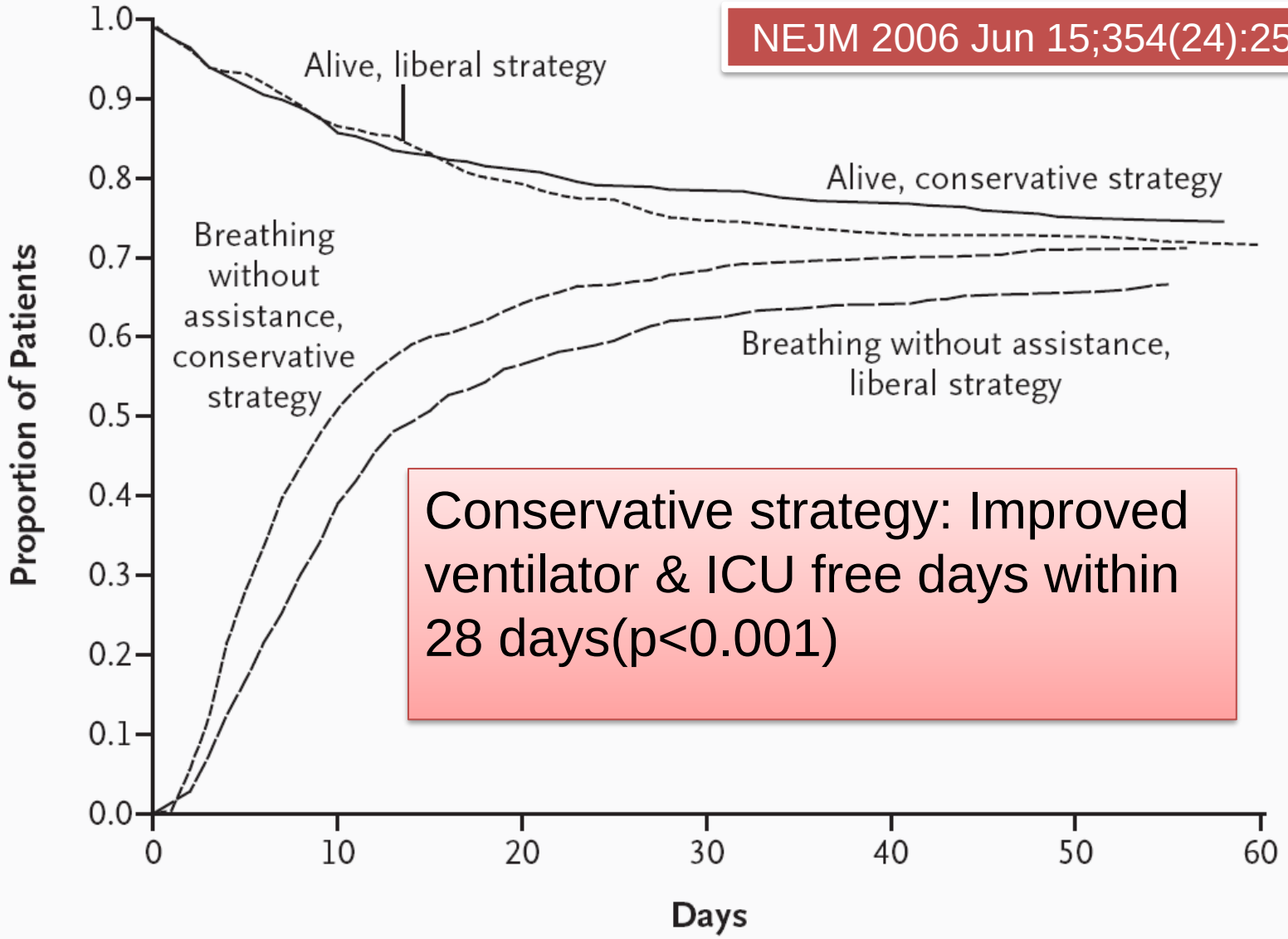
Table 5. Cox regression analysis for predictors of intensive care unit mortality (*n*=125)

Variable	β	HR	95 % CI	P value
Age* years				
50–64	0.632	1.882	0.210–16.886	0.572
≥65	0.555	1.742	0.179–16.904	0.632
APACHE II score	0.018	1.018	0.922–1.124	0.727
TISS score	0.045	1.046	0.955–1.146	0.332
Glasgow Coma Scale score	0.076	1.079	0.911–1.278	0.381
Multiple organ failures ≥2	1.286	3.618	1.058–13.662	0.048
Influenza A	0.077	1.080	0.303–3.855	0.906
ARDS at admission	0.213	1.237	0.357–4.287	0.738
APTT, second	0.017	1.017	0.987–1.048	0.260
BUN, mg dl^{-1}	0.010	1.010	0.998–1.022	0.093
Potassium, mmol l^{-1}	−0.332	0.718	0.357–1.443	0.352
Lactate, mmol l^{-1}	0.093	1.097	0.968–1.243	0.146
Platelet, 10^3 per mm^3	0.000	1.000	1.000–1.000	0.646
Mechanical ventilation	−0.769	0.464	0.083–2.584	0.381
Fluid-negative balance within 7 days of admission to ICU	−1.017	0.362	0.140–0.934	0.036

- The mortality rate of severe influenza patients admitted to the ICU was high (26.4%),
- A negative fluid balance associated with better survival

Comparison of Two Fluid-Management Strategies in Acute Lung Injury

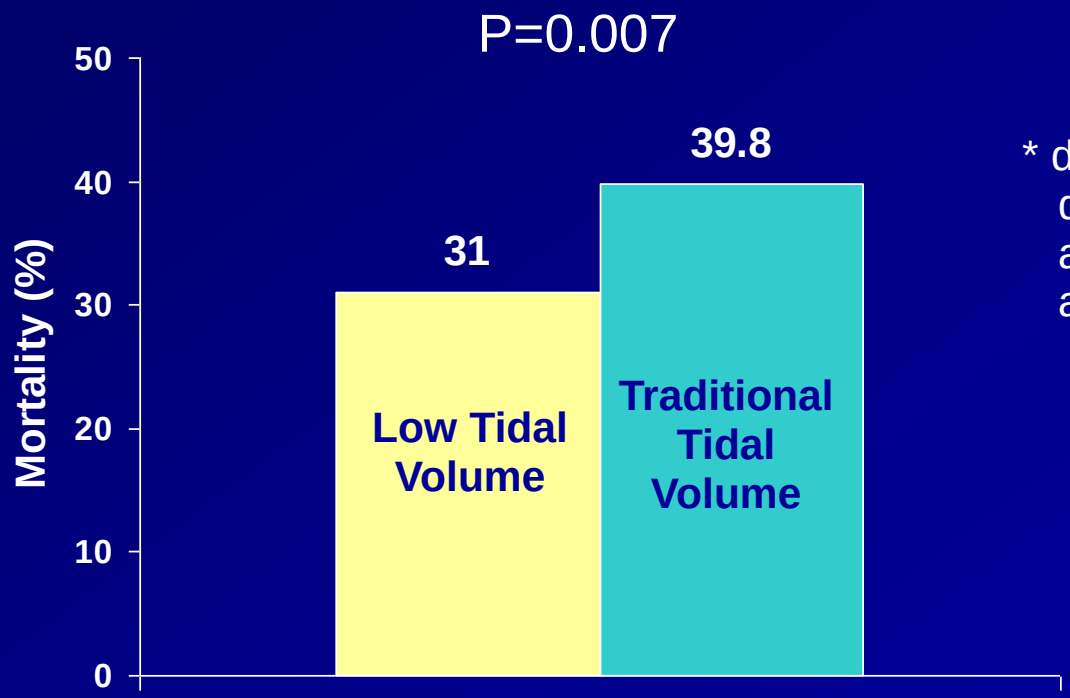
NEJM 2006 Jun 15;354(24):2564-75



Conservative strategy: Improved ventilator & ICU free days within 28 days($p<0.001$)

Mechanical Ventilation of Sepsis-Induced Acute Lung Injury (ALI)/ARDS

Mortality* - Low vs Traditional Tidal Volume



* death before discharge home and breathing without assistance

ARDSNet. N Eng J Med 2000;342:1301-1308.

Lung protective ventilation strategy for the acute respiratory distress syndrome (Review)

Analysis 1.1. Comparison 1 Protective versus conventional, Outcome 1 Mortality at the end of the follow up period for each trial.

THE COCHRANE COLLABORATION

Review: Lung protective ventilation strategy for the acute respiratory distress syndrome

Comparison: 1 Protective versus conventional

Outcome: 1 Mortality at the end of the follow up period for each trial

Mortality is lower with LPS for ARDS

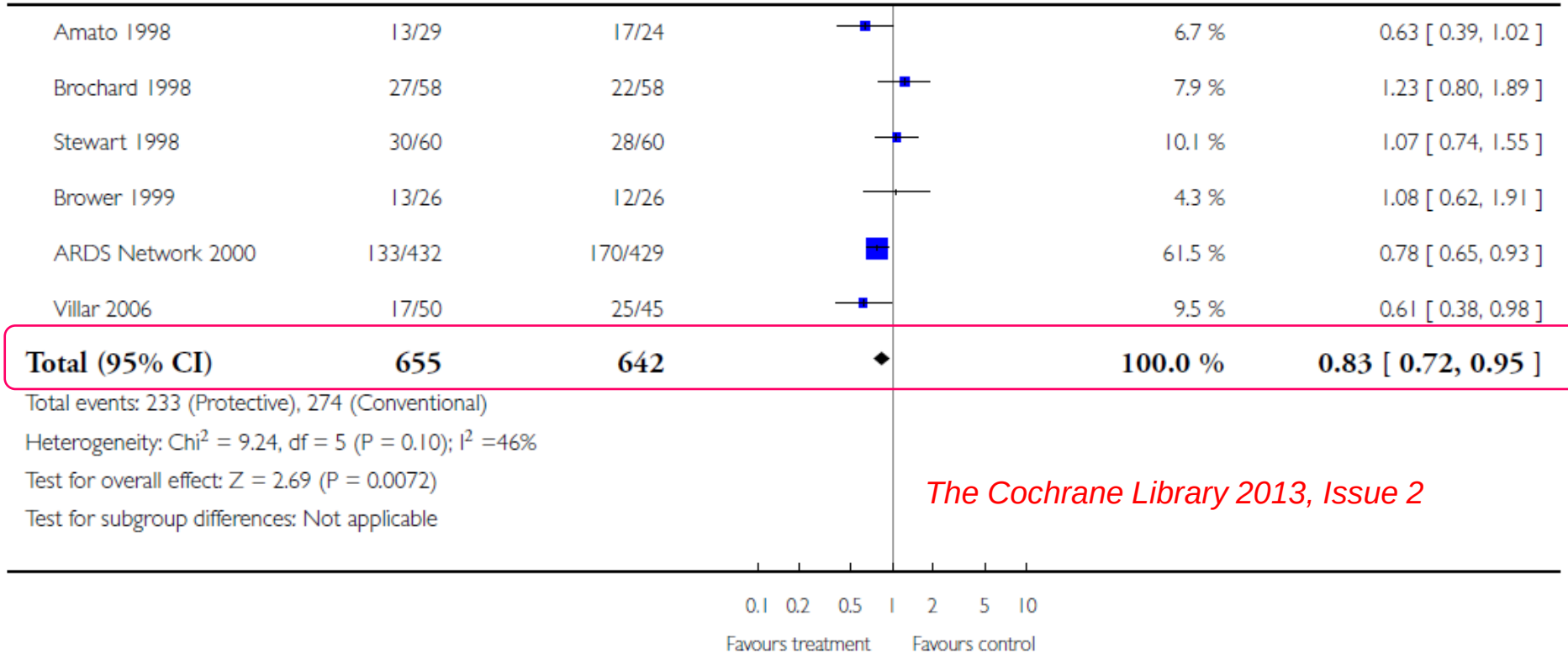
Study or subgroup	Protective n/N	Conventional n/N	Risk Ratio M-H,Fixed,95% CI	Weight	Risk Ratio M-H,Fixed,95% CI
Amato 1998	13/29	17/24		6.7 %	0.63 [0.39, 1.02]
Brochard 1998	27/58	22/58		7.9 %	1.23 [0.80, 1.89]
Stewart 1998	30/60	28/60		10.1 %	1.07 [0.74, 1.55]
Brower 1999	13/26	12/26		4.3 %	1.08 [0.62, 1.91]
ARDS Network 2000	133/432	170/429		61.5 %	0.78 [0.65, 0.93]
Villar 2006	17/50	25/45		9.5 %	0.61 [0.38, 0.98]
Total (95% CI)	**655**	**642**		**100.0 %**	**0.83 [0.72, 0.95]**

Total events: 233 (Protective), 274 (Conventional)

Heterogeneity: $Chi^2 = 9.24$, df = 5 (P = 0.10); $I^2 = 46\%$

Test for overall effect: Z = 2.69 (P = 0.0072)

Test for subgroup differences: Not applicable

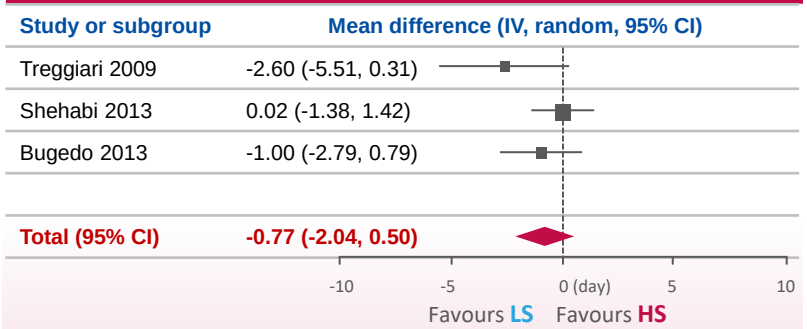


The Cochrane Library 2013, Issue 2

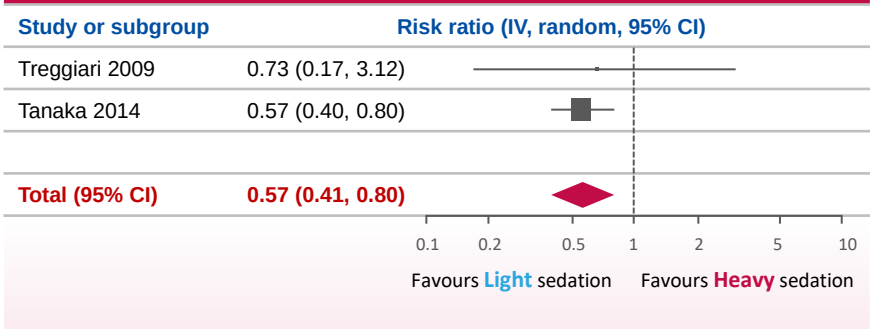
Sedation Goal in ICU Patients[1]

- Light Sedation (**RASS -2 to +1**) vs. Deep Sedation (RASS < -3)?
  - The 2013 guidelines suggested targeting **light levels of sedation** or using **daily awakening trials**, and **minimizing BZDs** to improve short-term outcomes

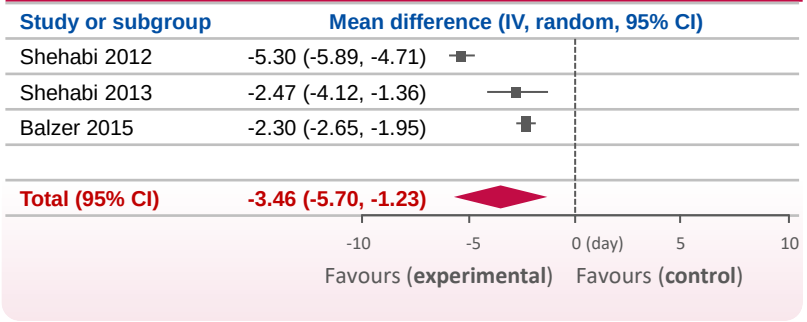
Time to extubation (3 RCTs, 453 patients)



Tracheostomy rate (1 RCT and observational study, 452 patients)



Time to extubation (3 observational studies, 1524 patients)



Light sedation was **not associated** with reduction in:

- Delirium (2 RCTS, 140 patients), RR 0.96 (95% CI, 0.80 to 1.16)
- PTSD (2 RTCs, 62 patients), RR 0.67 (95% CI, 0.12 to 3.79)
- Depression (2 RCTs, 128 patient), RR 0.76 (95% CI, 0.10 to 5.58)

1. Crit Care Med. 2018 Sep;46(9):e825-e873. (2018 PADIS Guidelines)

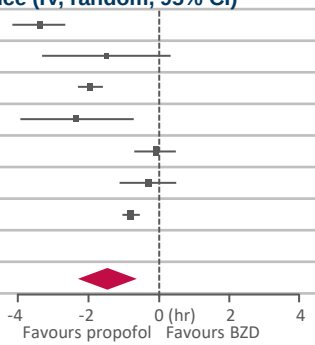
Non-BZD: First Choice of Sedative

Cardiac Surgery (Propofol > BZD)

- Propofol can reduce **1.4 hr** to extubation versus BZDs
- Propofol can achieve light sedation **52 min** faster than BZDs

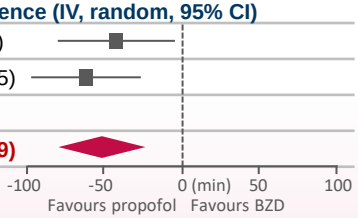
Time to extubation (7 RCTs, 409 patients)

Study or subgroup	Mean difference (IV, random, 95% CI)
Grounds 1987	-3.35 (-4.10, -2.60)
Snellen 1990	-1.48 (-3.28, 0.32)
McMurray 1990	-1.93 (-2.26, -1.60)
Roekaerts 1993	-2.35 (-3.92, -0.78)
Searle 1997	-0.07 (-0.71, 0.57)
Dowd 2001	-0.30 (-1.11, 0.51)
Ling 2008	-0.80 (-1.00, -0.60)
Total (95% CI)	**-1.41 (-2.19, -0.64)**



Time to light sedation (2 RCTs, 70 patients)

Study or subgroup	Mean difference (IV, random, 95% CI)
Snellen 1990	-42.00 (-78.82, -5.18)
Rorkaerts 1993	-61.00 (-96.65, -25.35)
Total (95% CI)	**-51.80 (-77.42, -26.19)**

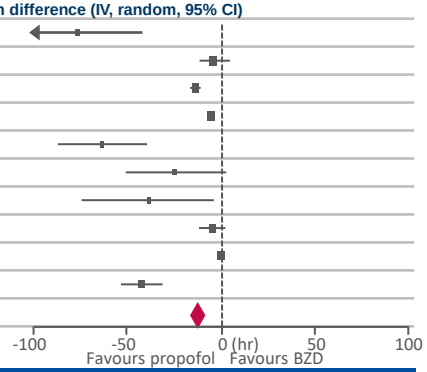


Noncardiac Surgery (Propofol, Dexmed. > BZD)

- Propofol can reduce **11.6 hr** to extubation versus BZDs
- Propofol can achieve light sedation **7.2 hr** faster than BZDs

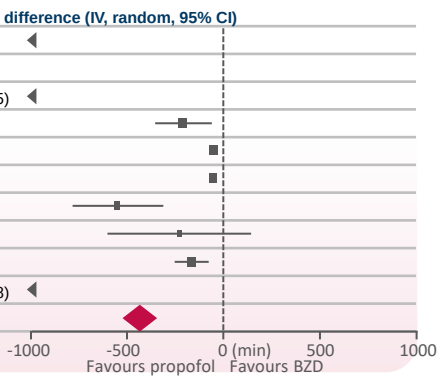
Time to extubation (10 RCTs, 423 patients)

Study or subgroup	Mean difference (IV, random, 95% CI)
Boeke 1989	-76.20 (-109.59, -42.81)
Clarke 1991	-3.54 (-11.23, 4.15)
Carrasco 1993 2	-13.10 (-15.36, -10.84)
Costa 1994	-5.20 (-5.65, -4.75)
Barrientos-Vega 1997	-63.10 (-86.70, -39.50)
Hall 2001 2	-23.90 (-49.91, 2.11)
Hall 2001 3	-38.40 (-73.18, -3.62)
Mesnil 2011	-4.57 (-10.58, 1.44)
Srivistava 2014	0.35 (0.30, 0.41)
Zhou 2014	-42.00 (-52.67, -31.33)
Total (95% CI)	**-11.60 (-15.62, -7.58)**



Time to light sedation (10 RCTs, 357 patients)

Study or subgroup	Mean difference (IV, random, 95% CI)
Carrasco 1993 2	-1176.00 (-1373.44, -978.56)
Carrasco 1993	Not estimable
Carrasco 1993 3	-3174.00 (-3632.15, -2715.85)
Chamorro 1996 2	-210.00 (-355.22, -64.78)
Chamorro 1996	-50.00 (-63.07, -36.93)
Weinbroum 1997	-60.0 (-71.53, -48.47)
Sanchez 1998	-550.00 (-778.43, -321.57)
Sandiumenge 2000	-227.00 (-592.05, 138.05)
Mesnil 2011	-168.90 (-249.86, -87.94)
Zhou 2014	-3390.00 (-4334.52, -2445.48)
Total (95% CI)	**-433.50 (-534.47, -332.52)**



Crit Care Med. 2018 Sep;46(9):e825-e873. (2018 PADIS Guidelines)

ICU rehabilitation

Mobility Is Medicine

Endothelium function

Neuromuscular integrity

CV function

Sugar homeostasis

Chronic inflammation

Depression

Early, goal-directed mobilisation in the surgical intensive care unit: a randomised controlled trial

The Lancet 2016

*Stefan J Schaller, Matthew Anstey, Manfred Blobner, Thomas Edrich, Stephanie D Grabitz, Ilse Gradwohl-Matis, Markus Heim, Timothy Houle, Tobias Kurth, Nicola Latronico, Jarone Lee, Matthew J Meyer, Thomas Peponis, Daniel Talmor, George C Velmahos, Karen Waak, J Matthias Walz, Ross Zafonte, Matthias Eikermann, for the International Early SOMS-guided Mobilization Research Initiative**

	Mobility (n=104)	Control (n=96)	P value
Total PT minutes in ICU	60 (0-110)	48 (20-128)	
Sedation Score (RASS)	-0.7 (0.1)	-0.8 (0.1)	
Mean SOMS in ICU	2.2 (1.0)	1.5 (0.8)	<0.001
Walking at ICU D/C	52%	25%	
ICU / Hospital LOS	7 (5-12) / 15 (11-27)	10 (6-15) / 22 (15-30)	0.005 / 0.01
Func Indepen / DC home	51% / 51%	28% / 27%	0.003 /<0.001
ICU delirium-free days	25 (16-27)	22 (15-25)	0.016

- **Adverse events:**
  - No serious adverse events, no imp't difference between groups
  - In-hospital/3-mo. death: 16% v. 8% (p=0.09) / 22% v. 17% (p=0.35)

海報文章

ACRM
AMERICAN CONGRESS OF REHABILITATION MEDICINE

Archives of Physical Medicine and Rehabilitation

journal homepage: www.archives-pmr.org

Archives of Physical Medicine and Rehabilitation 2017;98:931-9

ORIGINAL RESEARCH

SCI, IF:3.289, 5/65

Early Mobilization Reduces Duration of Mechanical Ventilation and Intensive Care Unit Stay in Patients With Acute Respiratory Failure

Chih-Cheng Lai, MD,[a,*] Willy Chou, MD,[b,*] Khee-Siang Chan, PhD,[c] Kuo-Chen Cheng, MD,[d,e] Kuo-Shu Yuan, PhD,[f,g] Chien-Ming Chao, MD,[a] Chin-Ming Chen, MD[b,c]

Correspondence author

Journal Metrics

2016 Impact Factor: **3.289**

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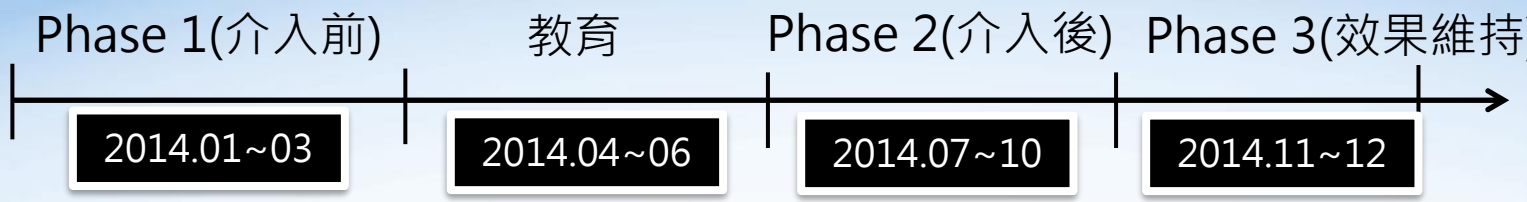
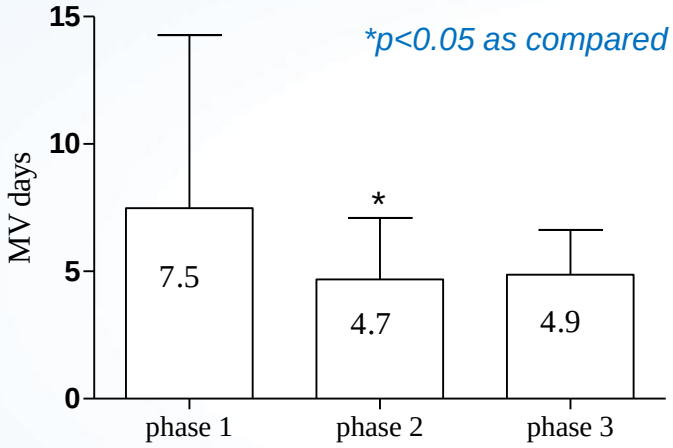
Clinical outcomes of different groups

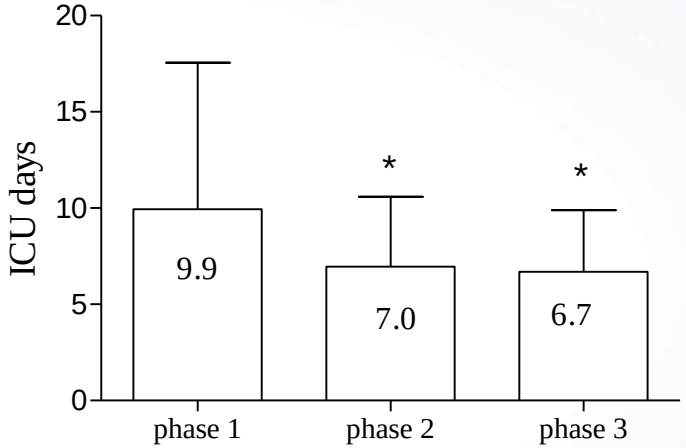


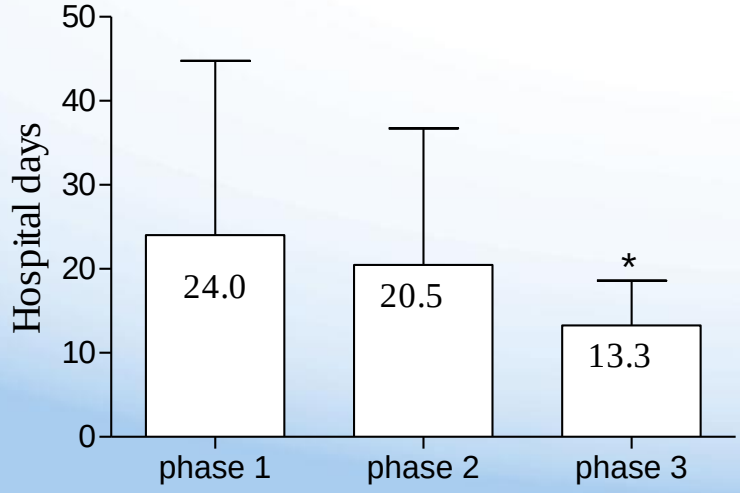
介入前(63 pts)

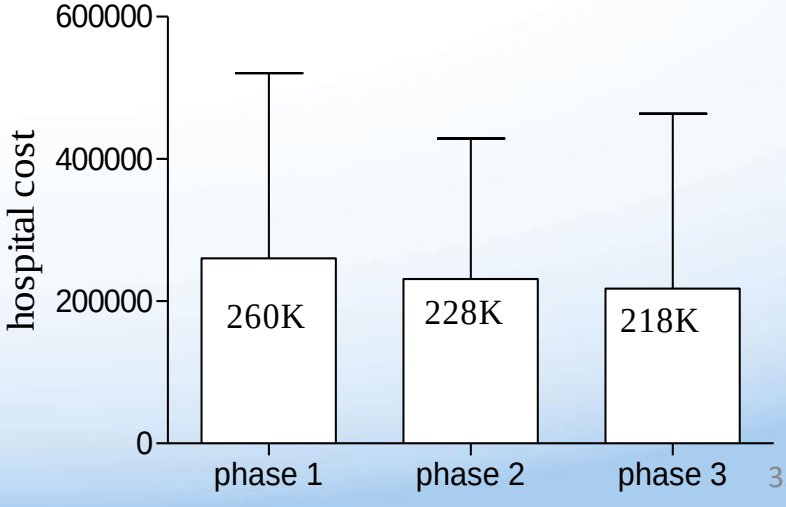
介入前(90 pts)

*p<0.05 as compared with phase 1









Original Paper

Chronic Respiratory Disease

Effectiveness of early rehabilitation on patients with chronic obstructive lung disease and acute respiratory failure in intensive care units: A case–control study

Chronic Respiratory Disease
Volume 16: 1–8

DOI: 10.1177/1479973118820310
journals.sagepub.com/home/crd
SAGE

(***SCI, IF*: 2.275, *correspondence author**, 39/60)

Early rehabilitation for COPD pts in the ICU with ARF is associated with↓ **MV duration**

Willy Chou[1,2,*], Chih-Cheng Lai[3,*], Kuo-Chen Cheng[4,5], Kuo-Shu Yuan[6,7], Chin-Ming Chen[2,8] and Ai-Chin Cheng[9,10]

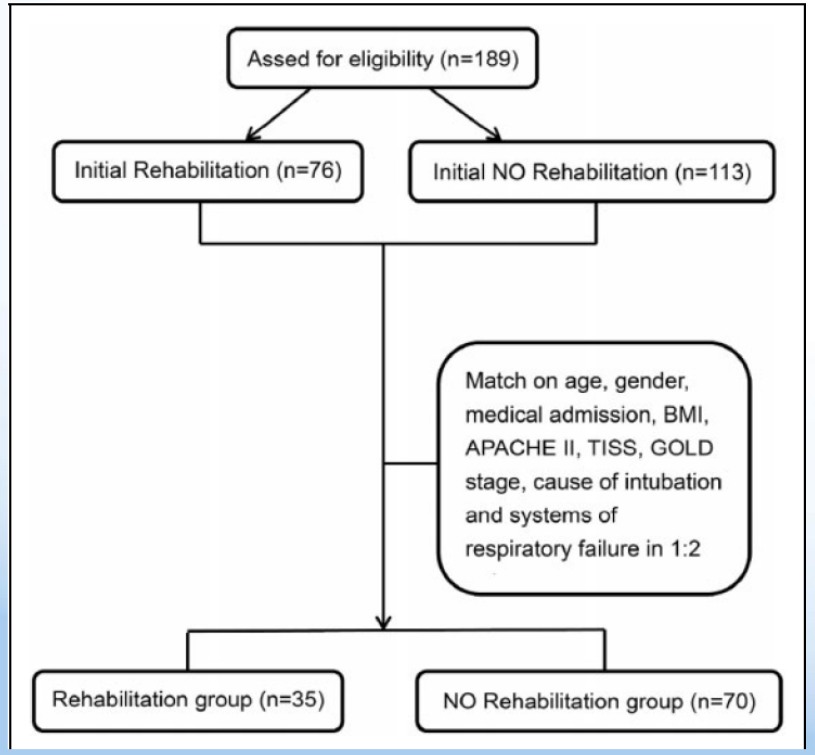


Table 3. Clinical outcomes of the groups.[a]

Groups: Variables	Total (n = 105)	Rehabilitation (n = 35)	No rehabilitation (n = 70)	p
28-Day survival	97 (92.4)	33 (94.3)	64 (91.4)	0.716
Survival at discharge	90 (85.7)	31 (88.6)	59 (84.3)	0.554
Successful extubation	93 (88.6)	33 (94.3)	60 (85.7)	0.329
MV duration (hours)	152.5 ± 129.3	137.3 ± 136.9	160.1 ± 125.7	0.396
ICU stays (days)	8.1 ± 7.8	5.8 ± 6.1	9.2 ± 8.3	0.033
Hospital stays (days)	22.9 ± 21.5	17.9 ± 14.6	25.4 ± 24.0	0.095
Medical costs (×NT$10,000)	20.3 ± 19.7	15.2 ± 13.6	22.9 ± 21.7	0.058

Table 4. Multiple regression model: the predictors of MV, ICU stays, hospital stays, and medical costs after planned extubation in COPD patients with respiratory failure.

Variables	Mechanical ventilation (hours)					ICU stays (days)					Hospital stays (days)					Medical costs (×NT$10,000)				
	β	SE	t	p	95.0% CI	β	SE	t	p	95.0% CI	β	SE	t	p	95.0% CI	β	SE	t	p	95.0% CI
Rehabilitation therapy	−.188	24.327	2.115	**0.037**	−99.754	−3.137	−0.001	1.361	−0.008	0.994	−2.713	2.693	−0.058	4.622	−0.568	0.572	−11.802	6.554	−0.041	3.962	−0.429	0.669	−9.568	6.169
Age	−0.027	1.066	−0.308	0.759	−2.446	1.789	0.090	0.060	1.110	0.270	−0.052	0.185	−.039	0.203	−.388	0.699	−.481	0.324	0.079	0.174	0.840	0.403	−.199	0.491
Gender	−0.088	25.401	−1.064	0.290	−77.465	23.417	−0.033	1.421	−0.422	0.674	−3.422	2.222	0.038	4.826	0.397	0.692	−7.668	11.498	0.052	4.137	0.582	0.562	−5.808	10.623
APACHE II Score	−0.117	2.360	−1.035	0.304	−7.129	2.245	0.128	0.132	1.222	0.225	−0.101	0.424	0.110	0.448	0.854	0.395	−.507	1.273	0.132	0.384	1.092	0.277	−.343	1.183
TISS	0.062	1.868	0.668	0.506	−2.461	4.959	−0.005	0.105	−0.058	0.954	−0.214	0.202	0.103	0.355	0.967	0.336	−0.362	1.048	0.137	0.304	1.372	0.174	−.187	1.022
Hemoglobin	−0.300	5.706	−3.188	**0.002**	−29.522	−6.859	−0.156	0.319	−1.781	0.078	−1.203	0.065	−.140	1.084	−1.307	0.194	−3.570	0.736	−.146	0.929	−1.454	0.149	−3.197	0.494
Albumin	−0.089	26.254	−1.047	0.298	−79.629	24.640	−0.033	1.469	−0.411	0.682	−3.521	2.313	−0.026	4.988	−0.266	0.791	−11.232	8.578	−.028	4.276	−.310	0.757	−9.818	7.165
Comorbidity	−.198	14.089	−2.294	**0.024**	−60.307	−4.349	−0.076	0.788	−.951	0.344	−2.315	0.816	0.074	2.677	0.750	0.455	−3.309	7.323	−.016	2.295	−.175	0.861	−4.959	4.155
Pulmonary cause of respiratory failure	0.277	25.561	3.319	**0.001**	34.081	135.598	0.110	1.430	1.413	0.161	−0.819	4.861	0.220	4.856	2.308	**0.023**	1.566	20.853	0.113	4.163	1.262	0.210	−3.015	13.520

Observational Study

Medicine (2019) 98:11(e14877

Medicine®

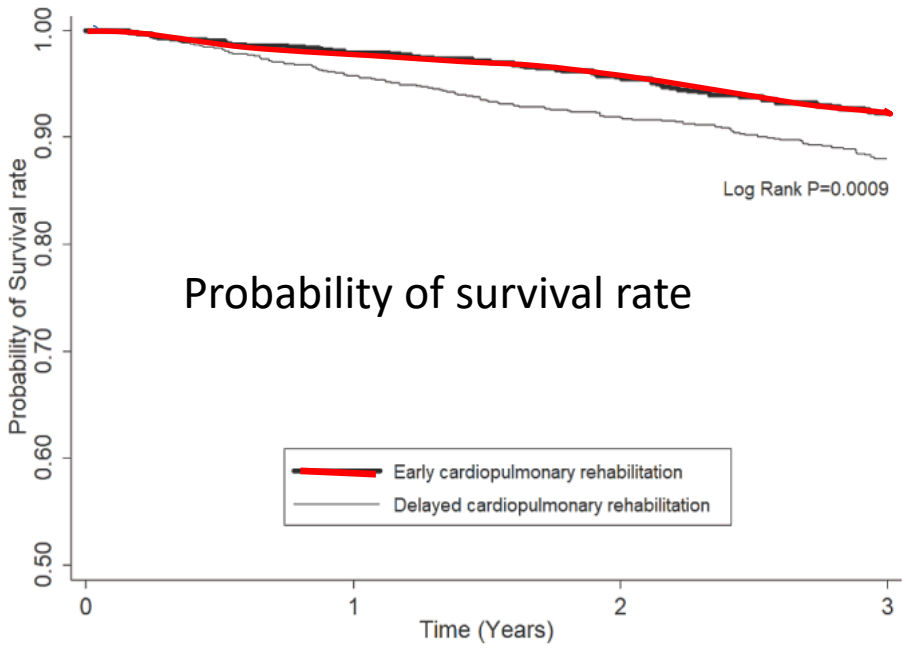
OPEN

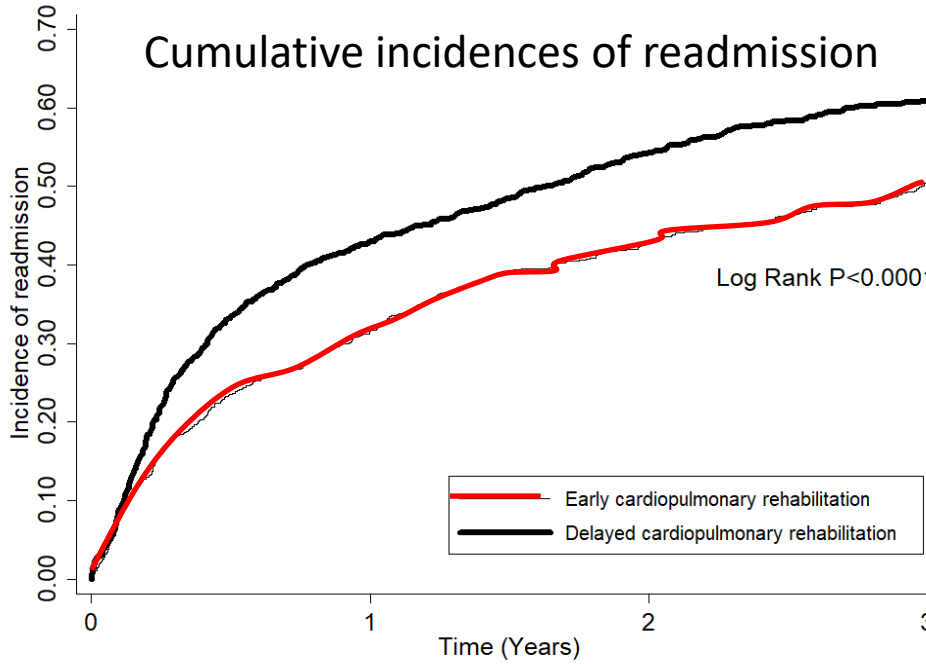
(SCI, IF:2.028,*correspondence author, 56/154)

The effect of early cardiopulmonary rehabilitation on the outcomes of intensive care unit survivors

Chih-Cheng Lai, MD[a], Willy Chou, MD[b,c], Ai-Chin Cheng, RRT[d,e], Chien-Ming Chao, MD[a], Kuo-Chen Cheng, MD[f,g], Chung-Han Ho, PhD[h], Chin-Ming Chen, MD[i,*]

Early post-discharge **rehabilitation** among ICU survivors has the long-term **survival** benefit and significantly ↓ **readmission** rate





Safety Screening --- MOVE

- **M**yocardial stability
  - (1)超過24小時無心肌缺血
  - (2)24小時內無增加抗心律不整藥物
- **O**xygenation adequate
  - (1)FiO_2<0.6
  - (2)PEEP<10cmH_2O
- **V**asopressor minimal
- **E**ngaged to voice

奇美醫療財團法人 奇美醫院
Chi Mei Medical Center

Assess readiness to wean/ Spontaneous breathing trial (SBT: T-piece, low PSV, CPAP)

Discontinuing mechanical ventilation (MV)

Two-step process:

- **Readiness testing**:
  - **Objective clinical criteria** are evaluated to determine whether a patient is ready to begin weaning.

- **Weaning:**
  - The process of decreasing ventilator support & allowing patients to assume a greater proportion of their ventilation.

Discontinuation of ventilatory support: new solutions to old dilemmas

Table 1. Clinical criteria to readiness during a spontaneous breathing trial

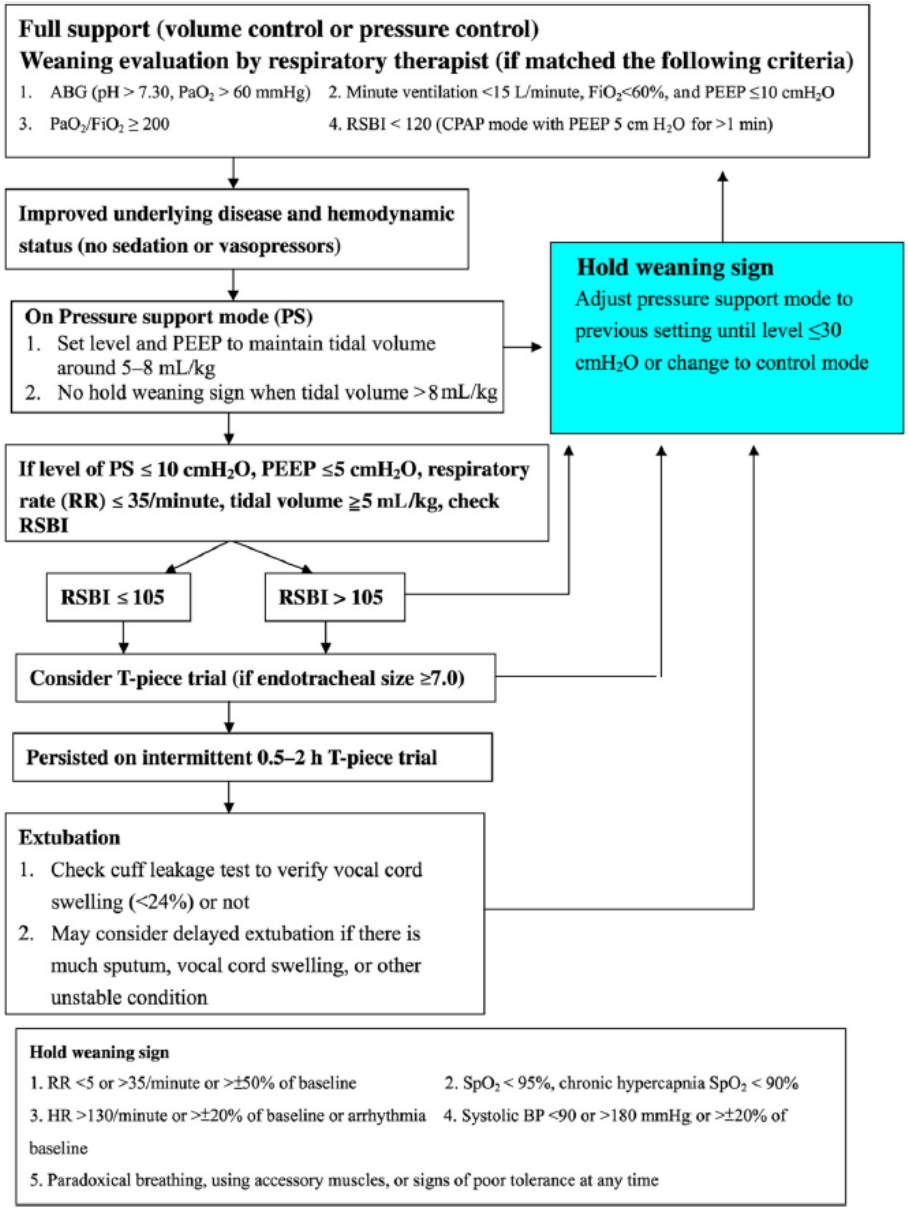
Clinical criteria	Readiness for starting weaning trial	Good tolerance of an SBT
Objectives	Adequate oxygenation (e.g., PaO_2/FiO_2 ratio 150–200; requiring positive end-expiratory pressure ≤5 to 8 cmH_2O; FiO_2 ≤0.4 to 0.5	RR <35 breaths/min
		Arterial oxygen saturation >90% or PaO_2 >60 mmHg on FiO_2 <0.4
	Febrile (temperature <38 °C).	HR <140 beats/minute or a sustained increase or decrease in the heart rate of >20%
	Hemodynamic stability (e.g., HR ≤140 bpm); stable BP; no (or minimal) pressors; no myocardial ischemia	Systolic BP <180 mmHg or >80 mmHg or change <20% from baseline
	Adequate hemoglobin (e.g., Hb ≥8–10 g/dl)	
	Adequate mentation (e.g., arousable, no continuous sedative infusions)	
Subjectives	Resolution of disease acute phase	No signs of increased work of breathing (accessory muscle use, paradoxical or asynchronous rib cage-abdominal breathing movements, intercostal retractions, nasal flaring).
	Adequate cough	No other signs of distress (profuse diaphoresis, agitation)

Curr Opin Crit Care 2015, 21:74–81

The Outcome and Predictors of Failed Extubation in Intensive Care Patients—The Elderly is an Important Predictor☆

IJG 5(2011) 206-211

Ai-Chin Cheng [1,2], Kuo-Chen Cheng [1,3,4,5], Chin-Ming Chen [2,6,7,8]*, Shu-Chen Hsing [1], Mei-Yi Sung [1]



W:weaning parameters
E:Electrolyte
A:ABG
N:nutrition
S:secretion
N:neuromuscular block agent
O:obstruction of airway
W:wait underlying disease

Chi-Mei weaning protocol

Classification of Weaning

- **Simple weaning:**
  - Patient tolerates first SBT and is successfully extubated (70% of all patients)
- **Difficult weaning:**
  - Patient fails to tolerate initial SBT, successful weaning requiring up to three SBTs or up to 7 days from first SBT
- **Prolonged weaning:**
  - Patient fails at least three SBTs or takes more than 7 days after the first SBT.

Curr Opin Crit Care 15:36–43

Classification of patients according to the weaning process

Groups	Definition	Incidence	Tracheotomy	ICU mortality
Easy weaning	Extubation after successful first attempt of SBT	30%–58%	6%–7%	0%–13%
Difficult weaning	Patients who fail the first SBT and require up to three SBTs or up to 7 days to reach a successful extubation	26%–40%	6%–15%	1%–11%
Prolonged weaning	Patients who require >7 days after failure of the first SBT	6%–30%	10%–68%	13%–22%

ICU, intensive care unit; SBT, spontaneous breathing trial.

Boles et al Eur Respir J 2007; 29: 1033–1056
Peñuelas et al. Curr Opin Crit Care. 2015 Feb;21(1):74-81

Observational Study

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Establishing predictors for successfully planned endotracheal extubation

Chih-Cheng Lai, MD[a], Chin-Ming Chen, MD[b,d], Shyh-Ren Chiang, MD[c,d], Wei-Lun Liu, MD[a], Shih-Feng Weng, PhD[e], Mei-I Sung, RT[c], Shu-Chen Hsing, RT[c], Kuo-Chen Cheng, MD[c,f,*]

Table 1

Baseline characteristics of the 3602 patients who started weaning, stratified by weaning category.

Variable	Simple weaning n=2613 (72.6%)	Difficult weaning n=678 (18.8%)	Prolonged weaning n=311 (8.6%)	*P* value
Age (yr)	61.7±16.3	69.0±15.6	73.0±14.5	.001
≧65 years old	1186 (45.4%)	443 (65.3%)	231 (74.3%)	<.001
Males	1680 (64.3%)	443 (65.3%)	195 (62.7%)	.718
Internal Medicine	560 (21.4%)	430 (63.4%)	238 (76.5%)	<.001
APACHE II	14.5±6.7	20.6±6.8	22.8±6.9	*<.001
TISS Scale	26.9±7.9	28.2±7.6	27.2±7.5	#<.001
COMA Scale	12.7±3.2	10.5±3.6	9.5±3.4	<.001
Number of comorbidities	1.1±0.9	1.3±0.9	1.4±1.0	*<.001
Pre-extubation parameter				
RSI	49.3±28.3	60.4±28.2	70.1±39.1	<.001
MIP (cmH_2O)	38.3±14.2	36.6±13.1	35.6±14.4	*<.017
MEP (cmH_2O)	63.0±28.5	56.2±31.1	50.5±28.7	<.016
Weaning methods				
T-piece	106 (4.1%)	488 (72.0%)	266 (85.5%)	<.001
Pressure support≦8cmH_2O	890 (34.1%)	549 (81.0%)	237 (76.2%)	<.001
SBT	994 (38.0%)	661 (97.5%)	307 (98.7%)	<.001
Number of attempts weaning				
T-piece	0±0.2	1±0.8	3.2±2.4	<.001
Pressure support≦8cmH_2O	0.3±0.5	0.9±0.5	0.9±0.7	*<.001
SBT	0.4±0.5	1.9±0.7	4.1±2.4	<.001
Weaning rate (120 hrs re-on)	94.2%	92.2%	90.7%	0.029
90 day mortality	7.7%	13.9%	22.2%	<0.01

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Chi Mei Medical Center

SBT trial comparison & how long?

SBT: Spontaneous Breathing Trial

- **T-piece** breath
- **Pressure support** of 5-8 cm H_2O
- **CPAP** of 0-5 cm H_2O

- The **initial 3-5 minutes** of SBT is the test phase.
- If patient can tolerate, keep SBT for **30-120** min, then decide extubation or not.

Criteria of Tolerance on SBT

- RR > 35 bpm or > 50% change from baseline
- HR > 140 bpm or > 20% change from base line
- SBP > 180 or < 90 mmHg or > 20% change from baseline
- Oxygen saturation < 90%
- $PaCO_2$ > 10 mmHg increment
- Signs of increased WOB (respiratory paradox, use of accessory respiratory muscles)
- Change in mental status
- Excessive anxiety or agitation
- Diaphoresis

*presence of any of the above indicates **intolerance***

120 mins SBT vs. no intervention

TABLE 3. COMPLICATIONS OF RESPIRATORY FAILURE.

COMPLICATION	INTERVENTION GROUP (N = 149)	CONTROL GROUP (N = 151)	P VALUE
	no. of patients (%)		
Any	30 (20)	62 (41)	0.001
Reintubation within 48 hr	5 (3)	12 (8)	0.08
Any reintubation	6 (4)	15 (10)	0.04
Self-extubation	2 (1)	5 (3)	0.25
Tracheostomy	13 (9)	22 (15)	0.10
Mechanical ventilation for >21 days	9 (6)	20 (13)	0.04

TABLE 2. COMPARISON OF OUTCOMES BETWEEN STUDY GROUPS.

END POINT	INTERVENTION GROUP (N = 149)	CONTROL GROUP (N = 151)	P VALUE
	median no. of days (interquartile range)		
Weaning time*	1 (0–2)	3 (2–7)	<0.001
Mechanical ventilation	4.5 (2–9)	6 (3–11)	0.003
Intensive care	8 (4–18)	9 (5–16)	0.17
Hospital care	14 (9–26)	15.5 (6–30)	0.93

Complication ↓

Weaning time ↓

MV time ↓

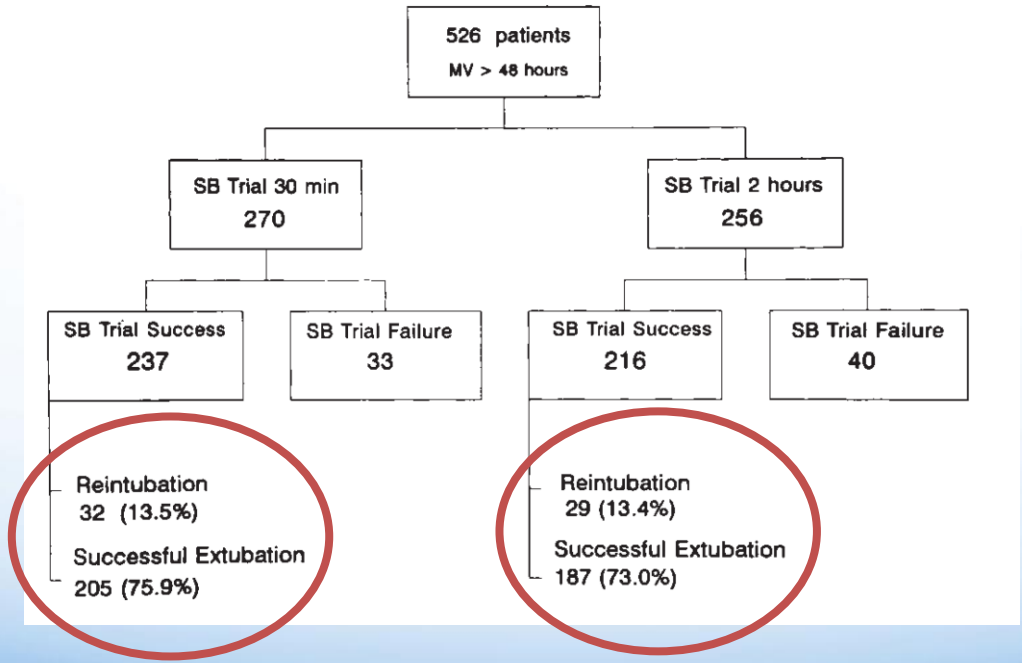
Ely EW et al N Engl J Med. 1996 Dec 19;335(25):1864-9

SBT 120mins vs 30 mins

TABLE 2

RESPIRATORY FUNCTIONAL INDICES MEASURED DURING THE FIRST 3 min AFTER DISCONTINUATION OF VENTILATOR SUPPORT AND BEFORE RANDOMIZATION TO THE TWO STUDY GROUPS

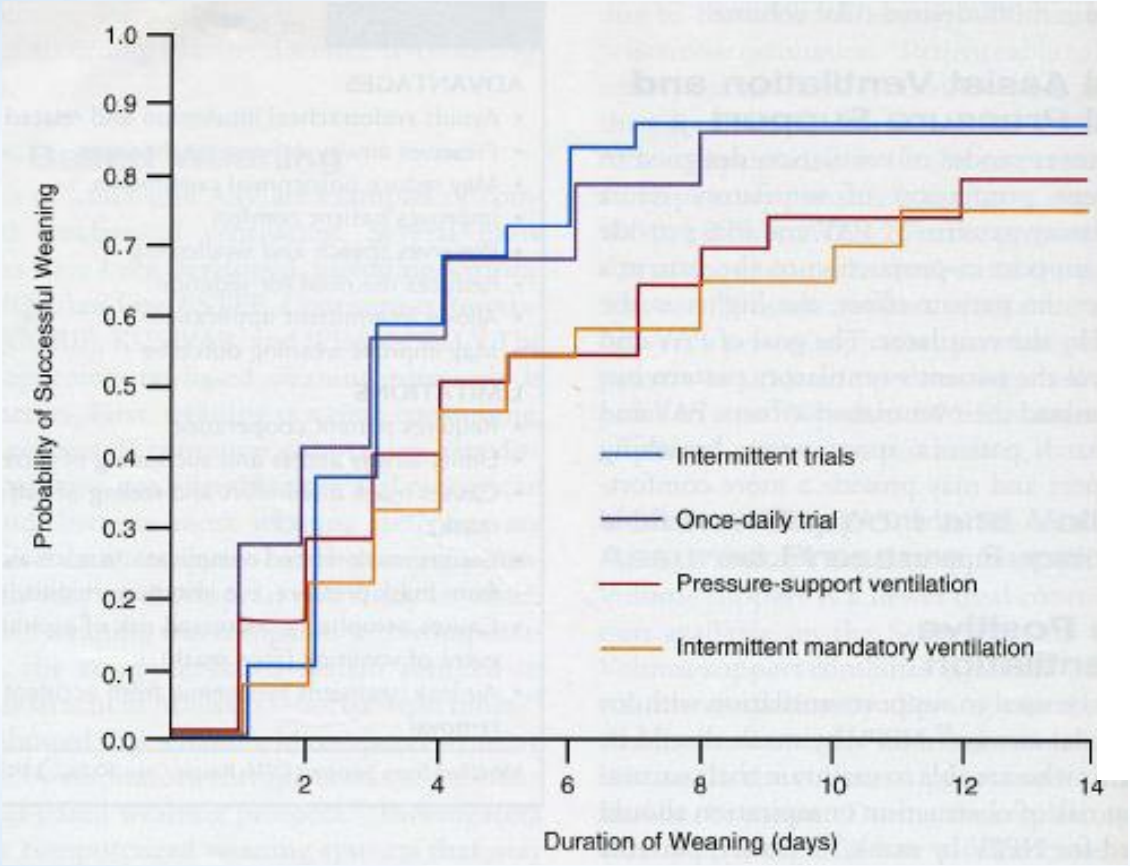
Functional Indices	30 min ($n = 270$)	120 min ($n = 256$)	p Value
Ratio of Pa_{O_2} to $F_{I_{O_2}}$	263 (220, 335)	262 (225, 323)	0.69
V_T, ml	450 (360, 575)	420 (350, 528)	0.08
Respiratory frequency, breaths/min	23 (18, 28)	24 (20, 28)	0.34
f/V_T ratio*	51 (36, 69)	55 (37, 74)	0.12
$P_{I_{max}}$, cm H_2O	−28 (−22, −38)	−28 (−24, −39)	0.94



No difference

Esteban A Am J Respir Crit Care Med 1999 159:512–518.

Which Method is Better for Weaning



Rate of successful weaning with various weaning techniques

Weaning technique	Relative rate of successful weaning (95% confidence interval)	P value
Once daily trial of spontaneous breathing vs intermittent mandatory ventilation	2.83 (1.36-5.89)	<0.006
Once daily trial of spontaneous breathing vs pressure-support ventilation	2.05 (1.04-4.04)	<0.04
Once daily trial of spontaneous breathing vs intermittent trials of spontaneous breathing	1.24 (0.64-2.41)	0.54

Proportional-hazards regression analysis was used to estimate the 95 percent confidence interval of the relative rate of successful weaning.
Data from Esteban, A, Frutos, F, Tobin, MJ, et al, N Engl J Med 1995; 332:345.

UpToDate®

Once daily SBT(T-piece trial) is better than **IMV** & PSV(?)

Esteban A, N Engl J Med 1995

JAMA | Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT

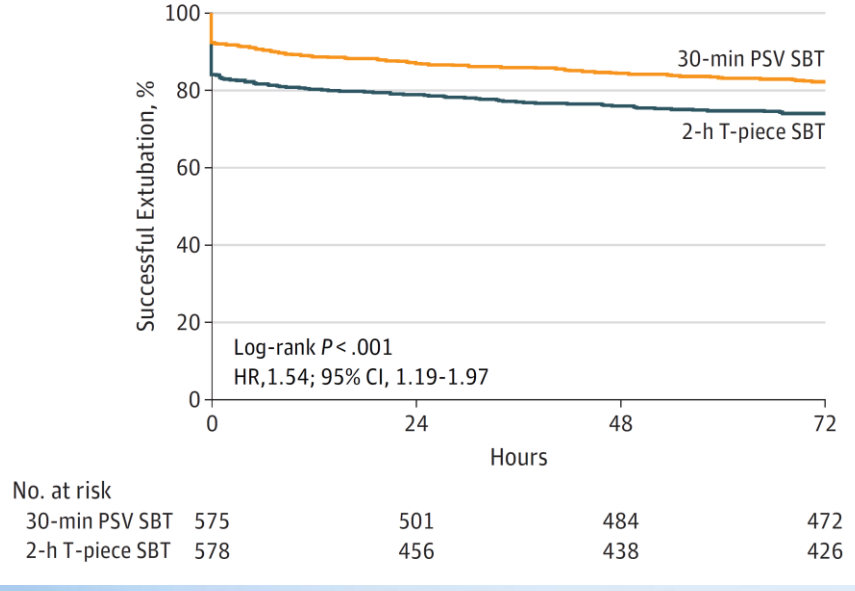
Effect of Pressure Support vs T-Piece Ventilation Strategies During Spontaneous Breathing Trials on Successful Extubation Among Patients Receiving Mechanical Ventilation

A Randomized Clinical Trial

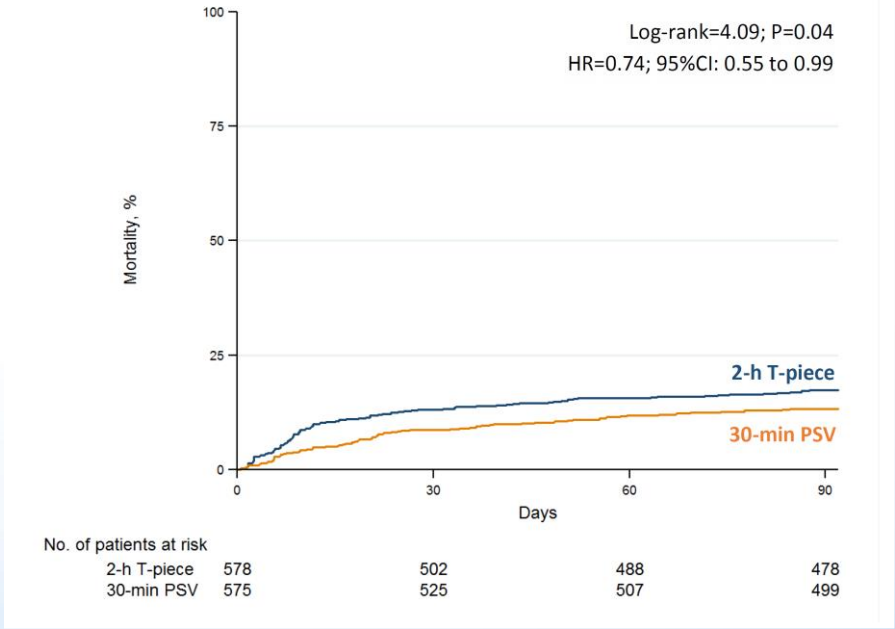
JAMA. 2019;321(22):2175-2182

SBT trail by **PSV(PS:8) 30'** had a **better outcome** (successful weaning, 90 days mortality) than **T-piece 120'**

Figure 2. Probability of Successful Extubation After First SBT in Each Group



eFigure 1. Probability of 90-Day Mortality According to Group Allocation



Liberation From Mechanical Ventilation in Critically Ill Adults: An Official American College of Chest Physicians/American Thoracic Society Clinical Practice Guideline

Inspiratory Pressure Augmentation During Spontaneous Breathing Trials, Protocols Minimizing Sedation, and Noninvasive Ventilation Immediately After Extubation

SBT with **PSV** vs T-piece: ↑rate of successful **extubation** at 48 hours (85 vs 77 %) ; insignificant ↓ in ICU mortality (9 vs 12 %)

TABLE 4] Evidence Profile for Conducting the Spontaneous Breathing Trial With or Without Inspiratory Pressure Augmentation[12-15]

Quality Assessment							No. of Patients		Effect			
No. of Studies	Study Design	Risk of Bias	Inconsistency	Indirectness	Imprecision	Other Considerations	SBT Conducted With Pressure Augmentation	SBT Conducted Without Pressure Augmentation	Relative (95% CI)	Absolute (95% CI)	Quality	Importance
Extubation success												
4	Randomized trials	Serious[a]	Not serious	Not serious	Not serious	None	312 of 423 (73.8%)	303 of 452 (67.0%)	RR, 1.09 (1.02-1.18)	60 more per 1,000 (from 13 more to 121 more)	Moderate[a]	Critical
Successful SBT												
3	Randomized trials	Serious[a]	Not serious	Not serious	Not serious	None	388 of 488 (79.5%)	331 of 452 (73.2%)	RR, 1.11 (1.0-1.18)	81 more per 1,000 (from 22 more to 132 more)	Moderate[a]	Important
Short-term mortality (assessed with ICU mortality)												
2	Randomized trials	Serious[a]	Not serious	Not serious	Serious[b]	None	26 of 300 (8.7%)	36 of 307 (11.7%)	RR, 0.74 (0.45-1.24)	30 less per 1,000 (from 28 more to 64 less)	Low[a,b]	Important

CHEST 2017; 151(1):166-180

奇美醫療財團法人 奇美醫院
Chi Mei Medical Center

Weaning Index /Protocol

Weaning predictors[1]

Measurements of oxygenation and gas exchange
PaO_2/FiO_2
PaO_2/PAO_2
Alveolar-arterial (A-a) oxygen gradient
Dead space (V_D/V_T)
Simple measurements of respiratory system load and respiratory muscle capacity
Negative inspiratory force (NIF) or maximal inspiratory pressure (MIP)*
Respiratory system compliance (dynamic, static)
Respiratory system resistance
Total minute ventilation*
Vital capacity
Respiratory frequency*
Tidal volume*

$PaO_2/FiO_2 > 150$

MIP

Compliance

Minute ventilation

Integrative indices

Frequency-tidal volume ratio, f/V_T, or rapid shallow breathing index (RSBI)*

RSBI

CROP index (dynamic **C**ompliance, **R**espiratory rate, **O**xygenation, maximal inspiratory **P**ressure)*

Integrative Weaning Index (IWI)

IWI = [(Cst,rs)*SaO2] / [f/VT]

Inspiratory Effort Quotient (IEQ)

IEQ

CROP index= [Cdyn * MIP * (PaO2/PAO2)] / R

Complex measurements (may require special equipment)

Airway occlusion pressure measured at 100 msec (P0.1)

P0.1

P0.1/MIP*

Esophageal pressure

Oxygen cost of breathing (O2COB)

Oxygen cost of breathing

Mechanical work of breathing

Work of breathing

Pdi/Pdimax

Tension-time index

Gastric intramucosal pH or P_gCO_2

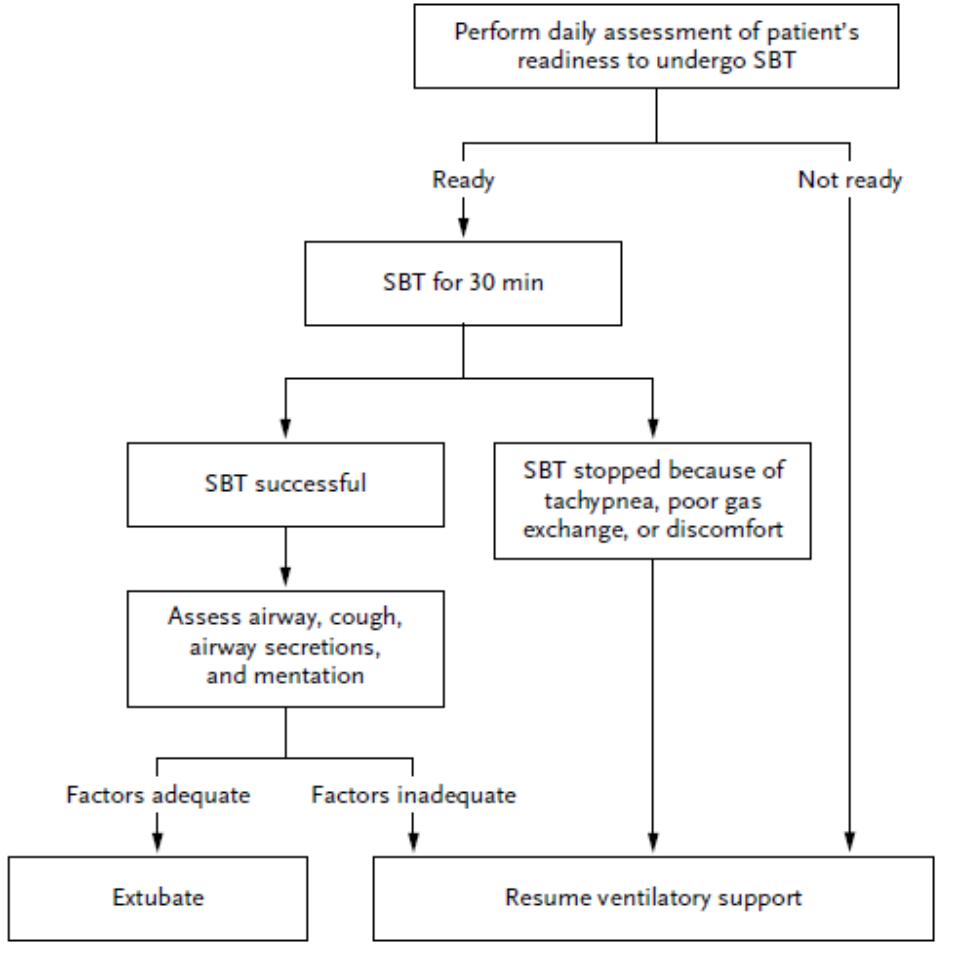
Gastric PH

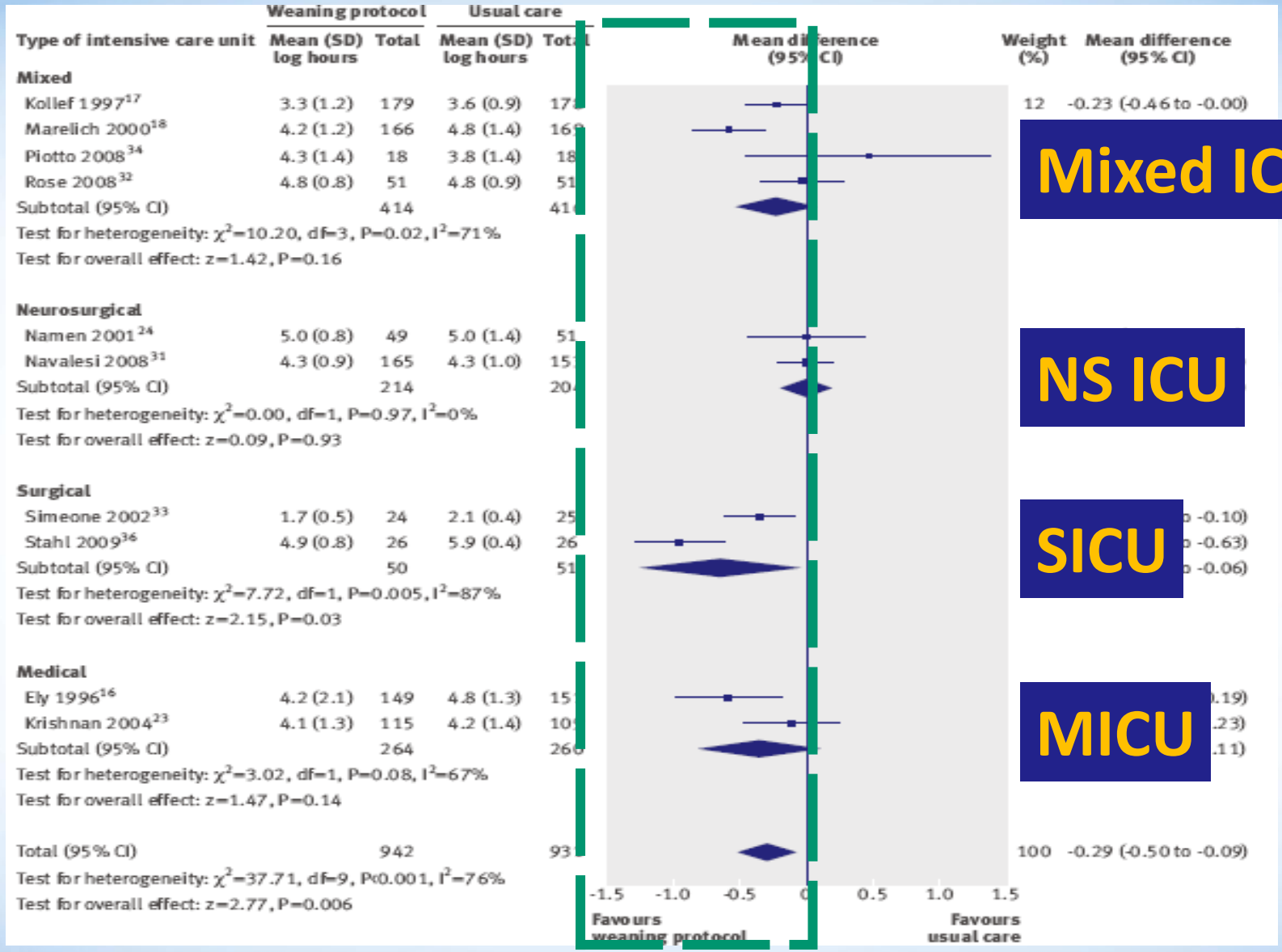
The NEW ENGLAND JOURNAL of MEDICINE

REVIEW ARTICLE

Weaning Patients from the Ventilator

N Engl J Med 2012;367:2233-9.





Favor Protocol

Blackwood et al. BMJ 2011; 342:c7237.

Automated versus non-automated weaning for reducing the duration of mechanical ventilation for critically ill adults and children (Review)

Cochrane Database of Systematic Reviews 2014, Issue 6. Art. No.: CD009235

21 randomized studies (1676 patients)

Analysis 1.9. Comparison 1 Primary analysis: automated closed loop system versus non-automated system, Outcome 9 Secondary outcome 5.1: mortality.

Study or subgroup	Automated n/N	Non-automated n/N	Risk Ratio M-H, Random, 95% CI	Weight	Risk Ratio M-H, Random, 95% CI
1.9.1 ICU mortality					
Agarwal 2013	8/23	9/25		8.8%	0.97[0.45,2.08]
Hendrix 2006	0/10	0/10			Not estimable
Jouvet 2013	1/15	0/15		0.55%	3[0.13,68.26]
Liu 2013	4/19	4/20		3.45%	1.05[0.31,3.62]
Rose 2008	7/51	1/51		1.25%	7[0.89,54.87]
Strickland 1993	0/9	1/6		0.57%	0.23[0.01,4.93]
Subtotal (95% CI)	**127**	**127**		**14.63%**	**1.23[0.58,2.6]**
Total events: 20 (Automated), 15 (Non-automated)					
Heterogeneity: Tau^2=0.14; Chi^2=4.87, df=4(P=0.3); I^2=17.88%					
Test for overall effect: Z=0.53(P=0.6)					
1.9.2 30 day mortality					
Kirakli 2011	9/49	9/48		7.46%	0.98[0.43,2.26]
Schädler 2012	29/150	24/150		20.42%	1.21[0.74,1.97]
Subtotal (95% CI)	**199**	**198**		**27.88%**	**1.14[0.75,1.75]**
Total events: 38 (Automated), 33 (Non-automated)					
Heterogeneity: Tau^2=0; Chi^2=0.18, df=1(P=0.67); I^2=0%					
Test for overall effect: Z=0.63(P=0.53)					
1.9.3 Hospital					
Burns 2013	13/49	11/43		10.74%	1.04[0.52,2.07]
Lellouche 2006	28/74	20/70		22%	1.32[0.83,2.12]
Walkey 2011	1/15	6/18		1.32%	0.2[0.03,1.48]
Xirouchaki 2008	25/108	30/100		23.43%	0.77[0.49,1.22]
Subtotal (95% CI)	**246**	**231**		**57.49%**	**0.95[0.62,1.45]**

Favours automated 0.01 0.1 1 10 100 Favours non-automated

Analysis 1.7. Comparison 1 Primary analysis: automated closed loop system versus non-automated system, Outcome 7 Ventilation duration of by non-automated strategy (control arm).

Study or subgroup	Automated N	Automated Mean(SD)	Non-automated N	Non-automated Mean(SD)	Mean Difference Random, 95% CI	Weight	Mean Difference Random, 95% CI
1.7.1 Usual care							
Jouvet 2013	15	5 (0.7)	15	5.4 (0.9)		1.68%	-0.32[-0.9,0.26]
Rose 2008	51	4.8 (0.8)	51	4.8 (0.9)		5.7%	-0.05[-0.37,0.27]
Subtotal ***	**66**		**66**			**7.39%**	**-0.11[-0.39,0.17]**
Heterogeneity: Tau^2=0; Chi^2=0.64, df=1(P=0.43); I^2=0%							
Test for overall effect: Z=0.79(P=0.43)							
1.7.2 Protocolized weaning (non-automated)							
Agarwal 2013	23	4.8 (1)	25	5 (0.9)		2.08%	-0.18[-0.71,0.35]
Aghadavoudi 2012	41	2.1 (0.4)	40	2 (0.3)		28.31%	0.04[-0.1,0.18]
Burns 2013	48	5.5 (0.6)	43	5.6 (1.1)		4.43%	-0.05[-0.41,0.31]
Hendrix 2006	10	2 (0.3)	10	2.3 (0.2)		11.82%	-0.25[-0.47,-0.03]
Kirakli 2011	49	5 (0.9)	48	5.1 (0.9)		4.77%	-0.12[-0.47,0.23]
Lellouche 2006	74	5.1 (0.8)	70	5.3 (1)		6.63%	-0.24[-0.53,0.05]
Liu 2013	19	4.9 (0.5)	20	5.3 (0.9)		2.91%	-0.34[-0.78,0.1]
Petter 2003	16	1 (0.5)	18	1.2 (0.3)		7.12%	-0.17[-0.45,0.11]
Ramet 2002	9	4.6 (0.4)	9	4.4 (0.7)		2%	0.24[-0.3,0.78]
Schädler 2012	150	3.8 (1.2)	150	4 (1.2)		7.45%	-0.17[-0.45,0.11]
Sulzer 2001	16	1.2 (0.5)	20	1.4 (0.8)		3.59%	-0.23[-0.63,0.17]
Xirouchaki 2008	108	5.3 (0.8)	100	5.5 (0.8)		11.51%	-0.14[-0.36,0.08]
Subtotal ***	**563**		**553**			**92.61%**	**-0.11[-0.19,-0.03]**
Heterogeneity: Tau^2=0; Chi^2=10.2, df=11(P=0.51); I^2=0%							
Test for overall effect: Z=2.69(P=0.01)							
Total ***	**629**		**619**			**100%**	**-0.11[-0.18,-0.03]**
Heterogeneity: Tau^2=0; Chi^2=10.83, df=13(P=0.62); I^2=0%							
Test for overall effect: Z=2.81(P=0.01)							
Test for subgroup differences: Chi^2=0, df=1 (P=0.98), I^2=0%							

Favours automated -2 -1 0 1 2 Favours non-automated

Automated weaning (Proprietary computerized, closed loop weaning software packages) **↓MV duration (10%) & ICU LOS (8 %).** There was **no difference in mortality rates**

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Chi Mei Medical Center

Extubation success /Predictor

REVIEW ARTICLE

Table 2. Risk Factors for Unsuccessful Discontinuation of Mechanical Ventilation.

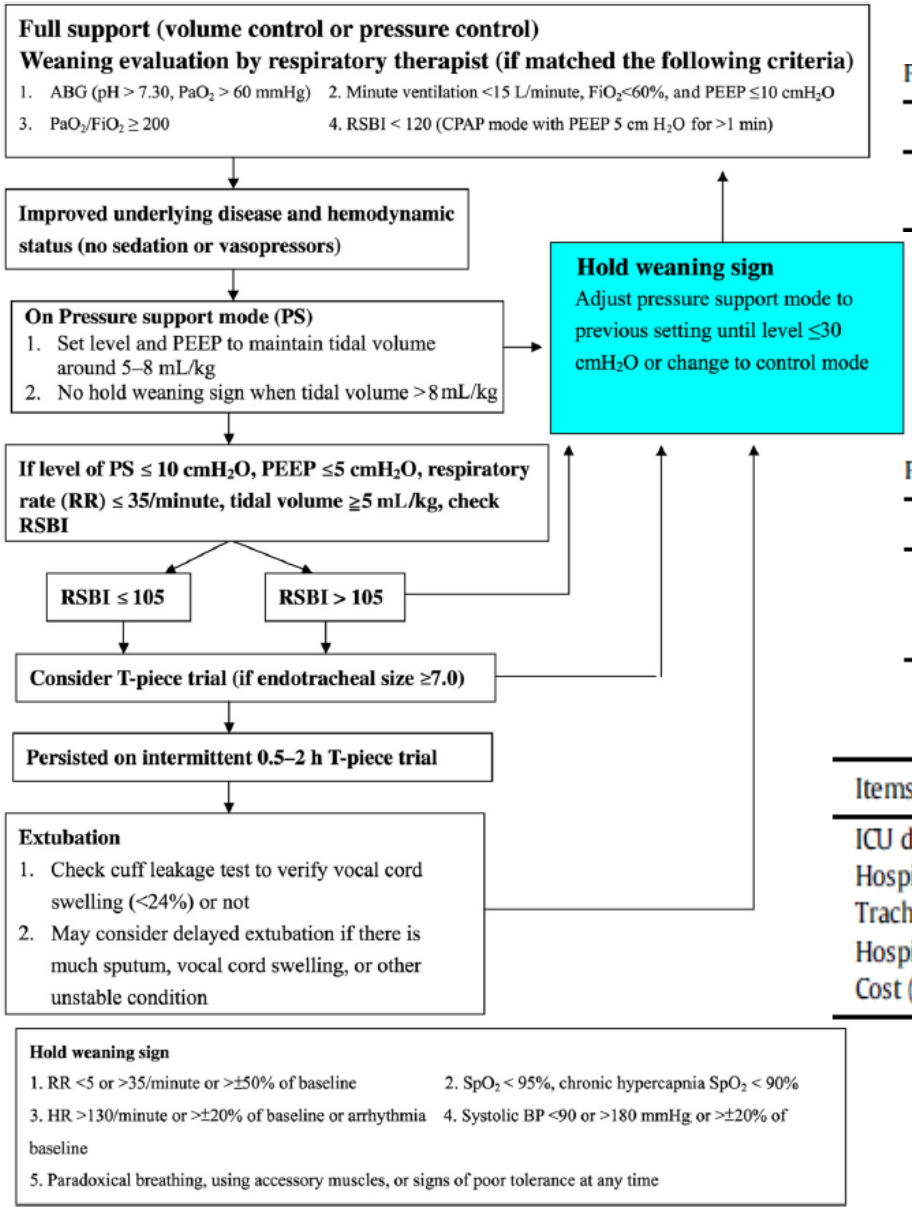
Failure of two or more consecutive spontaneous-breathing trials
Chronic heart failure
Partial pressure of arterial carbon dioxide >45 mm Hg after extubation
More than one coexisting condition other than heart failure
Weak cough
Upper-airway stridor at extubation
Age ≥65 yr
APACHE II score >12 on day of extubation*
Patient in medical, pediatric, or multispecialty ICU
Pneumonia as cause of respiratory failure

McConville JF *N Engl J Med* 2012;367:23

The Outcome and Predictors of Failed Extubation in Intensive Care Patients—The Elderly is an Important Predictor☆

IJG 5(2011) 206-211(SCI paper)

Ai-Chin Cheng [1,2], Kuo-Chen Cheng [1,3,4,5], Chin-Ming Chen [2,6,7,8]*, Shu-Chen Hsing [1], Mei-Yi Sung [1]



Predictors of failed extubation, using multivariate analyses.

	Odds ratio	95% CI	p
Age ≥65 y	2.161	1.437–3.250	<0.001
Medical origin	2.611	1.776–3.831	<0.001

Predictors of hospital mortality, using multivariate analyses.

Item	Odds ratio	95% CI	p
Age ≥65	1.718	1.067–2.768	0.026
APACHE II score	1.065	1.036–1.095	<0.001
Failed extubation	14.492	9.346–22.727	<0.001

Items	Failed extubation ($n = 167$)	Successful extubation ($n = 1627$)	p
ICU duration	15.2 ± 12.5	6.6 ± 7.4	<0.001
Hospital duration	40.3 ± 34.0	24.0 ± 21.8	<0.001
Tracheostomy	36 (21.6%)	25 (1.5%)	<0.001
Hospital mortality	76 (45.5%)	69 (4.2%)	<0.001
Cost (×10,000 NTD)	52.3 ± 41.1	30.4 ± 28.0	<0.001

Chi-Mei weaning protocol

Medicine (2016) 95:41(e4852)

Medicine®

Table 3

Predictors of successful extubation.

Variable	Crude OR (95% CI)	*P* value	Adjusted OR (95% CI)	*P* value
Age				
≥ 65 y	1.00		1.00	
< 65 y	1.34 (1.09–1.65)	0.005	1.07 (0.86–1.33)	0.497
APACHE II score				
≥ 15	1.00		1.00	
< 15	1.25 (1.01–1.55)	0.039	1.00 (0.78–1.29)	0.981
Glasgow coma scale				
≥ 10	1.00		1.00	
< 10	0.77 (0.63–0.95)	0.015	0.86 (0.70–1.06)	0.184
RSBI				
≥ 68	1.00		1.00	
< 68	1.79 (1.46–2.20)	<0.001	1.57 (1.27–1.93)	<0.001
MIP				
≥ −40	1.00		1.00	
< −40	1.58 (1.28–1.95)	<0.001	0.84 (0.66–1.06)	0.170
MEP				
< 55	1.00		1.00	
≥ 55	1.92 (1.56–2.38)	<0.001	1.73 (1.39–2.15)	<0.001
Cuff leak test				
N	1.00		1.00	
+	1.25 (0.83–1.87)	0.28	1.13 (0.75–1.71)	0.549
++	2.43 (1.69–3.50)	<0.001	2.07 (1.42–3.00)	<0.001

3 factors for **successful extubation** after a successful breathing trial: **CLT of 2+** (airway patency), **MEP ≥ 55 cmH2O** (cough), and a **RSBI < 68** (respiratory capacity)

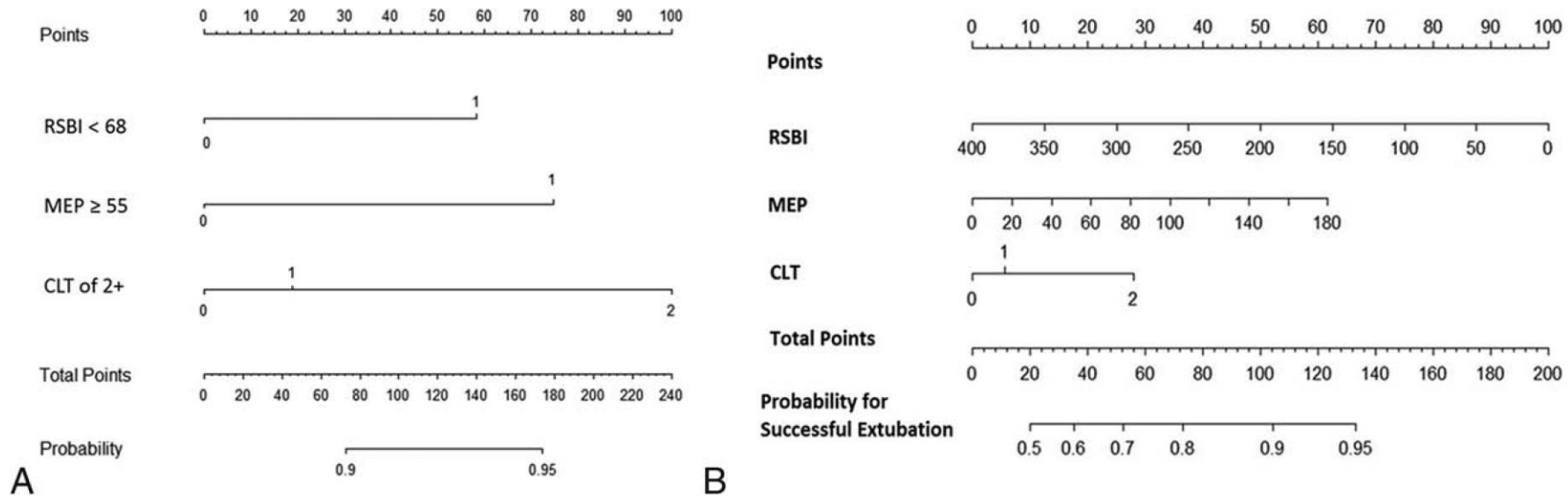


Figure 4. Nomogram of predicted probability for successful extubation using (A) category variables and (B) continuous variables.

Journal of *Clinical Medicine* (SCI, IF: 5.688)

MDPI

Article

An Artificial Neural Network Model for Predicting Successful Extubation in Intensive Care Units

Meng-Hsuen Hsieh [1,†], Meng-Ju Hsieh [2,†], Chin-Ming Chen [3,4,*], Chia-Chang Hsieh [5], Chien-Ming Chao [6] and Chih-Cheng Lai [6,*]

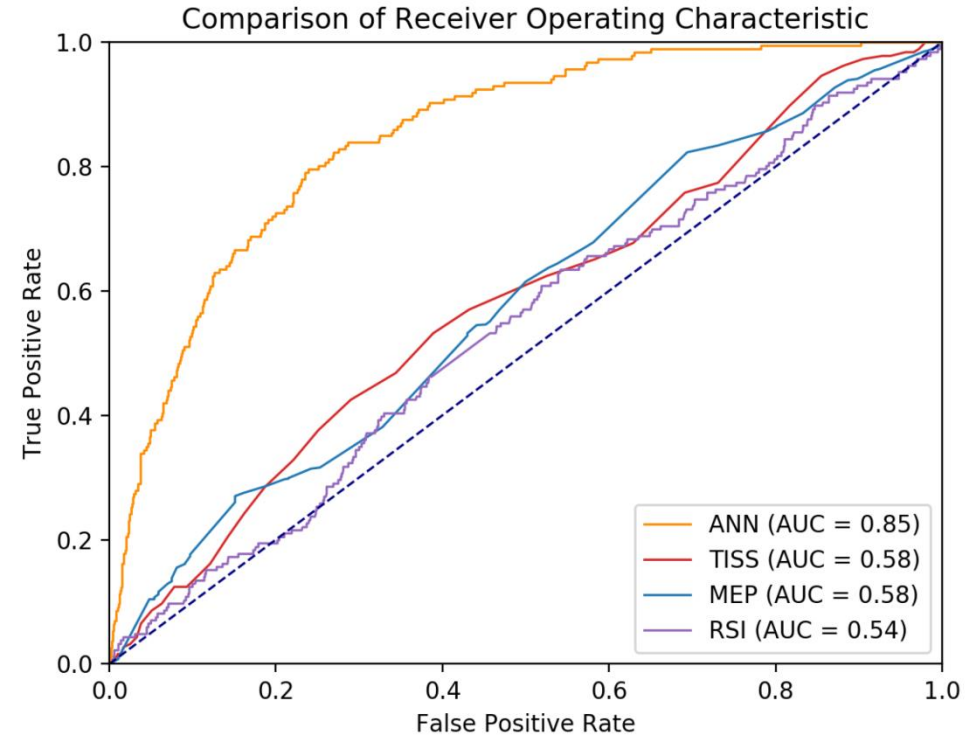


Table 2. Significant predictors of the failed extubation of all planned extubation patients.

Variable	OR	95% CI	*P**	OR	95% CI	*P***
Age (years)	1.107	1.007–1.027	0.001			
APACHE II	1.046	1.027–1.066	<0.001			
TISS Scale	1.036	1.017–1.055	<0.001	1.814 [#]	1.283–2.563	0.001
Glasgow coma scale	0.930	0.894–0.967	<0.001			
Comorbidities						
Chronic hemodialysis	12.970	9.483–17.740	<0.001	12.264	8.556–17.580	<0.001
Diabetes	1.507	1.110–2.045	0.008			
Active cancer	0.629	0.417–0.948	0.027			
Ventilator use duration (*h*)	1.002	1.001–1.003	<0.001			
Weaning parameter						
RSI	1.008	1.004–1.012	<0.001	2.003 [%]	1.378–2.910	<0.001
MIP	0.983	0.970–0.995	0.008			
MEP	0.989	0.983–0.995	<0.001	0.610 [@]	0.413–0.899	0.013
Pre-extubation data						
Pulse rate	1.014	1.005–1.023	0.003	1.705 *	1.173–2.480	0.005
PaO_2/FiO_2	0.997	0.995–0.998	<0.001	0.529 [%]	0.373–0.750	<0.001
Hemoglobin	0.832	0.765–0.904	<0.001			
Hematocrit (%)	0.961	0.939–0.984	0.001			
BUN	1.012	1.007–1.017	<0.001			

[#]: TISS $\geq$ 28.5, AUC $\approx$ 0.6, $p < 0.001$; [%]: RSI $\geq$ 49.95, AUC $\approx$ 0.6, $p < 0.001$; [@]: MEP < 39 cm H_2O, AUC $\approx$ 0.6, $p < 0.001$; Pulse rate $\geq$ 102.5 /min, AUC $\approx$ 0.6, $p = 0.026$; [%]: $PaO_2/FiO_2 \leq 323.25$, AUC $\approx$ 0.6, $p < 0.001$; * Value for univariate analysis; ** Value for multivariate analysis;

Quality Improvement Study

Medicine 2019;98:40(e17392

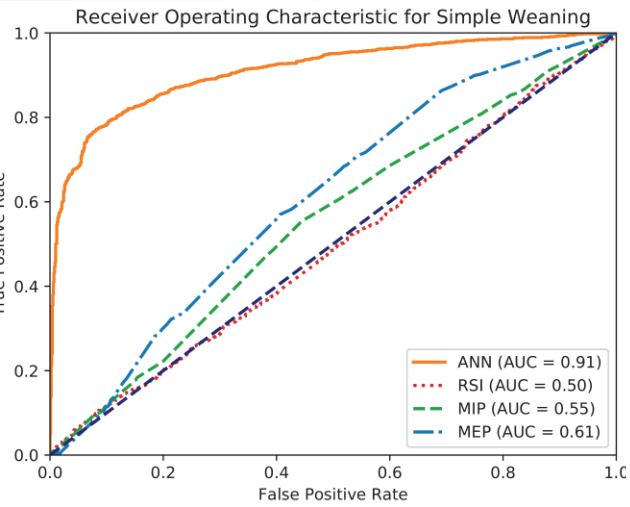
Medicine®

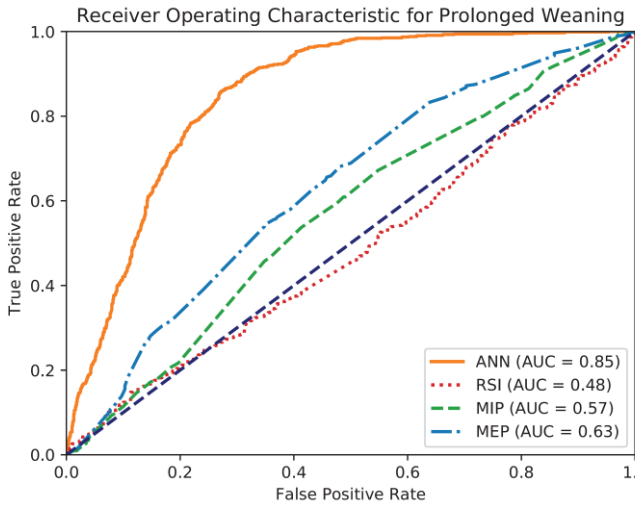
OPEN

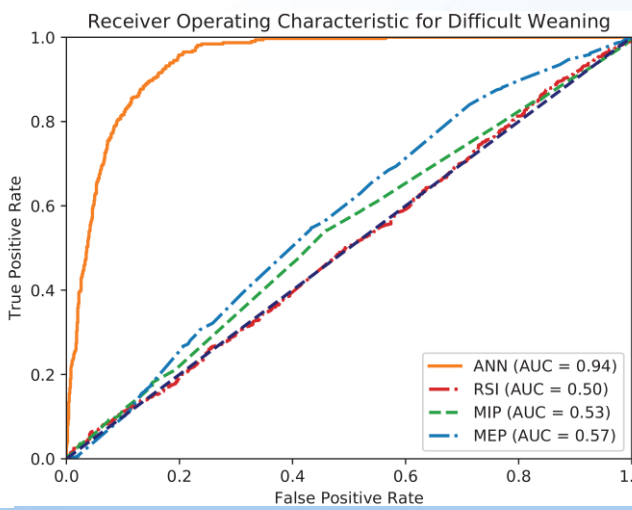
Predicting weaning difficulty for planned extubation patients with an artificial neural network

Meng Hsuen Hsieh, BS[a], Meng Ju Hsieh, MD[b], Ai-Chin Cheng, RRT[c,d], Chin-Ming Chen, MD[e,*], Chia-Chang Hsieh, MD[f], Chien-Ming Chao, MD[g], Chih-Cheng Lai, MD[h], Kuo-Chen Cheng, MD[d], Willy Chou, MD[i,j,*]

ANN model achieved a good performance in prediction the weaning difficulty (simple, difficult & prolonged) in planned extubation patients

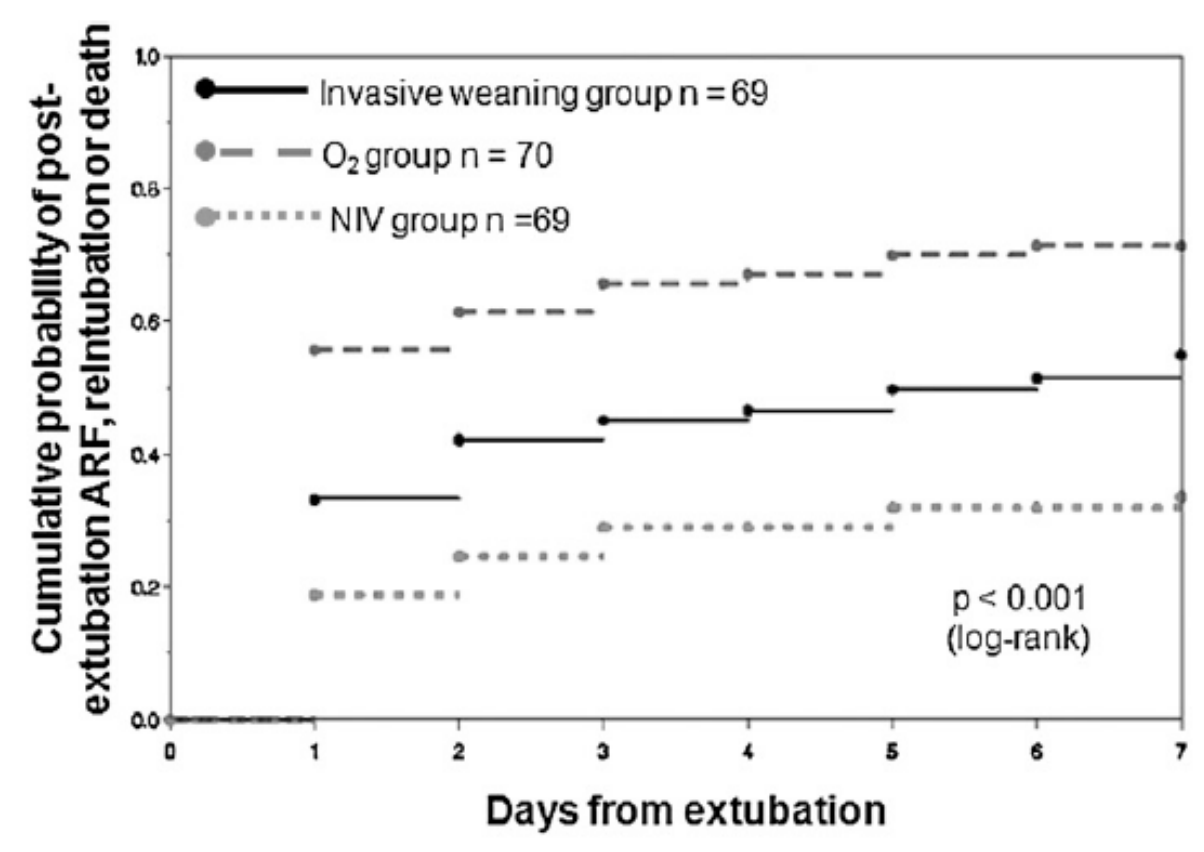






Post-Extubation: NIV/HFNC for Weaning? Steroids?

Hypercapnic COPD Patients



reducing the risk of postextubation ARF

Girault et al. Am J Respir Crit Care Med 2011; 184:672–679.

JAMA | Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT

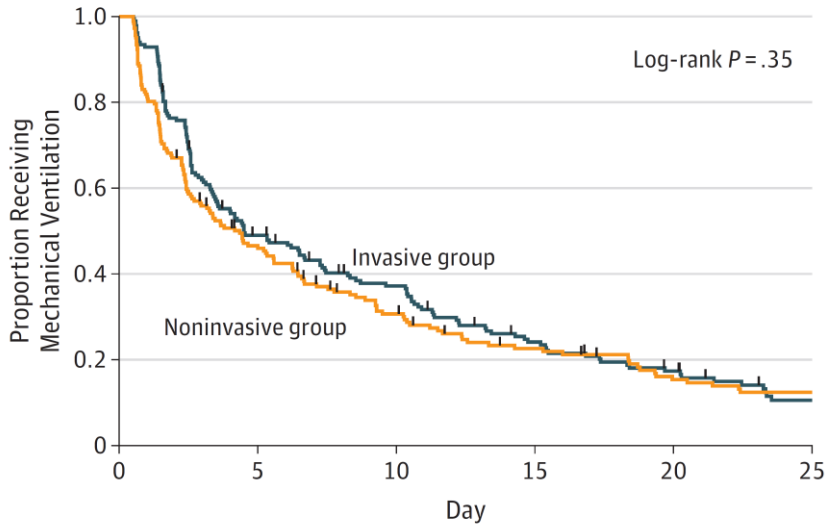
Effect of Protocolized Weaning With Early Extubation to Noninvasive Ventilation vs Invasive Weaning on Time to Liberation From Mechanical Ventilation Among Patients With Respiratory Failure

The Breathe Randomized Clinical Trial

JAMA. 2018;320(18):1881-1888

Pts **failed SBT**→**early extubation** to **NIV** did **not** ↓MV time or death

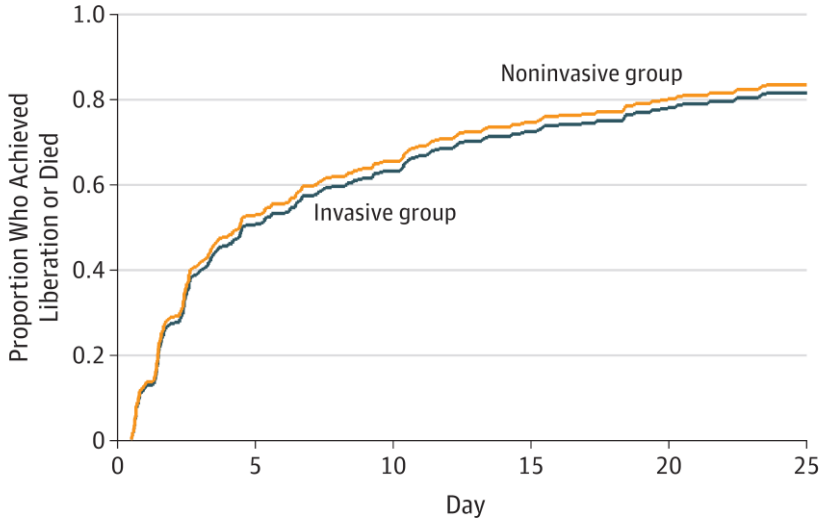
Figure 2. Time to Liberation From Mechanical Ventilation by Treatment Group



No. at risk

Invasive group	182	86	61	37	24	12
Noninvasive group	182	79	48	32	21	17

Figure 3. Cumulative Incidence of Liberation From Ventilation or Death by Treatment Group



No. at risk

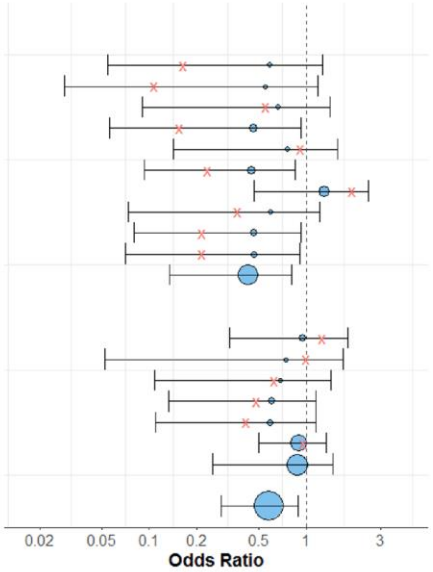
Invasive group	182	86	61	37	24	12
Noninvasive group	182	79	48	32	21	17

sion • Accountability • Effectiveness

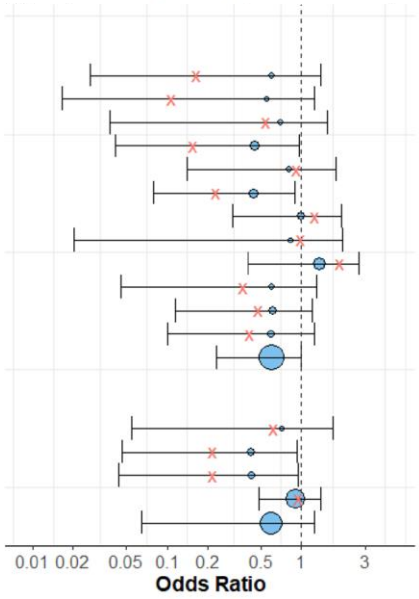
Intensive Care Med (2018) 44:2192–2204

Non-invasive ventilation as a strategy for weaning from invasive mechanical ventilation: a systematic review and Bayesian meta-analysis

Study	n/N (Intervention vs Control)	Posterior Mean Odds Ratio (95% HDI)	Observed Odds Ratio (95% CI)
COPD			
Girault et al. (1999)	0 / 17 vs 2 / 16	0.58 (0.05, 1.28)	0.17 (0.01, 3.73)
Chen et al. (2001)	0 / 12 vs 3 / 12	0.55 (0.03, 1.19)	0.11 (0.00, 2.36)
Wang et al. (2004)	1 / 14 vs 2 / 14	0.66 (0.09, 1.41)	0.56 (0.06, 4.84)
Wang et al. (2005)	1 / 47 vs 7 / 43	0.46 (0.06, 0.93)	0.16 (0.03, 0.96)
Zheng et al. (2005)	3 / 17 vs 3 / 16	0.77 (0.14, 1.59)	0.93 (0.18, 4.88)
Zou et al. (2006)	3 / 38 vs 11 / 38	0.45 (0.09, 0.85)	0.24 (0.06, 0.86)
Girault et al. (2011)	16 / 69 vs 9 / 69	1.30 (0.46, 2.50)	1.96 (0.82, 4.73)
Mohamed and Ibrahim (2012)	1 / 15 vs 3 / 15	0.59 (0.07, 1.23)	0.37 (0.05, 2.89)
Rong (2012)	2 / 33 vs 8 / 31	0.46 (0.08, 0.92)	0.22 (0.05, 0.99)
Mishra et al. (2014)	2 / 25 vs 8 / 25	0.47 (0.07, 0.92)	0.22 (0.05, 1.02)
Pooled COPD	29 / 287 vs 56 / 279	0.43 (0.13, 0.81)	
Mixed population			
Trevisan et al. (2008)	9 / 28 vs 10 / 37	0.95 (0.32, 1.85)	1.28 (0.45, 3.65)
Charra et al. (2009)	0 / 12 vs 0 / 12	0.74 (0.05, 1.71)	1.00 (0.02, 54.47)
Vaschetto et al. (2012)	2 / 10 vs 3 / 10	0.69 (0.11, 1.44)	0.63 (0.09, 4.20)
Carron et al. (2014)	3 / 32 vs 6 / 32	0.60 (0.13, 1.16)	0.48 (0.12, 1.96)
Wang et al. (2014)	2 / 26 vs 5 / 27	0.59 (0.11, 1.16)	0.42 (0.08, 2.07)
Perkins et al. (2018)	35 / 182 vs 36 / 182	0.89 (0.50, 1.35)	0.97 (0.58, 1.62)
Pooled mixed population	51 / 290 vs 60 / 300	0.88 (0.25, 1.48)	
Overall pooled	80 / 577 vs 116 / 579	0.58 (0.29, 0.89)	



Study	n/N (Intervention vs Control)	Posterior Mean Odds Ratio (95% HDI)	Observed O Ratio (95%
No Protocolised Weaning			
Girault et al. (1999)	0 / 17 vs 2 / 16	0.60 (0.03, 1.40)	0.17 (0.01, 3.73)
Chen et al. (2001)	0 / 12 vs 3 / 12	0.56 (0.02, 1.27)	0.11 (0.00, 2.36)
Wang et al. (2004)	1 / 14 vs 2 / 14	0.70 (0.04, 1.56)	0.56 (0.06, 4.84)
Wang et al. (2005)	1 / 47 vs 7 / 43	0.45 (0.04, 0.96)	0.16 (0.03, 0.96)
Zheng et al. (2005)	3 / 17 vs 3 / 16	0.82 (0.14, 1.81)	0.93 (0.18, 4.88)
Zou et al. (2006)	3 / 38 vs 11 / 38	0.44 (0.08, 0.89)	0.24 (0.06, 0.86)
Trevisan et al. (2008)	9 / 28 vs 10 / 37	1.00 (0.31, 2.00)	1.28 (0.45, 3.65)
Charra et al. (2009)	0 / 12 vs 0 / 12	0.83 (0.02, 2.04)	1.00 (0.02, 54.47)
Girault et al. (2011)	16 / 69 vs 9 / 69	1.38 (0.40, 2.68)	1.96 (0.82, 4.73)
Mohamed and Ibrahim (2012)	1 / 15 vs 3 / 15	0.61 (0.05, 1.30)	0.37 (0.05, 2.89)
Carron et al. (2014)	3 / 32 vs 6 / 32	0.61 (0.12, 1.22)	0.48 (0.12, 1.96)
Wang et al. (2014)	2 / 26 vs 5 / 27	0.60 (0.10, 1.26)	0.42 (0.08, 2.07)
Pooled No Protocolised Weaning	39 / 327 vs 61 / 331	0.60 (0.23, 1.01)	
Protocolised Weaning			
Vaschetto et al. (2012)	2 / 10 vs 3 / 10	0.71 (0.05, 1.72)	0.63 (0.09, 4.20)
Rong (2012)	2 / 33 vs 8 / 31	0.42 (0.05, 0.94)	0.22 (0.05, 0.99)
Mishra et al. (2014)	2 / 25 vs 8 / 25	0.43 (0.04, 0.94)	0.22 (0.05, 1.02)
Perkins et al. (2018)	35 / 182 vs 36 / 182	0.91 (0.48, 1.39)	0.97 (0.58, 1.62)
Pooled Protocolised Weaning	41 / 250 vs 55 / 248	0.59 (0.06, 1.25)	



The use of **NIV** in weaning from MV ↓ hospital **mortality**, **VAP** & **ICU LOS**. NIV as a weaning strategy: most **beneficial** in **COPD** pts

Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT

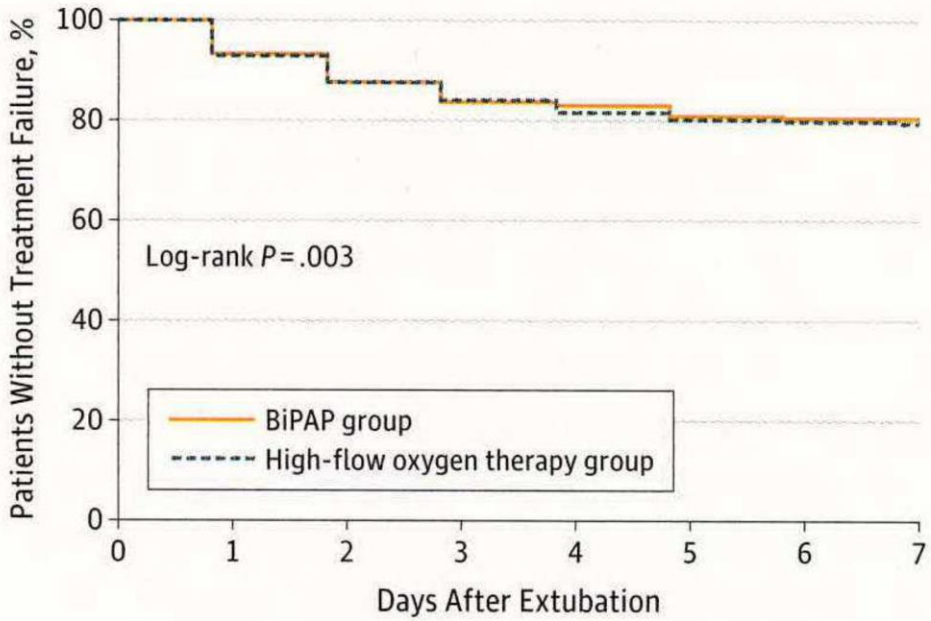
High-Flow Nasal Oxygen vs Noninvasive Positive Airway Pressure in Hypoxemic Patients After Cardiothoracic Surgery

A Randomized Clinical Trial

JAMA. 2015;313(23):2331-2339

Pts with failed SBT or failed extubation→ outcome of **HFNC** use **is** **similar** to NIV

Figure 2. Postoperative Patients Without Treatment Failure After Extubation



No. at risk								
BiPAP	416	385	363	348	339	333	331	329
High-flow oxygen therapy	414	385	361	346	342	334	333	331

NIV in the Post-extubation (risk patients)

Elderly patients (age > 65 y)

More than one consecutive failure of weaning trial

Chronic heart failure

P_{aCO_2} > 45 mm Hg after extubation

More than one medical/surgical co-morbid illness

Poor cough reflex

Upper-airways stridor at extubation that does not require immediate reintubation

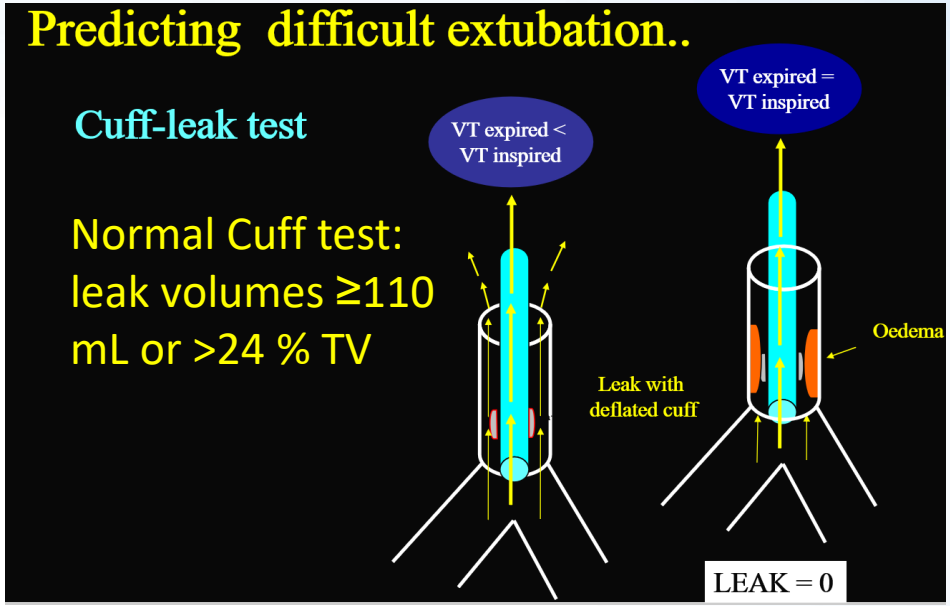
APACHE II score > 12 on the day of extubation

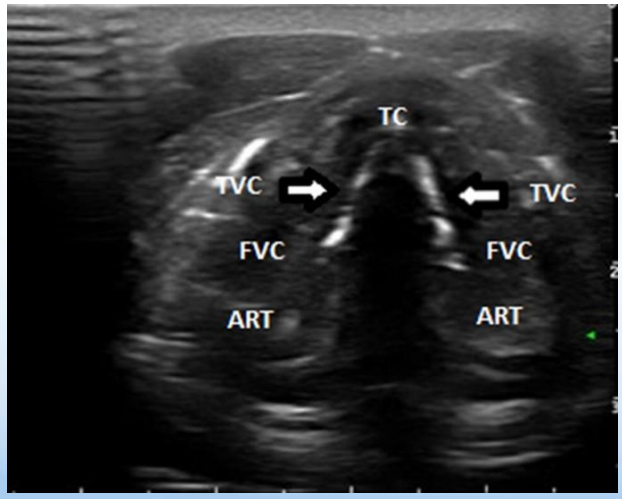
Severely obese patients (body mass index > 35 kg/m^2)

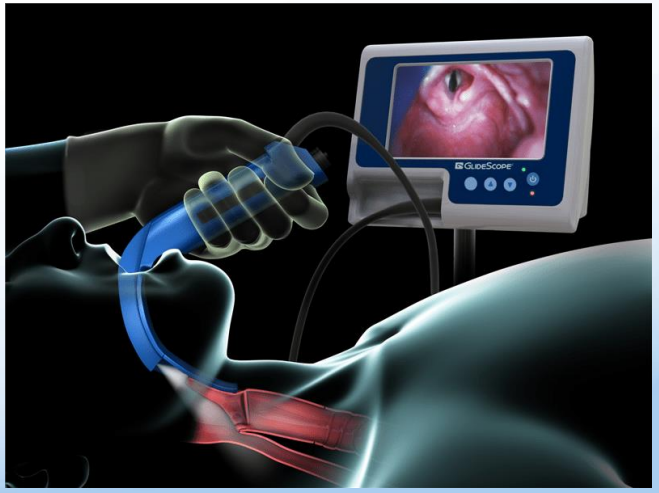
Agarwal et al. Respir Care. 2007 Nov;52(11):1472-9.

Assessment of Airway patency Before Extubation

- Cuff leak test
- Ultrasonography
- Video laryngoscopy







Cuff leak test 準不準?

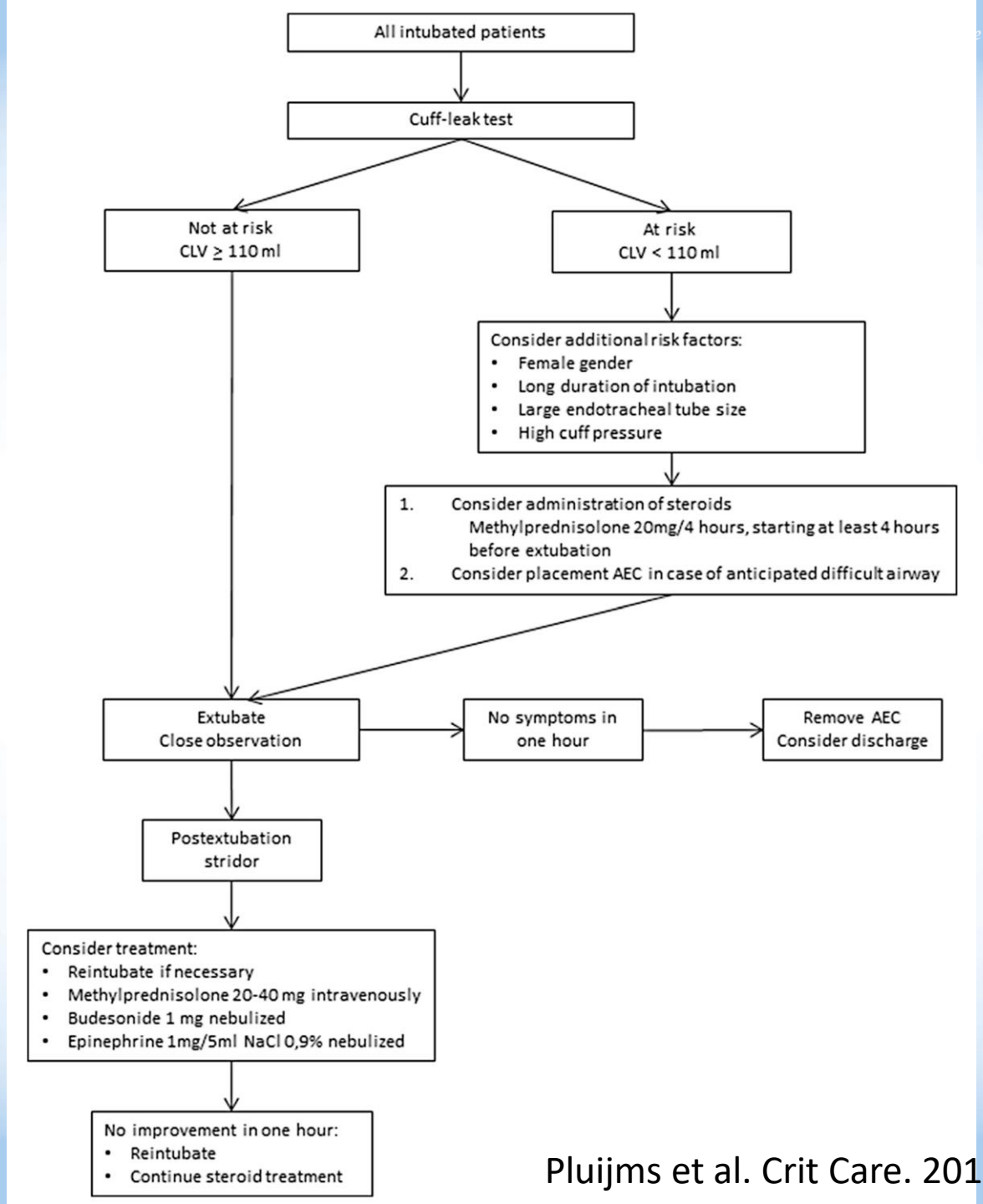
Table 4 Predictive value of the cuff leak test and laryngeal ultrasonography for postextubation stridor, laryngeal edema, and reintubation

Author	Year	Predefined cutoff value		Outcome	Sensitivity	Specificity	PPV	NPV
Cuff leak test		Volume, ml	Percentage of tidal volume					
Miller and Cole [22]	1996	110		Stridor	0.67 (0.51–0.82)	0.99	0.80	0.98
Jaber et al. [25]	2003	130	12	Stridor	0.85 (0.65–0.99)	0.95 (0.91–0.99)	0.69	0.98
De Bast et al. [2]	2002		15.5	Reintubation	0.75	0.72	0.25	0.96
Sandhu et al. [21]	2000		10.0	Stridor or reintubation	0.54	0.96	0.64	0.94
Wang et al. [19]	2007	88		Stridor	0.60	0.89	0.55	0.91
Maury et al. [20]	2004	0		Stridor	1.00	0.80	0.15	1.00
Chung et al. [13]	2006	140		Laryngeal edema	0.89	0.90	0.84	0.93
Engoren [34]	1999	110		Stridor	0.00	0.96	0.00	0.99
Kriner et al. [18]	2005	110		Stridor	0.50	0.84	0.12	0.97
Cheng et al. [16]	2006		18.0	Stridor	0.85	0.72	0.21	0.98
Mikaeili et al. [28]	2014	110		Stridor	0.25	0.84	0.14	0.91
		130			0.25	0.81	0.13	0.91
		249			0.75	0.59	0.17	0.96
Gros et al. [27]	2012	130		Stridor	0.86 (0.42–1.00)	0.76 (0.67–0.84)	0.21 (0.08–0.40)	0.99 (0.93–1.00)
Sutherasan et al. [15]	2013	110		Laryngeal edema	0.80	0.82	0.46	0.96
Ultrasonography		ACWD, mm						
Sutherasan et al. [15]	2013	1.6		Laryngeal edema	0.71	0.70	0.32	0.92
Mikaeili et al. [28]	2014	0.85		Stridor	0.50	0.57	0.11	0.91

Cutoff value：130 cc, PPV：10-20% NPV：>90%

沒過不一定有問題，有過應該沒問題

Pluijms et al. Crit Care. 2015 Sep 23;19:295.



Pluijms et al. Crit Care. 2015 Sep 23;19:295.

Prevention

- Adequate-size endotracheal tube (M/F:8/7)
- Minimized duration of intubation
- measured cuff pressures regularly
- IV corticosteroids before extubation
- Nebulized corticosteroids after extubation

Pluijms et al. Crit Care. 2015 Sep 23;19:295.

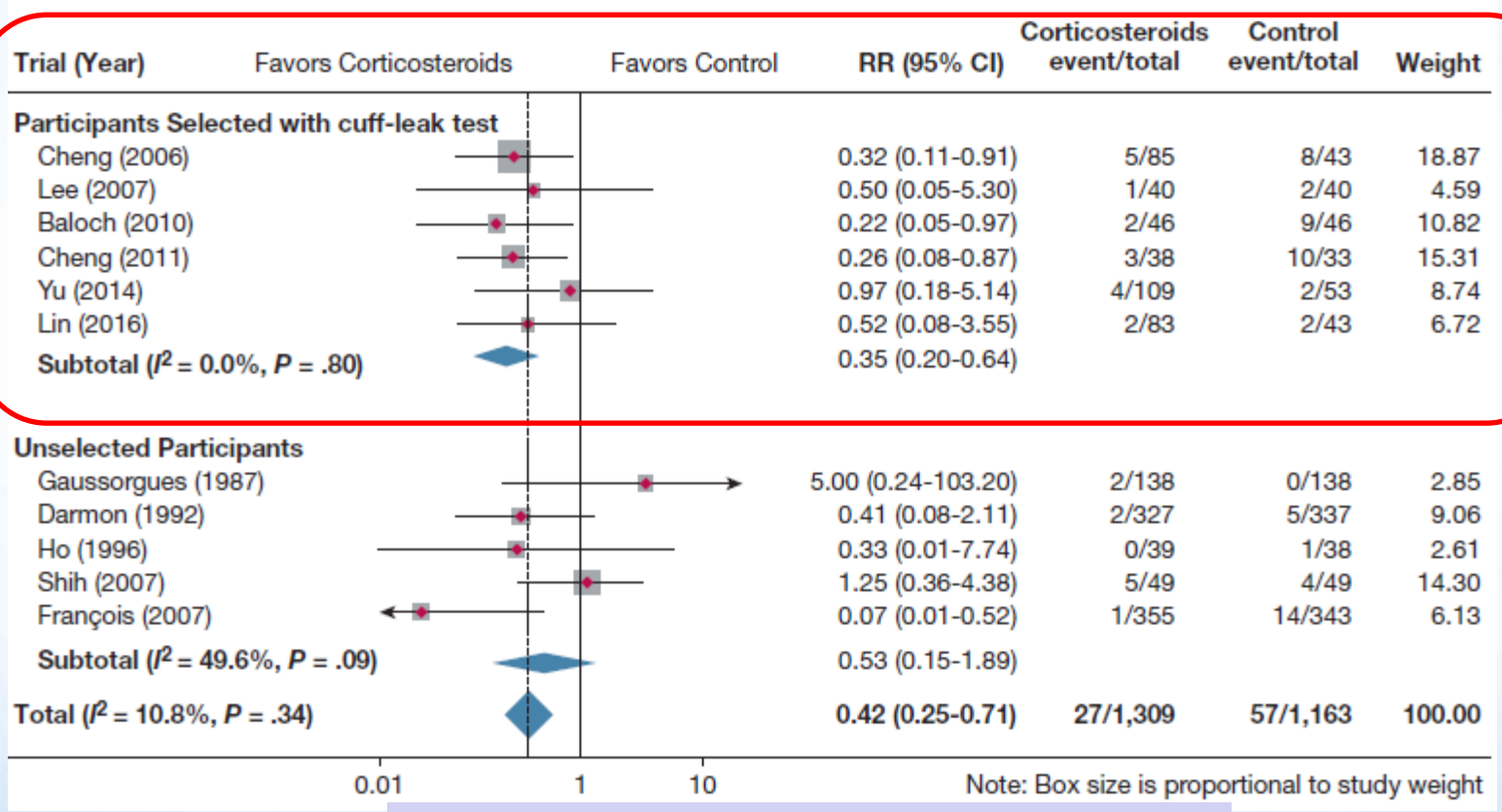
Abbasi et al. Adv Biomed Res. 2014 Aug 26;3:182.

Corticosteroids Dosage

Literatures	Dosage	Time before extubation
Cheng et al. 2006	Methylprednisolone 4 × 40 mg i.v. 24 hours	24 hours
François et al. 2007	Methylprednisolone 3 × 20 mg i.v. 12 hours	12 hours
Lee et al.2007	Dexamethasone 4 × 5 mg i.v. 48 hours	48 hours
Cheng et al. 2011	Methylprednisolone 40 mg i.v. 4 hours	4 hours
Abbasi et al. 2014	Budesonide 4 × 1 mg nebulized	48 hours

Pluijms et al. Crit Care. 2015 Sep 23;19:295

Prophylaxis Corticosteroids



Only selected with CLT!

Kuriyama, et al. CHEST 2017; 151(5):1002-1010

奇美醫療財團法人 奇美醫院
Chi Mei Medical Center

Weaning Experiences from Chi-Mei Medical Center

2004 **U**nplanned **E**xtubation

2009 **C**entral **L**ine **A**ssociated **B**lood **S**tream **I**nfection

2010 **S**epsis **B**undle

2012 **C**entral **L**ine **A**ssociated **B**lood **S**tream **I**nfection

2014 **E**arly **M**obilization

2016 **ABCDE B**undle

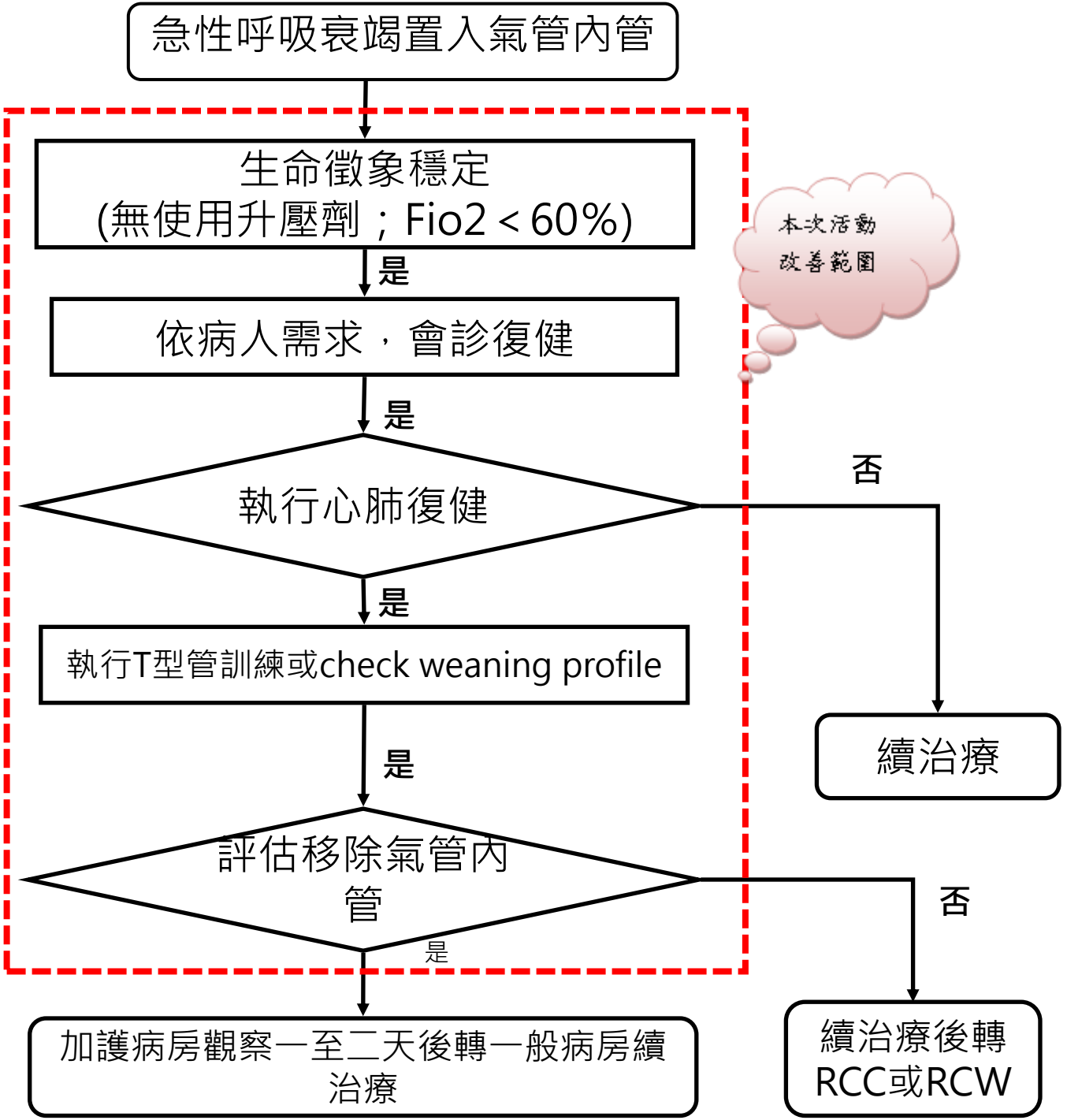
2018 **AI A**pplication

「早期下床活動」
縮短加護病房病人呼吸器使用天數

2014 Early Mobilization

2016 ABCDE Bundle

2018 AI Application


急性呼吸衰竭置入氣管內管
生命徵象穩定
(無使用升壓劑；Fio2 < 60%)
是
依病人需求，會診復健
是
執行心肺復健
否
是
執行T型管訓練或check weaning profile
是
評估移除氣管內管
否
是
加護病房觀察一至二天後轉一般病房續治療
續治療
續治療後轉RCC或RCW
本次活動改善範圍

文獻查證(依據Peter E. Morris 2008年介入計畫,分為四個階段)

	段階 I	段階 II	段階 III	段階 IV
入介	• 天每3次 • 被動動運節關	• 天每3次 • 動主/主式助協動運動 • 上床在坐30鐘分	• 天每3次 • 邊床在坐30鐘分	• 位移邊床由動主至床旁伴陪椅30分鐘
下入進段階一準標的	的況情識意步進	以可力肌肢上當動活力重抗-二肱力肌肌頭3/5上以	以可力肌肢下當動活力重抗-四股力肌肌頭3/5上以	
識意況情	識意無	成達能3上以個指令 開：(關)、睛眼嘴開打、我著看巴　點、頭舌出伸抬時五到數、頭毛眉高	段階和 II 同相	段階和 II 同相

對策實施與檢討：「早期下床」活動用運HFMEA行進安全性失疏之防護

管路滑脫

病人跌倒

0%

ACRM
AMERICAN CONGRESS OF REHABILITATION MEDICINE

Archives of Physical Medicine and Rehabilitation

journal homepage: www.archives-pmr.org

Archives of Physical Medicine and Rehabilitation 2017;98:931-9

ORIGINAL RESEARCH

SCI, IF:3.289, 5/65

Early Mobilization Reduces Duration of Mechanical Ventilation and Intensive Care Unit Stay in Patients With Acute Respiratory Failure

Chih-Cheng Lai, MD,[a,*] Willy Chou, MD,[b,*] Khee-Siang Chan, PhD,[c] Kuo-Chen Cheng, MD,[d,e] Kuo-Shu Yuan, PhD,[f,g] Chien-Ming Chao, MD,[a] Chin-Ming Chen, MD[b,c]

Correspondence author

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2016 Impact Factor: **3.289**

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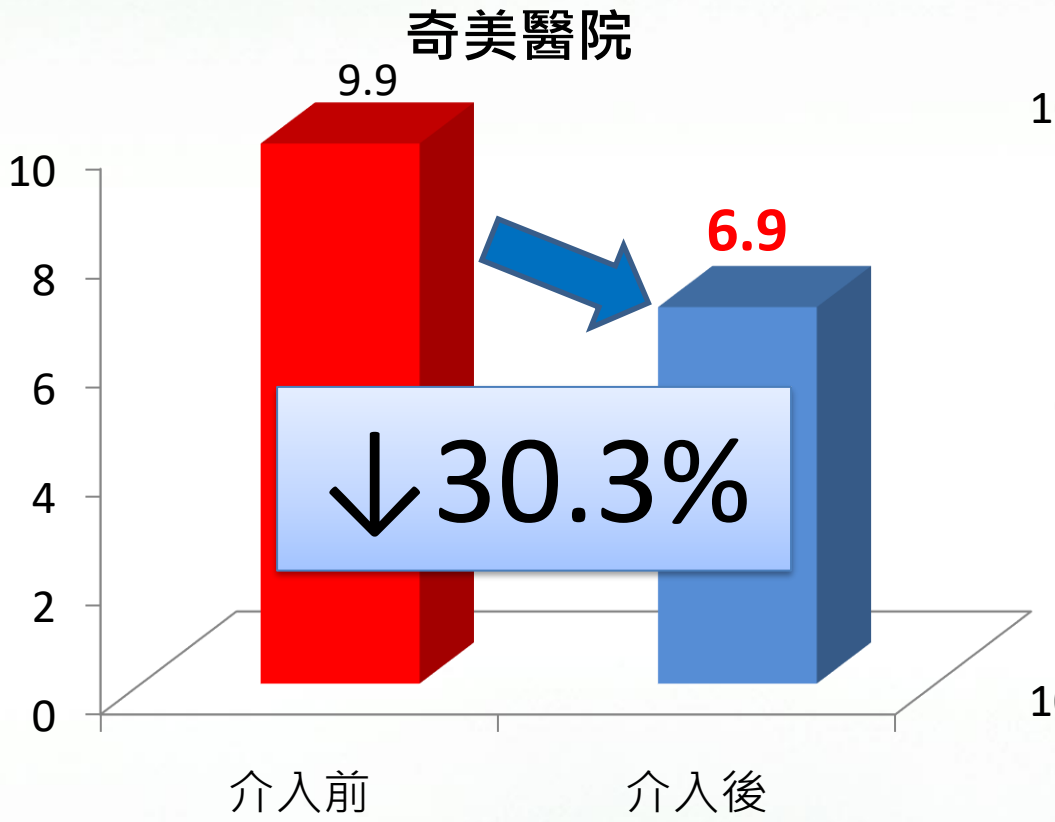
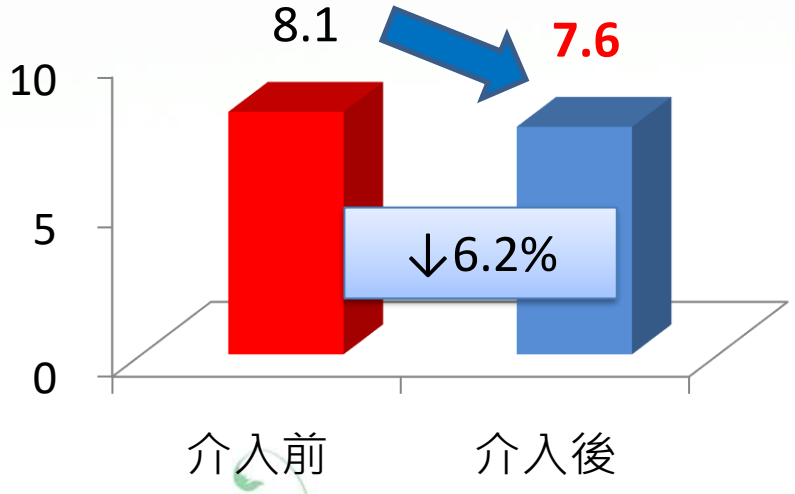
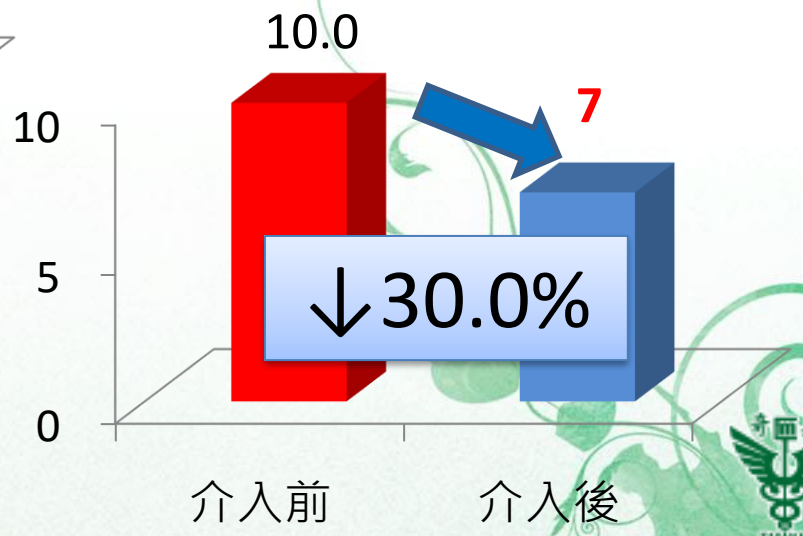
與國際知名文章比較(ICU天數)



North Carolina Baptist H (Peter E. M)

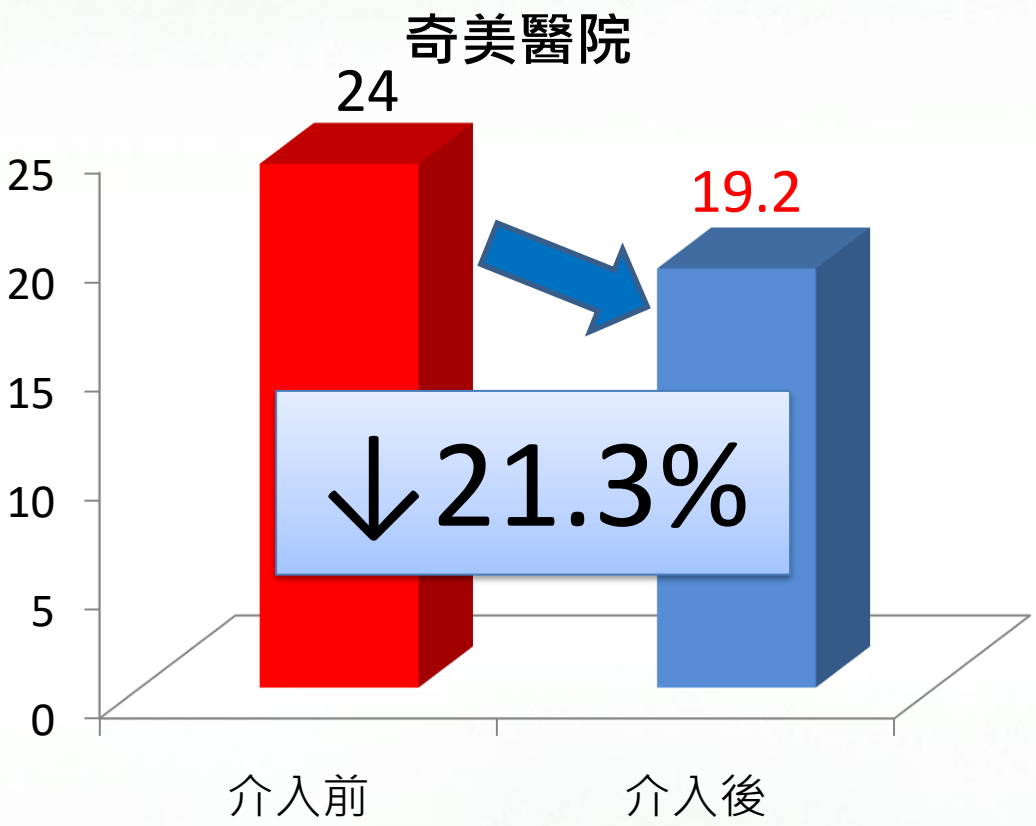


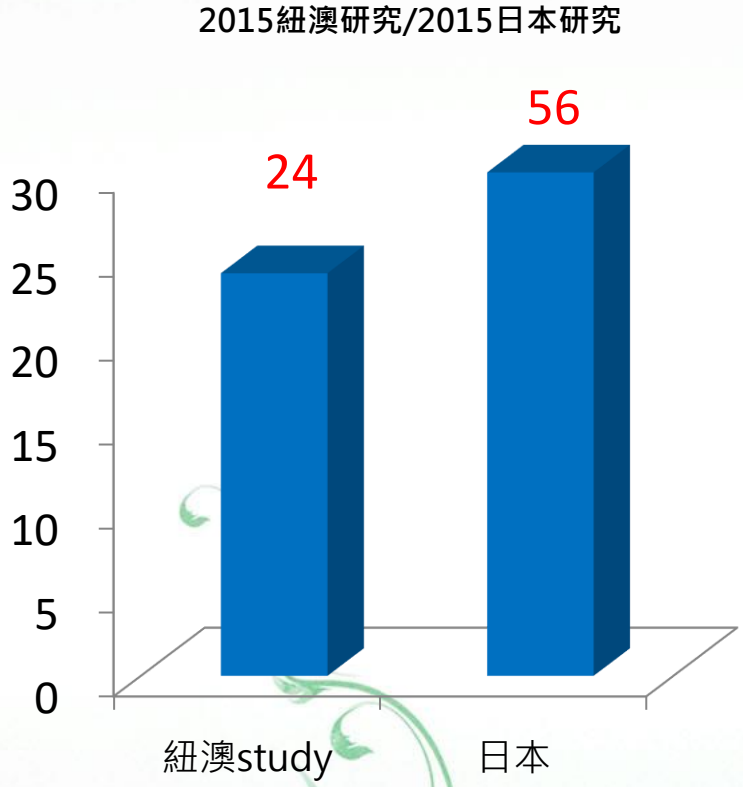
University of Massachusetts(Lancet 2016)



CC Lai et al. Arch of Phys Med and Rehab 2017; 98:931-9
Peter E. Morriset al. Critical Care Medicine 2008; 36(8): 2238-2243
Lancet 2016 :388:1377-1388

與國際知名文章比較(總住院天數)

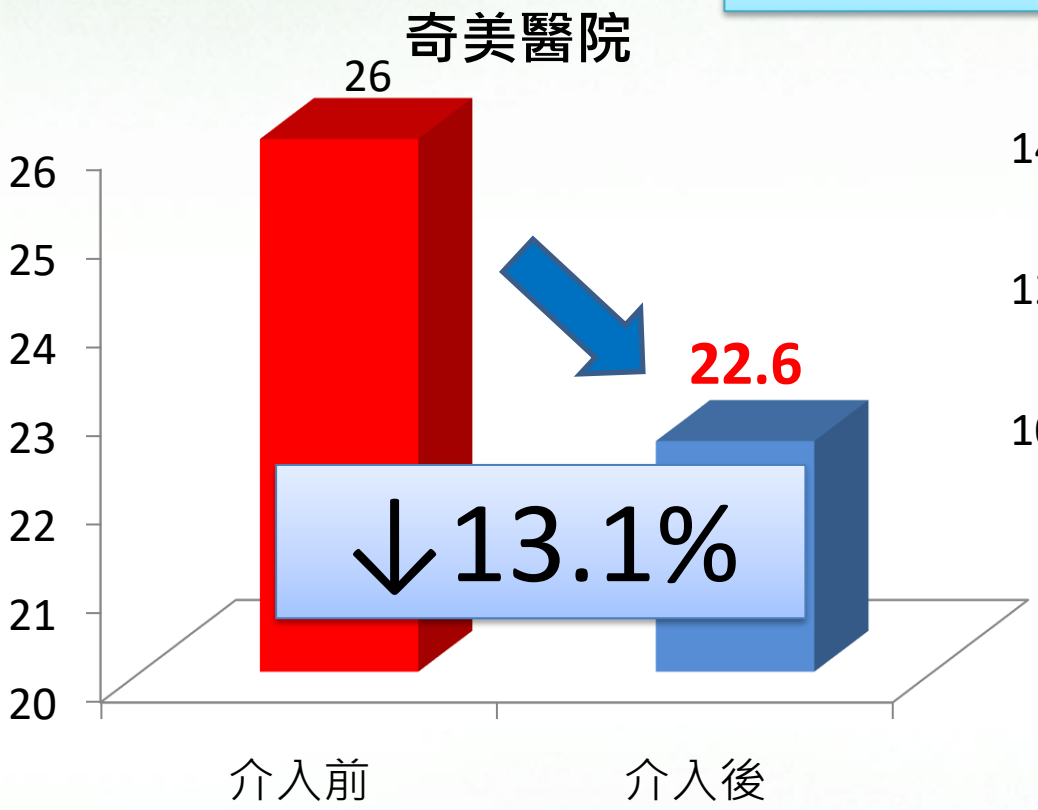


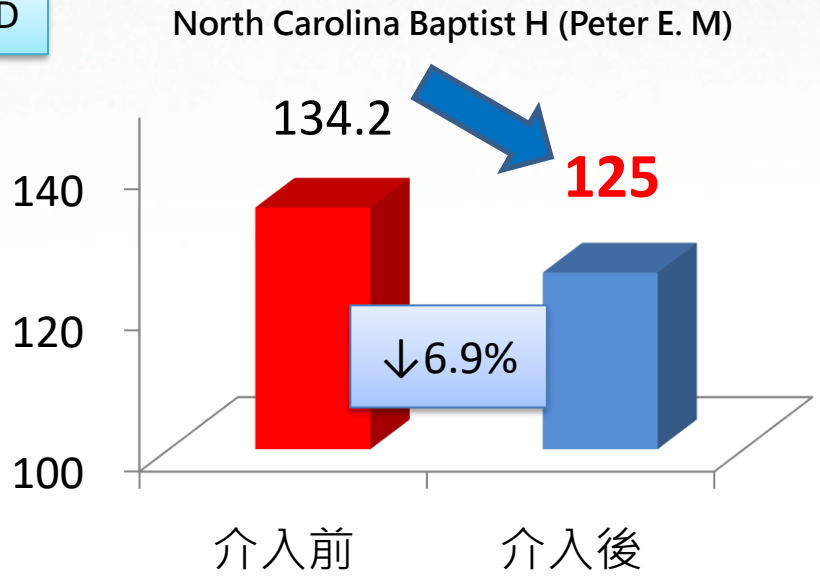


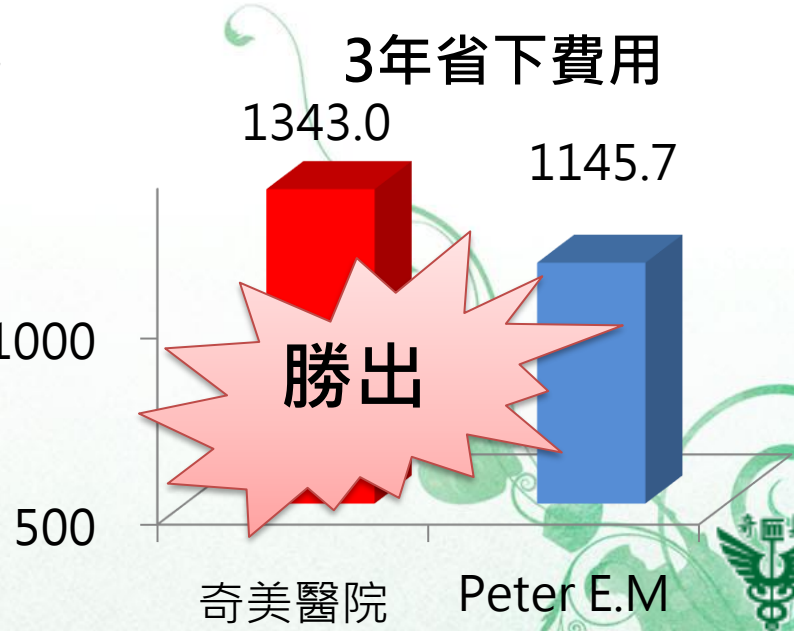
CC Lai et al. Arch of Phys Med and Rehab 2017; 98:931-9
Critical Care 2015:19:81
Lancet 2016 :388:1377-1388

與國際知名文章比較(總住院費用,新臺幣:萬)

1 USD=30.3NTD

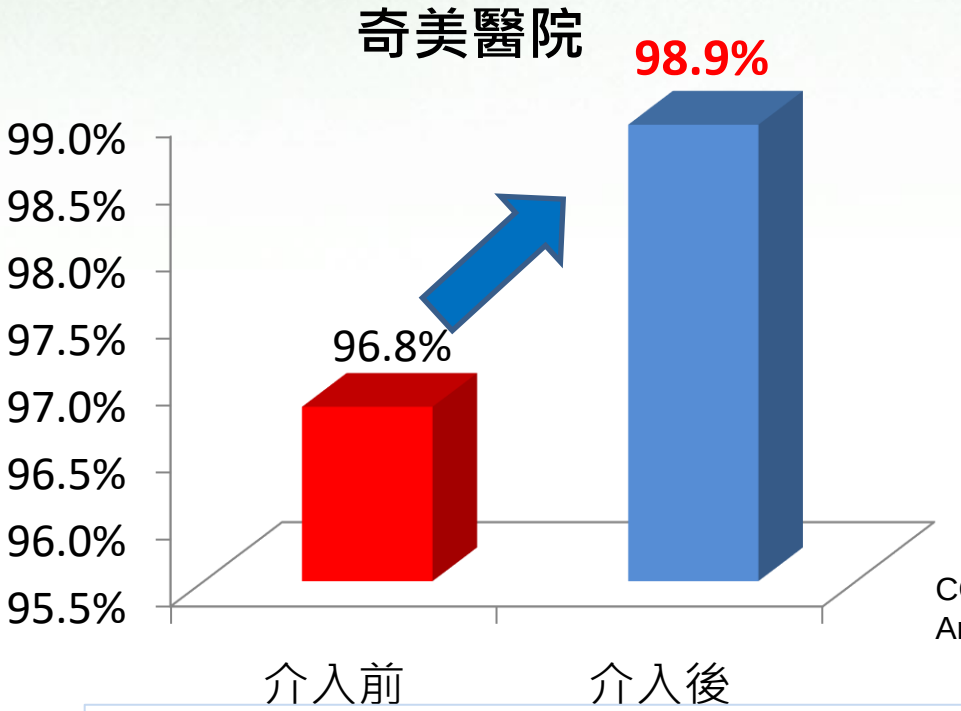


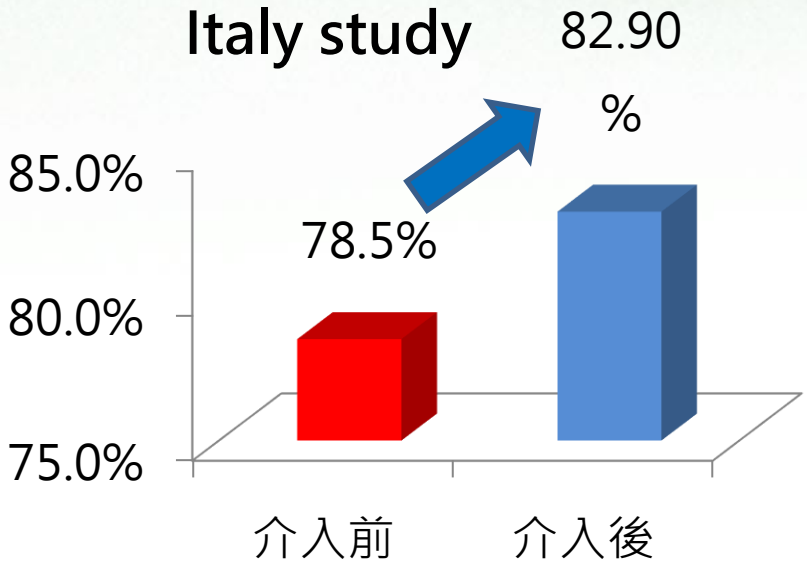




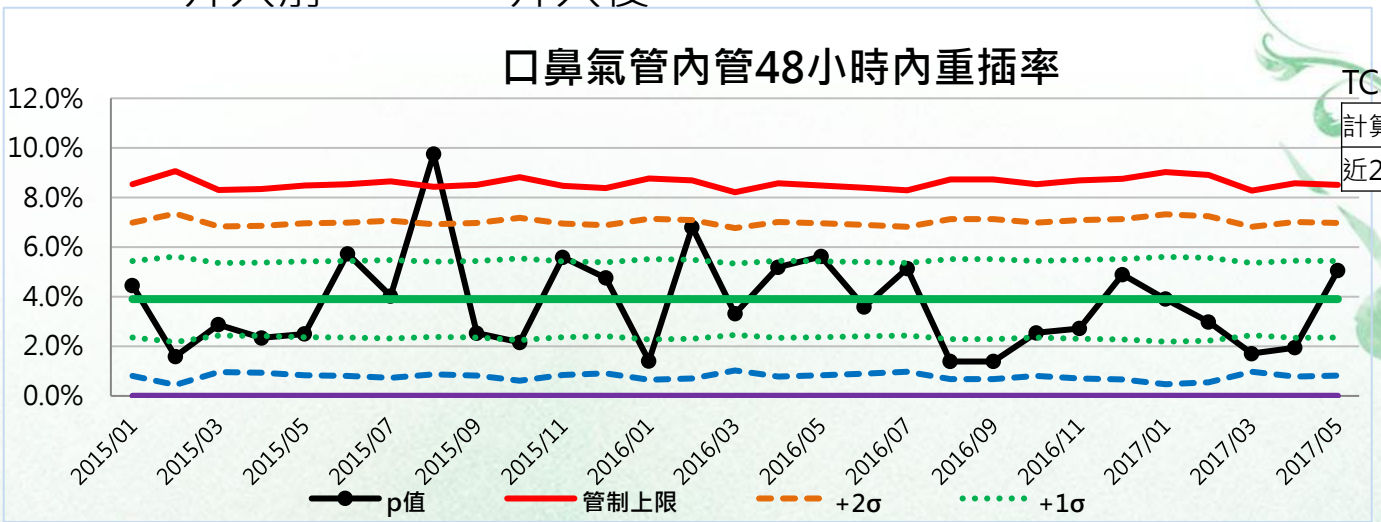
CC Lai et al. Arch of Phys Med and Rehab 2017; 98:931-9
Peter E. Morriset al. Critical Care Medicine 2008; 36(8): 2238-2243

與國際知名文章比較(呼吸器脫離率)





CC Lai et al. Arch of Phys Med and Rehab 2017; 98:931-9
Arch Phys Med Rehabil 1998;79:849-54



TCPI近兩年指標

計算平均值	3.7597%
近2年加權平均值	3.8985%

脫離率:96.1%

奇美醫療財團法人 奇美醫院
Chi Mei Medical Center

運用ABCDE bundle提升加護病房呼吸器病人臨床照護成效

課題達成型品管手法

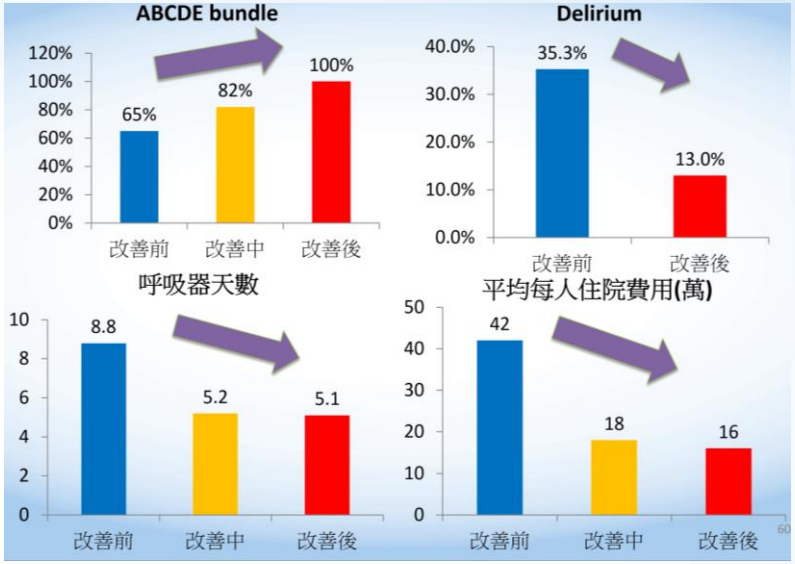
2014 Early Mobilization

2016 ABCDE Bundle

2018 AI Application

運用ABCDE bundle提升加護病房呼吸器病人臨床照護成效

要**活**就要**動**　沒**活動**多**病痛**



A B C

每天讓病人**清醒** (Awakening)

接受自主**呼吸**訓練(Breathing)

調整藥物(Coordination)

D

瞻妄監測和管理 (Delirium survey & management)

E

早期下床(Early Exercise and Mobility)

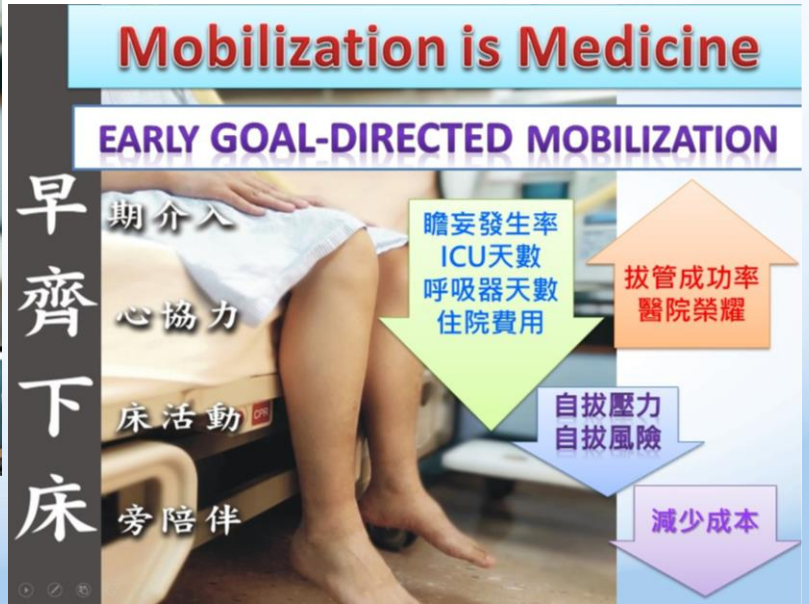
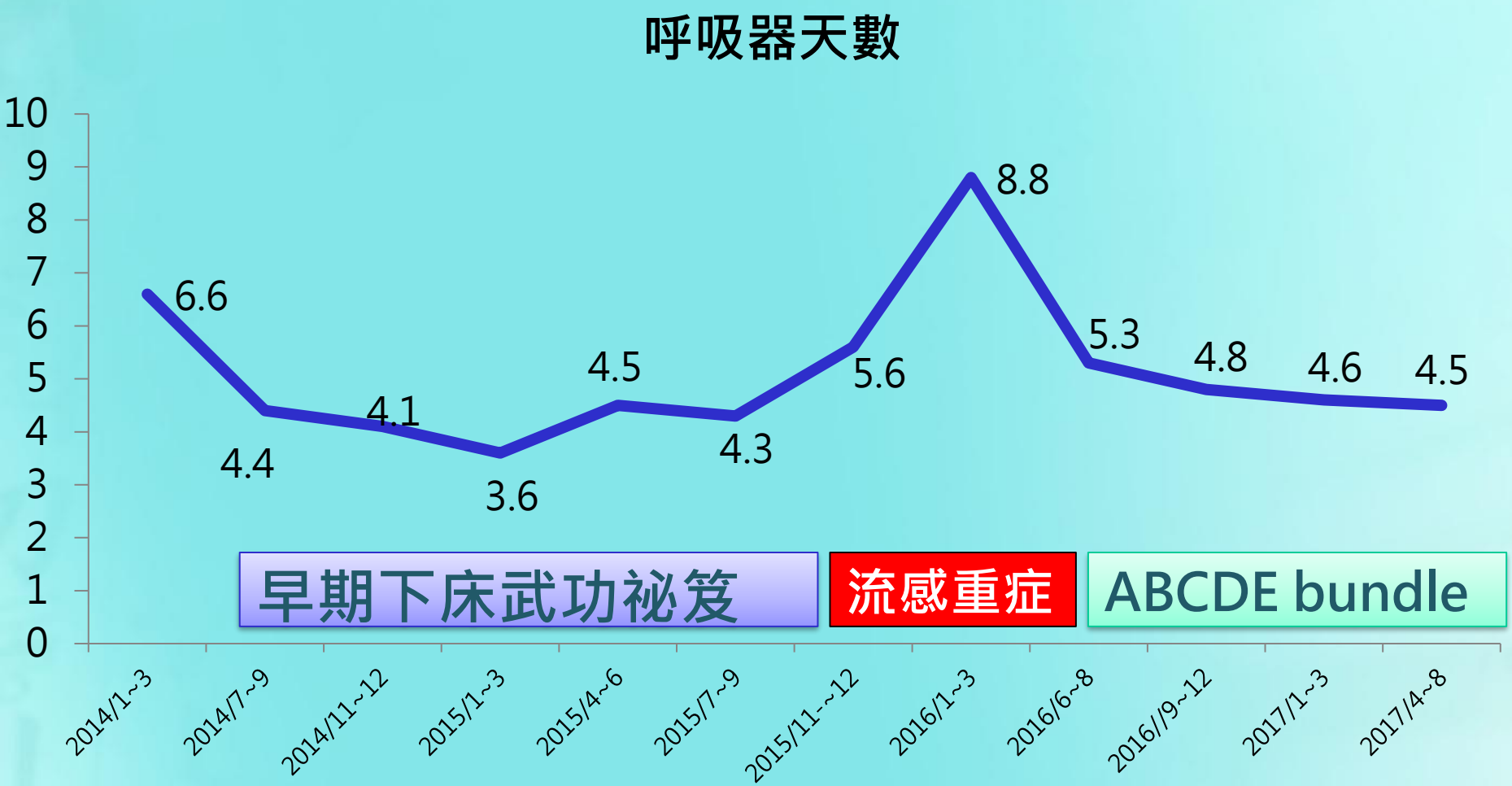


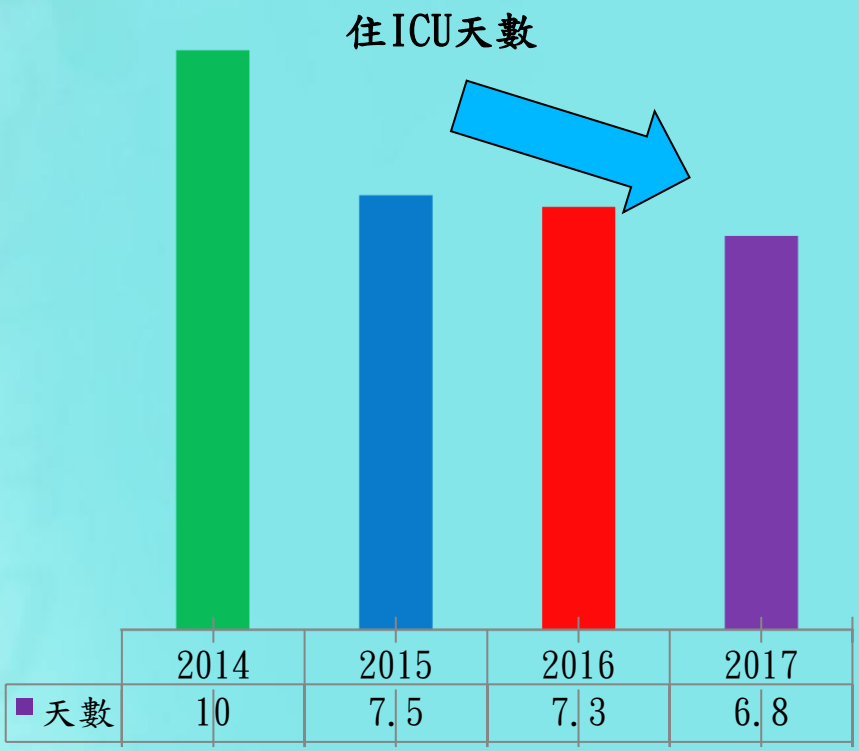
Table 4：Hierarchical regression model for associated factors and ICU days (N=173)

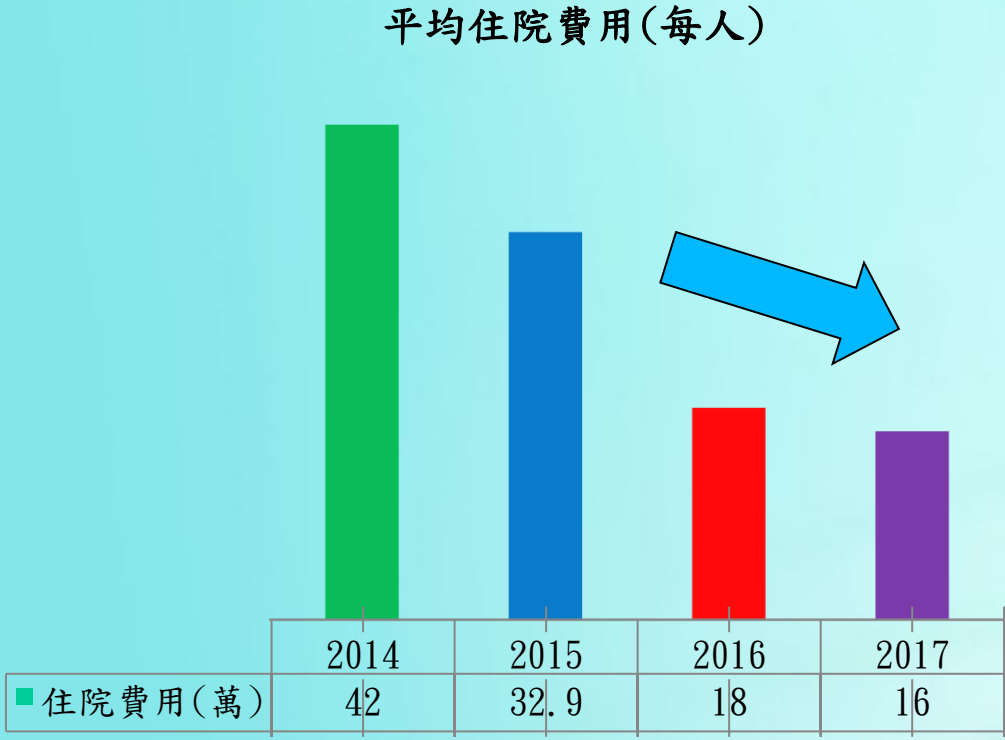
Variable	b	SE	t	p	95% CI
Age	-0.077	0.046	-1.026	0.306	-0.137~0.043
Sex	-0.137	1.391	-1.849	0.066	-5.317~0.174
Body mass index	**-0.166**	**0.108**	**-2.227**	**0.027**	**-0.453~-0.027**
APACHE II score	-0.087	0.081	-1.137	0.257	-0.252~0.068
TISS score	-0.025	0.113	-0.336	0.745	-0.261~0.187
GCS score	0.098	0.205	1.311	0.192	-0.136~0.673
No. of comorbidities	-0.062	0.035	-0.838	0.403	-0.097~0.039
Blood urea nitrogen	**0.269**	**0.021**	**3.344**	**0.001**	**-0.029~0.114**
Creatinine level	0.063	0.307	0.807	0.421	-0.358~0.853
Sodium level	0.041	0.138	0.547	0.585	-0.197~0.348
Potassium level	-0.028	1.101	-0.371	0.711	-2.582~1.766
Calcium level	0.113	0.621	1.437	0.153	-0.335~2.120
Phosphate level	-0.058	0.423	-0.699	0.485	-1.132~0.540
Albumin level	-0.094	1.252	-1.213	0.227	-3.991~0.953
Hemoglobin level	**-0.232**	**0.317**	**-3.172**	**0.002**	**-1.631~-0.380**
FiO_2	-0.051	0.325	-0.601	0.549	-0.839~0.448
PaO_2	0.003	0.019	0.032	0.974	-0.037~0.039
$PaCO_2$	0.024	0.097	0.226	0.822	-0.017~0.214
PaO_2/FiO_2	-0.116	0.010	-1.079	0.284	-0.032~0.009
Respiratory rate	0.256	0.139	1.886	0.061	-0.013~0.539
Heart rate	0.093	0.056	1.112	0.268	-0.049~0.174
Mean arterial pressure	-0.127	0.043	-1.540	0.126	-0.151~0.019
Tidal volume	-0.185	0.009	1.650	0.103	-0.032~0.003
Minute ventilation	-0.145	0.466	-1.278	0.206	-1.523~0.333
MIP	-0.063	0.107	-0.550	0.584	-0.272~0.154
MEP	-0.210	0.040	-1.881	0.064	-0.156~0.005
RSIB	0.109	0.037	0.962	0.339	-0.038~0.108
Phase 2 (ABCDE bundle)	**-0.214**	**1.379**	**-2.864**	**0.005**	**-6.673~-1.228**
F	8.202				
R^2	0.046				
$\triangle R^2$	0.005				

從武功祕笈到ABCDE bundle來改善呼吸器病人預後



從武功祕笈到ABCDE bundle來改善呼吸器病人預後





奇美醫療財團法人 奇美醫院
Chi Mei Medical Center

2014

2016

2018

Early Mobilization

ABCDE Bundle

AI Application

跨單位合作：
加護醫學部、護理部(6BICU)、復健部、呼吸治療科、藥劑部、感染管制中心、資訊室

選擇改善工具－精實管理

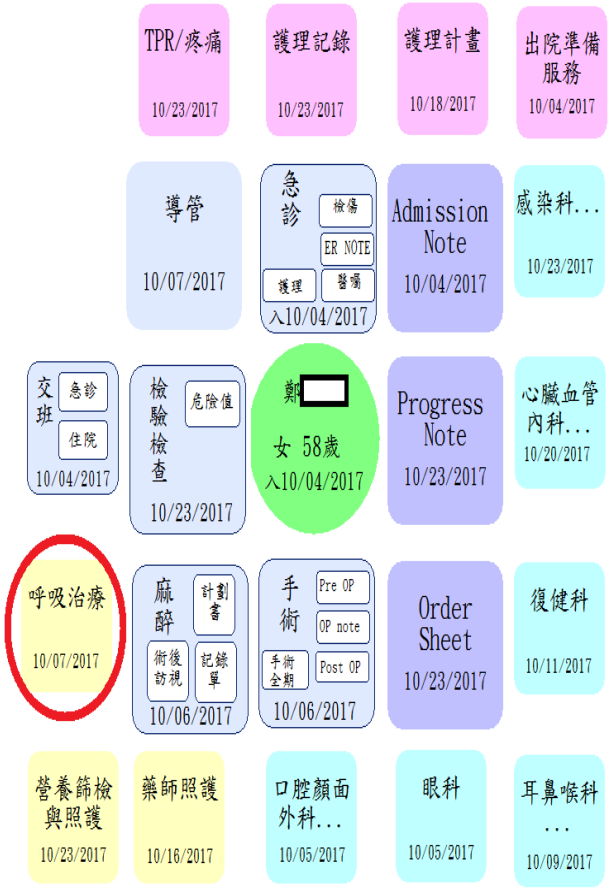
奇美醫療財團法人 奇美醫院
Chi Mei Medical Center

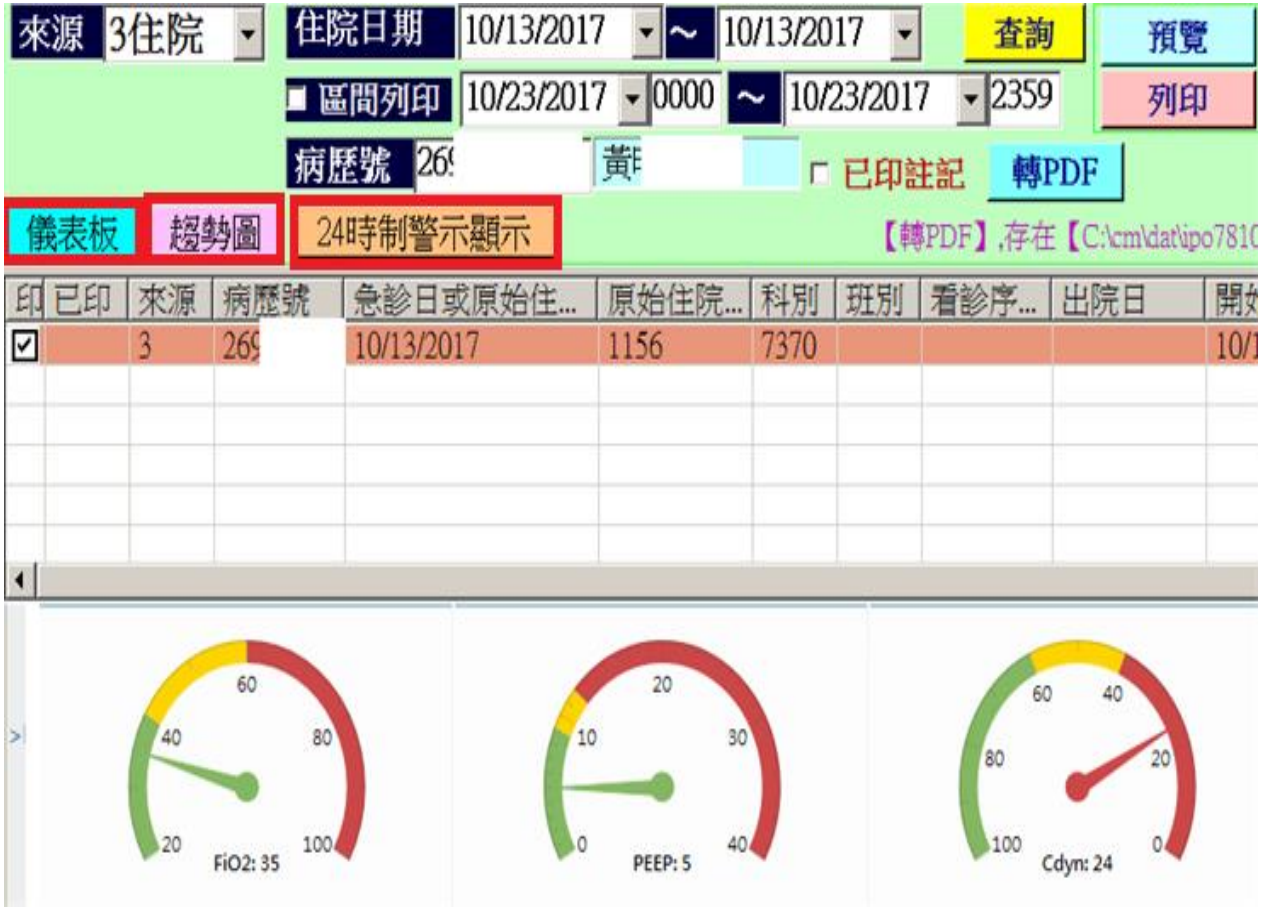
導入智慧化組合照護模式
降低呼吸器相關事件發生率

式模護照合組化慧智入導

- 運用智慧化呼吸器資訊拋轉(呼吸雲)/AI人工智慧加速呼吸器脫離

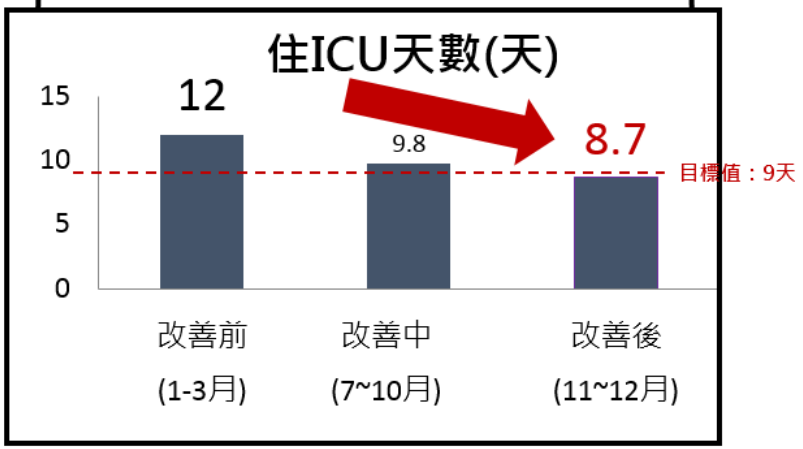
提供照護團隊即時資訊


TPR/疼痛
10/23/2017
護理記錄
10/23/2017
護理計畫
10/18/2017
出院準備服務
10/04/2017
導管
10/07/2017
急診
檢傷
ER NOTE
護理
醫囑
入10/04/2017
Admission Note
10/04/2017
感染科...
10/23/2017
交班
急診
住院
10/04/2017
檢驗檢查
危險值
10/23/2017
鄭
女 58歲
入10/04/2017
Progress Note
10/23/2017
心臟血管內科...
10/20/2017
呼吸治療
10/07/2017
麻醉
計劃書
術後訪視
記錄單
10/06/2017
手術
Pre OP
OP note
手術全期
Post OP
10/06/2017
Order Sheet
10/23/2017
復健科
10/11/2017
營養篩檢與照護
10/23/2017
藥師照護
10/16/2017
口腔顏面外科...
10/05/2017
眼科
10/05/2017
耳鼻喉科...
10/09/2017

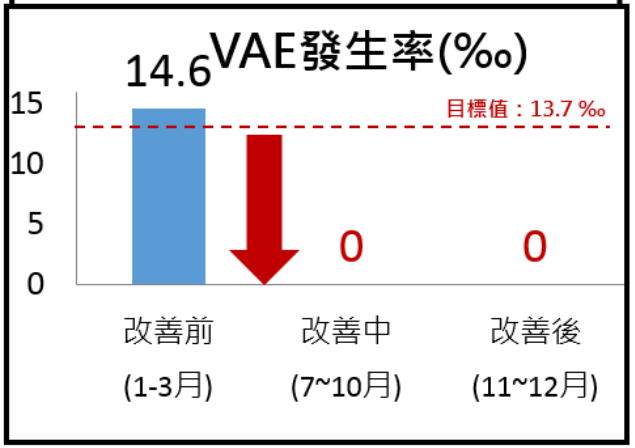

來源 3住院
住院日期 10/13/2017 ~ 10/13/2017
查詢
預覽
區間列印 10/23/2017 0000 ~ 10/23/2017 2359
列印
病歷號 269 黃
已印註記
轉PDF
儀表板
趨勢圖
24時制警示顯示
【轉PDF】,存在【C:\cm\dat\po7810
印 已印 來源 病歷號 急診日或原始住... 原始住院... 科別 班別 看診序... 出院日 開
3 269 10/13/2017 1156 7370
FiO2: 35
PEEP: 5
Cdyn: 24

效果確認

住加護病房天數
持續降低
目標達成率**110%**
進步率**27.5%**



呼吸器相關事件(VAE)
發生率**大幅下降**
目標達成率**162%**
進步率**100%**



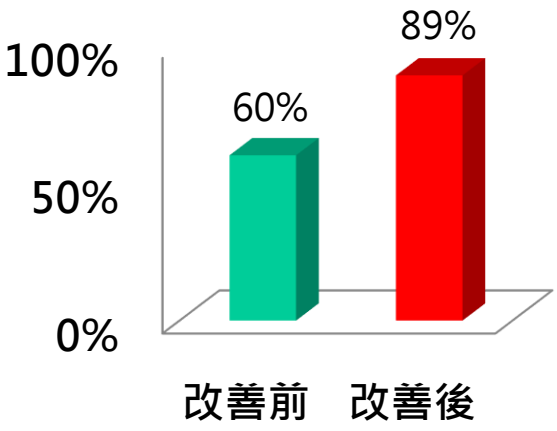
延伸效益

約束滿意**大幅提升**

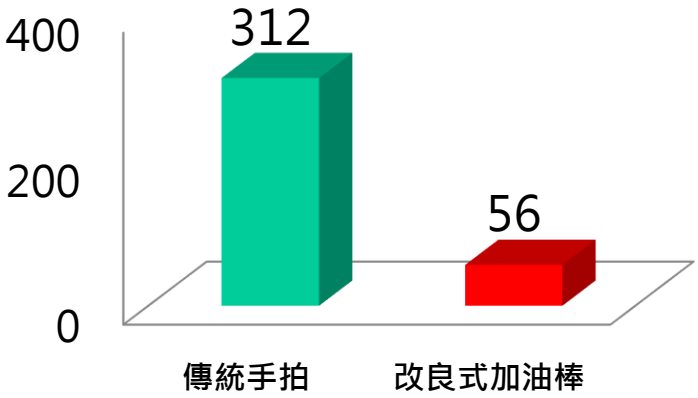
護理時數**大幅減少**

住院費用**持續改善**

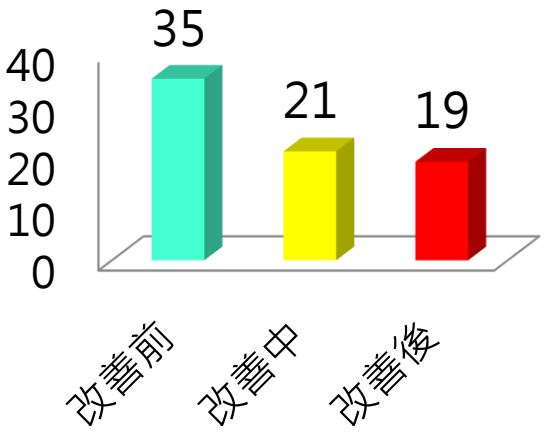
約束工具滿意度



減少護理時數(使用240人次)



住院費用(萬)



Mobilization is Medicine

EARLY GOAL-DIRECTED MOBILIZATION

早齊下床

瞻妄發生率
ICU天數
呼吸器天數
住院費用

拔管成功率
醫院榮耀

自拔壓力
自拔風險

減少成本

- 要活就要動
- 沒活動多病痛

持續改善-ABCDE bundle

A B C

每天讓病人**清醒** (Awakening)

接受自主**呼吸**訓練(Breathing)

整調物藥(Coordination)

D

妄瞻理管和測監 (Delirium survey & management)

E

床下期早(Early Exercise and Mobility)

Take home message-weaning

- Balance of ventilatory workload & demand
- Weaning after readiness
- SBT (T-piece or PSV) 30~120’
- NIV or HFNC for risky patients
- Steroid use for CLT(-)
- Early mobilization/ABCDEF bundle
- Using AI for survey/weaning prediction