



臺北市立萬芳醫院 - 委託臺北醫學大學辦理
Taipei Municipal Wanfang Hospital (Managed by Taipei Medical University)

漸進式運動之早期復健是 否能有助於重症加護病人 脫離呼吸器？

報告者:112051李宸儀

報告日期:2024/04/30

背景



重症病人使用呼吸器的致死率

- 脫離呼吸器時間
- 院內感染

長期使用呼吸器的併發症

- 感染:增加肺炎併發風險
- 延長長期臥床時間



長期使用呼吸器的併發症



Loss of muscle strength

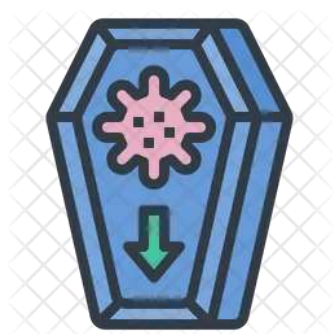


respiratory muscle weakness



Pneumonia

早期復健(**Early rehabilitation**)



mortality ↓



Hospital stay ↓



Disease complication ↓



Impact factor

2022 JOURNAL IMPACT FACTOR

3.7

[View calculation](#)



RESEARCH ARTICLE

Effects of different types and frequencies of early rehabilitation on ventilator weaning among patients in intensive care units: A systematic review and meta-analysis

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Abstract

Objective

This study aimed to investigate the effects of different types and frequencies of physiotherapy on ventilator weaning among patients in the intensive care unit (ICU) and to identify the optimal type and frequency of intervention.

Data sources

PubMed, Cochrane Library, EMBASE, and Airiti Library.

Study selection

Randomized controlled trials that provided information on the dosage of ICU rehabilitation and the parameters related to ventilator weaning were included.

OPEN ACCESS

Citation: Wu R-Y, Yeh H-J, Chang K-J, Tsai M-W (2023) Effects of different types and frequencies of early rehabilitation on ventilator weaning among patients in intensive care units: A systematic review and meta-analysis. *PLoS ONE* 18(4): e0284923. <https://doi.org/10.1371/journal.pone.0284923>

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Peer Review History: PLOS recognizes the benefits of transparency in the peer review process; therefore, we made the peer review for this article open. [View full review](#)

PICO

- P(participant)

ICU patient with MV

- I(intervention)

physiotherapy with high frequency or intensity exercise

- C(comparison)

physiotherapy with low frequency or intensity exercise,
usual care

- O(outcome)

Ventilation duration, extubation rate



Appraisal tool : CASP



- 英國牛津公共衛生部門研發
- 優點:針對不同類型的研究設計，都有明確的指導問題

Critical Appraisal Skills Programme (2018). CASP (insert name of checklist i.e. Systematic Review) Checklist.
[online] Available at: URL. Accessed: Date Accessed.



Three broad issue

A Are the results of the study valid?

B What are the results?

C Will the results help locally?



1. Did the review address a clearly focused question?

Study selection

PICO明確標示

The study selection criteria were based on the Population, Intervention, Comparison, and Outcome (PICO) method. The PICO parameters for this article were as follows: Population, critically ill patients; Intervention, physiotherapy (e.g., active mobilization) with high intensity and high frequency; Comparison, physiotherapy (e.g. passive mobilization) with low intensity and low frequency or control (e.g. medical usual care); Outcome, ventilator weaning. The following inclusion criteria were used for study selection: (1) The target population was the critically ill patients with MV in the ICU rather than in a chronic care center. (2) The interventions had to compare the control programs with lower intensity or frequency with experiment programs with higher dosage. (3) The outcome measures were focused on MV, such as ventilator duration or extubation rate. (4) Randomized controlled trials (RCTs) in English or Chinese published in peer-reviewed journals and the studies provided information on the intervention protocol and dosage. Unpublished manuscripts and conference abstracts were not eligible for study selection. The exclusion criteria were studies without physiotherapy interventions or ventilator-related outcomes, and those focusing on interventions after extubation.

1. Did the review address a clearly focused question?

Yes



Can't Tell

☐

No

☐

研究問題明確標示

Ventilator weaning is a goal for clinicians of all disciplines in the ICU; however, the optimal protocols of early rehabilitation for effective ventilator weaning remain unclear. The present systematic review and meta-analysis aimed to investigate the effects of different types and frequencies of early rehabilitation on ventilator weaning of patients in the ICU and to identify the optimal type and frequency of intervention.

2. Did the authors look for the right type of papers?

依照PICO內容訂定納入標準及排除標準

Yes	<input checked="" type="checkbox"/>
Can't Tell	<input type="checkbox"/>
No	<input type="checkbox"/>

and low frequency or control (e.g. medical usual care); Outcome, ventilator weaning. The following inclusion criteria were used for study selection: (1) The target population was the critically ill patients with MV in the ICU rather than in a chronic care center. (2) The interventions had to compare the control programs with lower intensity or frequency with experiment programs with higher dosage. (3) The outcome measures were focused on MV, such as ventilator duration or extubation rate. (4) **Randomized controlled trials (RCTs)** in English or Chinese published in peer-reviewed journals and the studies provided information on the intervention protocol and dosage. Unpublished manuscripts and conference abstracts were not eligible for study selection. The exclusion criteria were studies without physiotherapy interventions or ventilator-related outcomes, and those focusing on interventions after extubation.

合適的研究類型:RCT

Records identified through database

Additional records identified

Table 1. Demographics of included patients.

Demographics	Total n = 2,567
Geographical region (%)	Europe: 914 (35.61%)
	USA: 645 (25.13%)
	Asia: 542 (21.11%)
	Australia: 380 (14.80%)
	South America: 56 (2.18%)
	Turkey: 30 (1.17%)
Setting (%)	ICU: 1,045 (40.71%)
	MICU: 833 (32.45%)
	SICU: 609 (23.72%)
	RICU: 80 (3.12%)
Participants' type (%)	Critical illness: 1,955 (76.16%)
	Post-cardiac surgery: 370 (14.41%)
	Pulmonary: 196 (7.64%)
	Bed-ridden elderly: 28 (1.09%)
	ICUAW: 18 (0.7%)
Intervention type (%)	CPT: 767 (29.89%)
	EPT: 0 (0%)
	NMES: 74 (2.88%)
	PM: 350 (13.63%)
	Multi-component: 1,376 (53.60%)

納入文獻符合PICO内容

Age:55-65

CPT: Conventional physical therapy; EPT: Exercise-based physical therapy; ICU: Intensive Care Unit; ICUAW: Intensive Care Unit-Acquired Weakness; MICU: Medical Intensive Care Unit; NMES: Neuromuscular Electrical Stimulation; PM: Progressive mobility; RICU: Respiratory Intensive Care Unit; SICU: Surgery Intensive Care Unit

<https://doi.org/10.1371/journal.pone.0284923.t001>

than ventilator
duration, n=4

[Effects of different types and frequencies of early rehabilitation on ventilator weaning among patients in intensive care units: A systematic review and meta-analysis - PMC \(nih.gov\)](#)

3. Do you think all the important, relevant studies were included?

Data sources and searches

The concatenation of keywords and synonyms by “OR” and “AND” were searched in the following four databases on January 15, 2022: PubMed (1946–2021/12/31), Cochrane Library (1995–2021/12/31), EMBASE (1947–2021/12/31), and Airiti Library (1979–2021/12/31). The keywords included critical illness, intensive care unit, rehabilitation, physical therapy, early mobility, ventilator weaning, and extubation. Every synonym of the keywords was checked with MeSH and the same search protocol was used in each database. The detailed search strategy is shown in S1 Appendix.

Two reviewers (RYW and KJC) independently screened the titles and abstracts of the collected articles. Disagreement was resolved by consensus. Subsequently, a full-text review was conducted. In addition, handsearching was performed on the reference lists of included articles and previously published reviews.

Study recruitment

A total of 3,673 articles were eligible in the electronic search, and additional 18 articles were included from handsearching. Ninety-eight articles were selected after screening the titles and abstracts. During the full-text review process, 74 articles were excluded (i.e., non-RCTs, articles recruiting chronic patients, lacking physiotherapy intervention, lacking ventilator-related outcomes, and focusing on post-extubation interventions). A total of 24 articles were included for review (Fig 1).

4種電子資料庫
(包含人工搜尋)

Yes	<input checked="" type="checkbox"/>
Can't Tell	<input type="checkbox"/>
No	<input type="checkbox"/>

由2位專業人士
分別獨立進行篩選

明確記錄搜尋關鍵字

4. Did the review's authors do enough to assess quality of the included studies?

Risk of bias 2.0 was used to assess the methodological quality of the recruited articles [28], which was independently scored by two reviewers (RYW and KJC). The assessment items included bias arising from the randomization process, bias due to deviations from intended interventions, bias due to missing outcome data, bias in the measurement of outcome, and bias in the selection of the reported result. If no consensus was reached, a third reviewer (MWT) made the final determination. The inter-reviewer agreement score for quality assessment was calculated as kappa statistics and percentage agreement. If the value of kappa was > 0.75 , the inter-reviewer agreement was recognized as “excellent” [29].

由2位專業人士分別獨立進行篩選
若有意見不同之處，有獨立的第三者
做最後決定

4. Did the review's authors do enough to assess quality of the included studies?

使用考克蘭ROB 2.0進行評讀

Yes ☒

Can't Tell ☐

No ☐

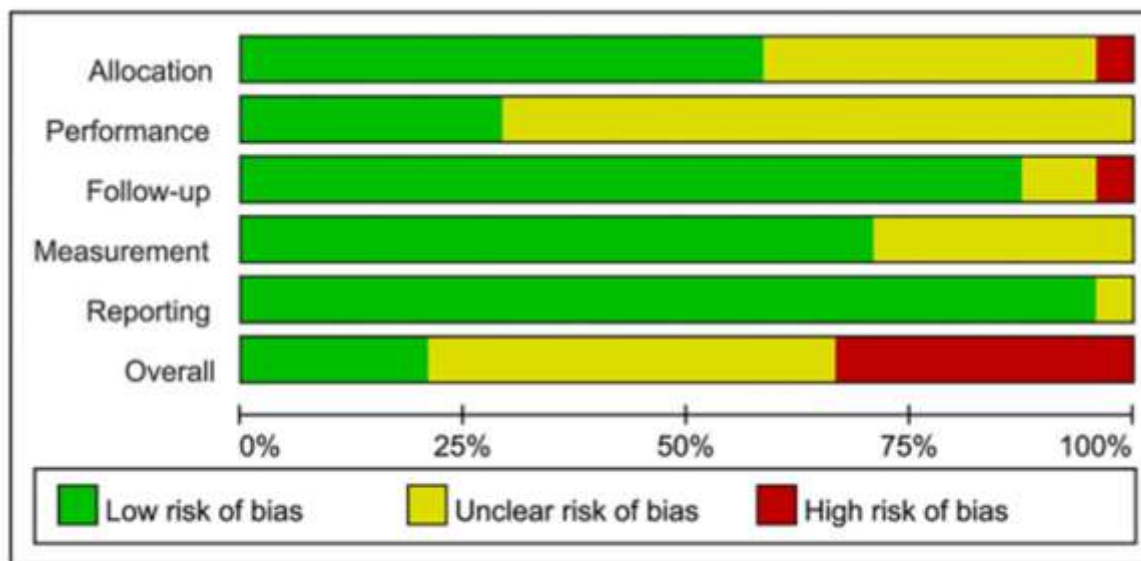


Fig 3. Risk of bias graph.

Fig 2. Risk of bias summary.
<https://doi.org/10.1371/journal.pone.0284923.g002>

Yosef-Brauner 2013	?	+
wright 2017	?	+
	+	+
	+	+
	+	+
	?	+

Allocation
 Performance
 Follow-up
 Measurement
 Reporting
 Overall



5. If the results of the review have been combined, was it reasonable to do so?

NEMS which was the rarest intervention (Table 1).

As summarized in S1 Table, seven (29%) of 24 studies were found to have positive effects on the ventilator duration, ventilator-free days, or extubation rate during hospitalization [31–37]. All 4 studies using the PM approach had significantly shorter ventilator duration in the intervention group; however, differences in the ventilator-free days were not significant [31–33, 35]. One of the studies using early mobilization with/without an elastic band was beneficial with respect to ventilator duration when compared to multiple components including passive and active range of motion and breathing exercises [34]. A study using rotation therapy (changing position continuously for 18 h/day) and percussion showed significantly shorter ventilator duration and longer ventilator-free days than that of routine position changing every 2–4 h [36]. A study using multimodality chest physical therapy showed a higher extubation rate when compared to studies using manual hyperinflation and suctioning [37]. Regarding multiple-component treatments as early rehabilitation intervention, 83% (10/12) of studies did not show significant benefit either in the outcomes related to ventilator weaning, when compared to the low dosage of intervention, medical treatment, or usual care as the control group [38–48]. Three studies using CPT, which were primarily comprised of chest physical therapy and range of motion exercise, did not show significant improvement in weaning outcomes [49–51]. All four studies using NEMS alone or combined exercises as an intervention did not show significant benefit on ventilator weaning [41, 42, 52, 53]. Only one study indicated that treatment combining physical therapy and airway clearance techniques may lead to

Yes	<input type="checkbox"/>
Can't Tell	<input checked="" type="checkbox"/>
No	<input type="checkbox"/>

並未展示
publication bias的
統計圖(funnel plot)

因納入文章異質性高($I^2 > 50\%$)，故
文章皆採用random-effects model

6. What are the overall results of the review?

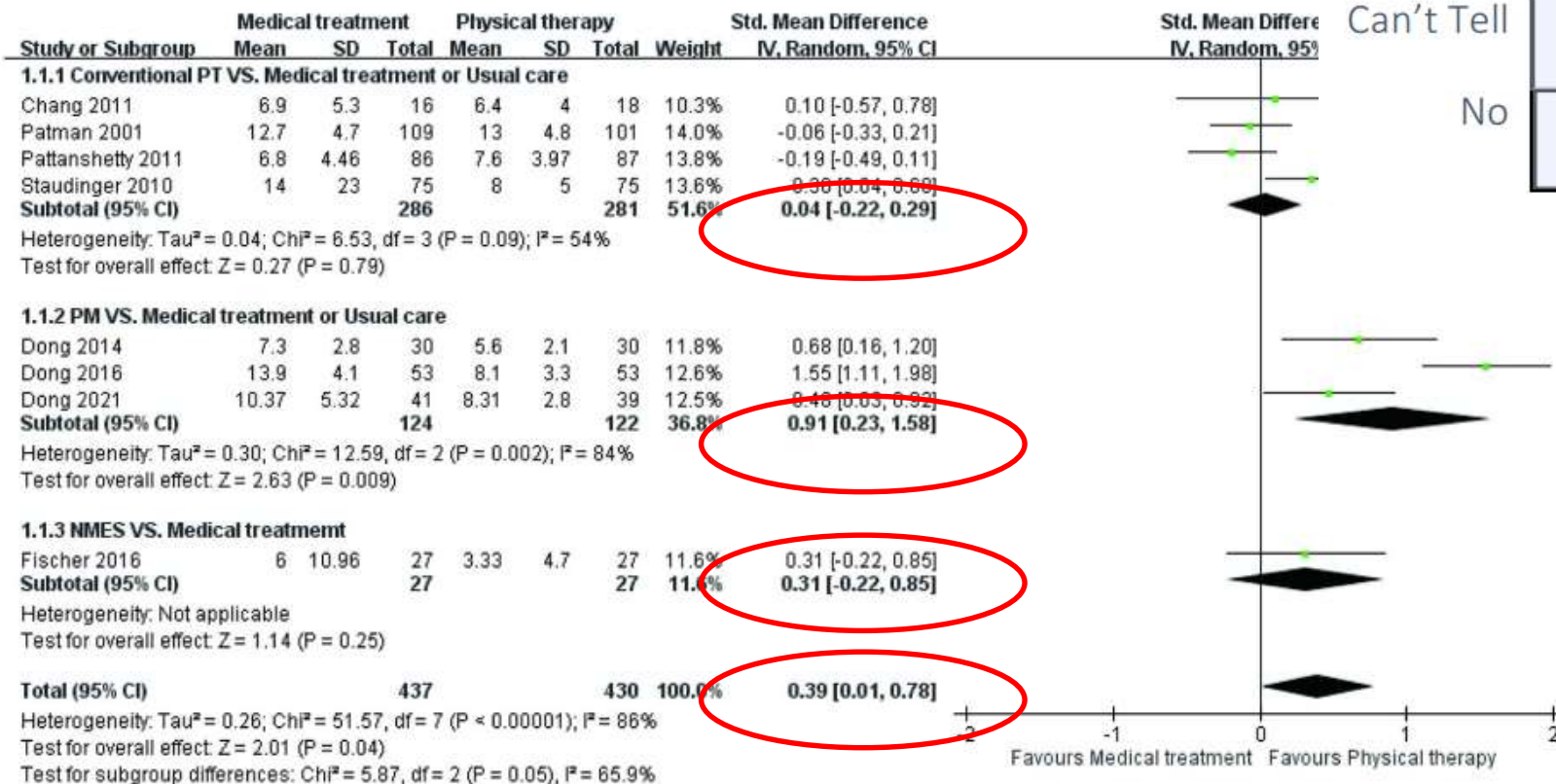
A. Physical therapy compared to medical treatment

Yes



Can't Tell

No



6. What are the overall results of the review?

B. Low-dose physical therapy compared to high-dose physical therapy

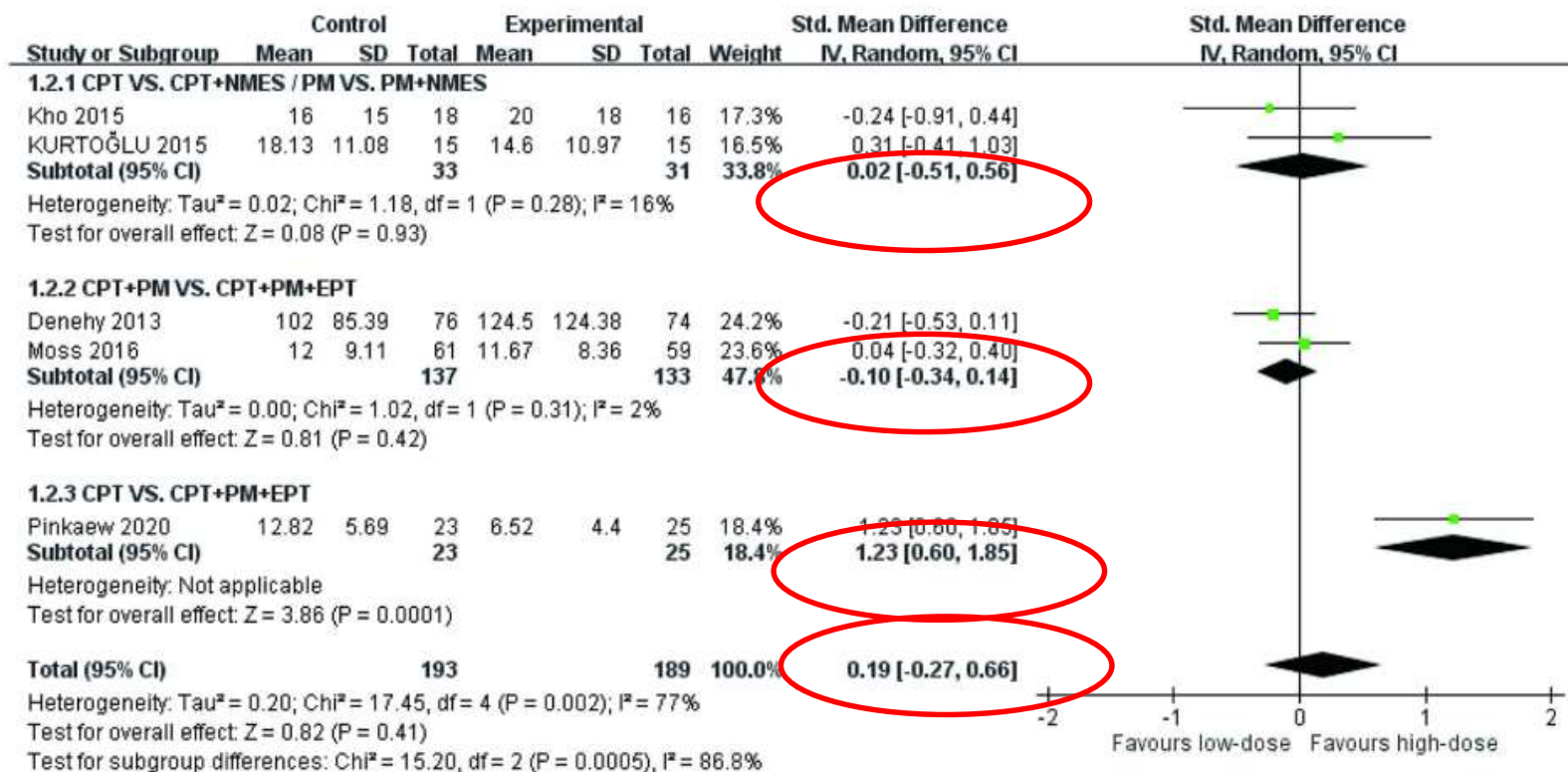
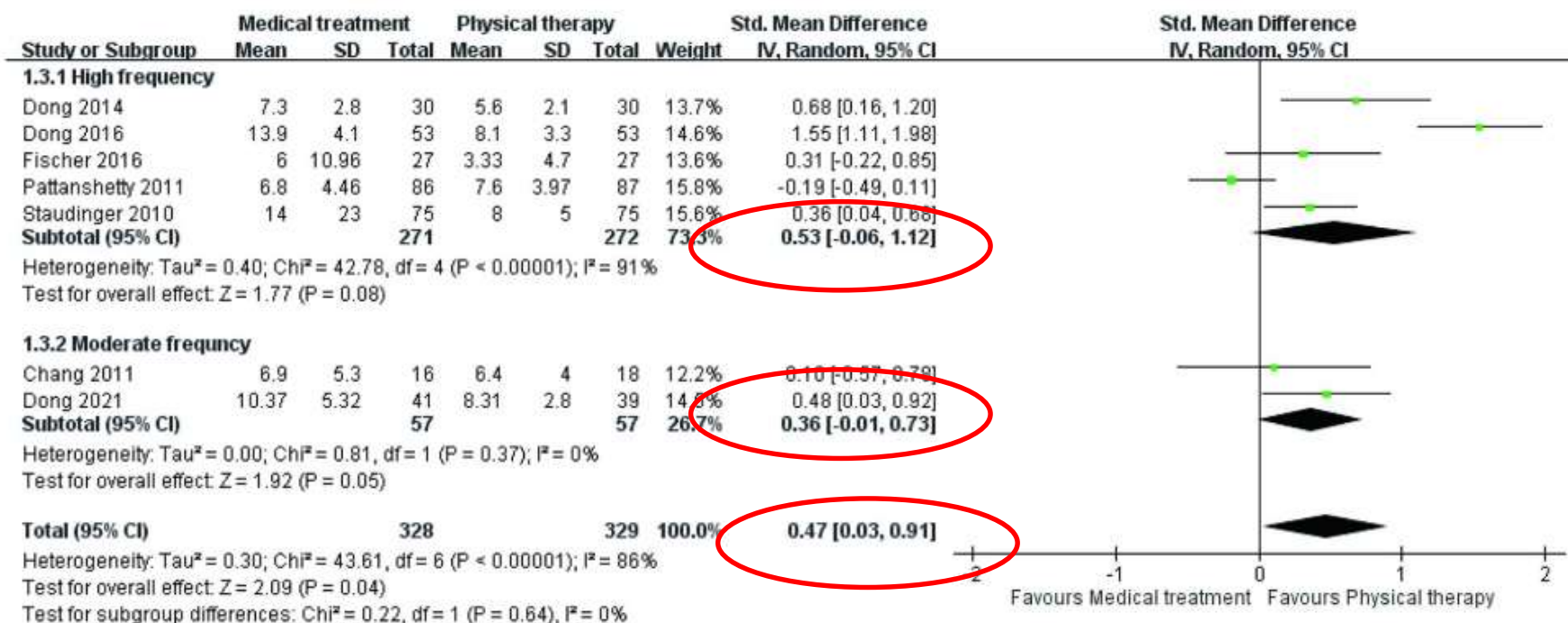


Fig 4. Forest plot: The effects of different types of physiotherapy on ventilator duration. (A) Physical therapy compared to medical treatment; (B) low-dose physical therapy compared to high-dose physical therapy.

6. What are the overall results of the review?

A. Physical therapy compared to medical treatment



6. What are the overall results of the review?

B. Moderate-frequency physical therapy compared to high-frequency physical therapy

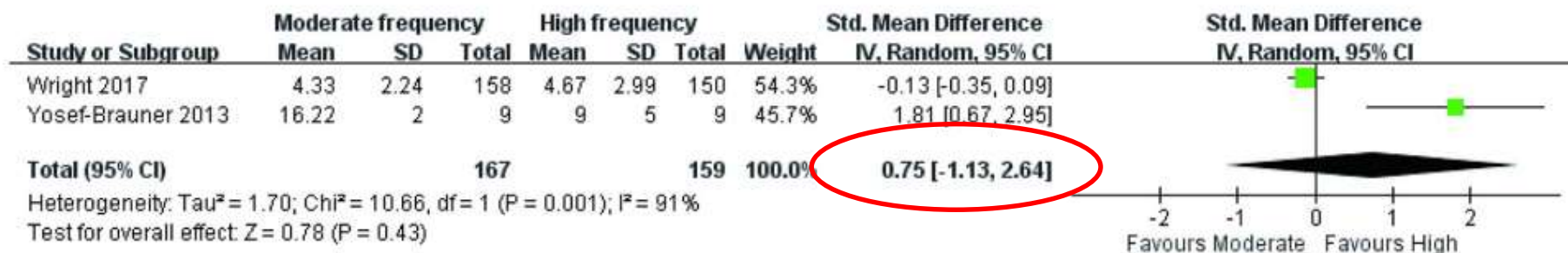


Fig 5. Forest plot: The effects of different frequencies of physiotherapy on ventilator duration. (A) Physical therapy compared to medical treatment; (B) moderate-frequency physical therapy compared to high-frequency physical therapy.

7. How precise are the results?

Total (95% CI) 437 430 100.0%
 Heterogeneity: $\tau^2 = 0.26$; $\chi^2 = 51.57$, $df = 7$ ($P < 0.00001$); $I^2 = 86\%$
 Test for overall effect: $Z = 2.01$ ($P = 0.04$)
 Test for subgroup differences: $\chi^2 = 5.87$, $df = 2$ ($P = 0.05$), $I^2 = 65.9\%$

0.39 [0.01, 0.78]



Yes

Can't Tell

No



Total (95% CI) 193 189 100.0%
 Heterogeneity: $\tau^2 = 0.20$; $\chi^2 = 17.45$, $df = 4$ ($P = 0.002$); $I^2 = 77\%$
 Test for overall effect: $Z = 0.82$ ($P = 0.41$)
 Test for subgroup differences: $\chi^2 = 15.20$, $df = 2$ ($P = 0.0005$), $I^2 = 86.8\%$

0.19 [-0.27, 0.66]

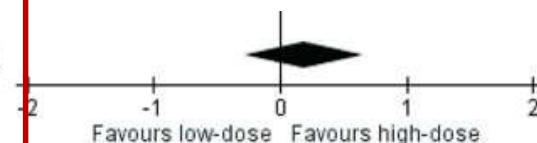
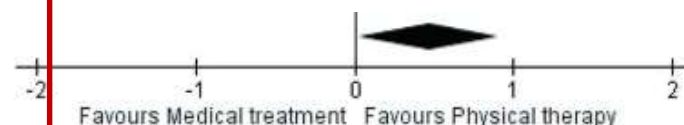


Fig 4. Forest plot: The effects of different types of physiotherapy on ventilator duration. (A) Physical therapy compared to medical treatment; (B) low-dose physical therapy compared to high-dose physical therapy.

Total (95% CI) 328 329 100.0%
 Heterogeneity: $\tau^2 = 0.30$; $\chi^2 = 43.61$, $df = 6$ ($P < 0.00001$); $I^2 = 86\%$
 Test for overall effect: $Z = 2.09$ ($P = 0.04$)
 Test for subgroup differences: $\chi^2 = 0.22$, $df = 1$ ($P = 0.64$), $I^2 = 0\%$

0.47 [0.03, 0.91]



信賴區間寬度與精準度有相對的關係
 各項結果的信賴區間寬度皆大於25%，
 屬於較寬的信賴區間。
 寬廣的信賴區間反映較大的不確定性

可能導致原因：
 1. 樣本數不夠大
 2. 納入文章的異質性高

8. Can the results be applied to the local population?

- 根據文中所設定的參與者類型及納入統合分析的文章的受試者屬性，應可運用於台灣當地族群。然而，受限於台灣醫療現況人力不足及ICU病人的疾病狀態，應謹慎運用於臨床實務中
- 最佳推薦:漸進式運動(PM)
- 搭配RASS的評估給予最適合的運動

Yes	<input checked="" type="checkbox"/>
Can't Tell	<input type="checkbox"/>
No	<input type="checkbox"/>

RASS	漸進式運動
-4~5	被動運動
-3~2	坐姿
-1~1	主動運動、床邊坐姿、站立、行走

- 特別注意病人的耐受度(設立停損點)
- 當人員不足，根據耐受度增加頻率的床上運動也是一種選擇

9. Were all important outcomes considered?

Yes	<input type="checkbox"/>
Can't Tell	<input checked="" type="checkbox"/>
No	<input type="checkbox"/>

- 明確的評估脫離呼吸器最合適的運動型態
- 對於複合型的運動計畫，無法去評估其效果量，各項治療間的效果量比較也無法明確得知(需要以網絡統合分析型的研究去評估)
- 對於不良反應事件，並未特別去評估
- 並未提出出版偏差的統計結果

10. Are the benefits worth the harms and costs?

Yes	<input type="checkbox"/>
Can't Tell	<input checked="" type="checkbox"/>
No	<input type="checkbox"/>

- 漸進式運動對於脫離呼吸器的成效是可見的
- 給予每位病人採取客製化、最合適之強度及頻率的運動處方，讓其治療計劃達到最大效益
- 漸進式運動能早期脫離呼吸器，降低肺炎感染風險及致死率
- 運動處方建議：中~高強度，每周治療三天

Limitation

- 最後納入統合分析的文章只有15篇，篇數過少
- 納入的文章屬於低到中品質，且文章缺乏盲性，需要納入更高品質研究設計的文章
- 並未將可能影響結果的變項進行敏感度分析(例如年齡、性別、樣本量)
- 沒有呈現出版偏差的統計結果圖
- 並不是每篇文章都有提供病人的RASS數值

目前臨床現況

- 人力缺乏
- 醫療團隊考量插管及管路病人運動的耐力及可行性調整運動型態，大多都會改為被動運動類型的運動。

Summary

Critical Appraisal Skills Programme	Yes	Nb	Can't tell
1. Did the review address a clearly focused question?	✓		
2. Did the authors look for the right type of papers?	✓		
3. Do you think all the important, relevant studies were included?	✓		
4. Did the review's authors do enough to assess quality of the included studies?	✓		
5. If the results of the review have been combined, was it reasonable to do so?			✓
6. What are the overall results of the review?	✓		
7. How precise are the results?		✓	
8. Can the results be applied to the local population?			✓
9. Were all important outcomes considered?	✓		
10. Are the benefits worth the harms and costs?	✓		



Let's vote!!!

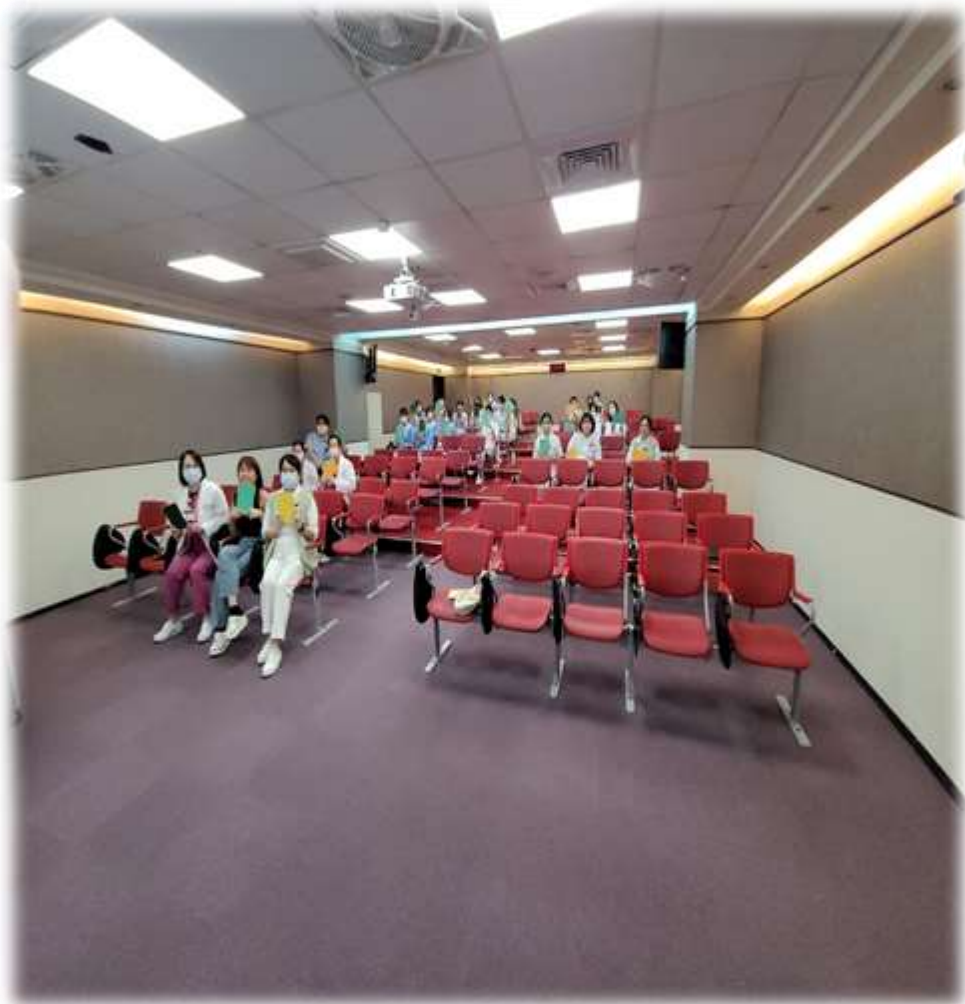
漸進式運動之早期復健是否能有助於重症加護病人脫離呼吸器？

同
意

仍有
疑慮

不
同
意





同意	18
仍有疑慮	8
不同意	0





臺北市立萬芳醫院 - 委託臺北醫學大學辦理
Taipei Municipal Wanfang Hospital (Managed by Taipei Medical University)

敬請指導

