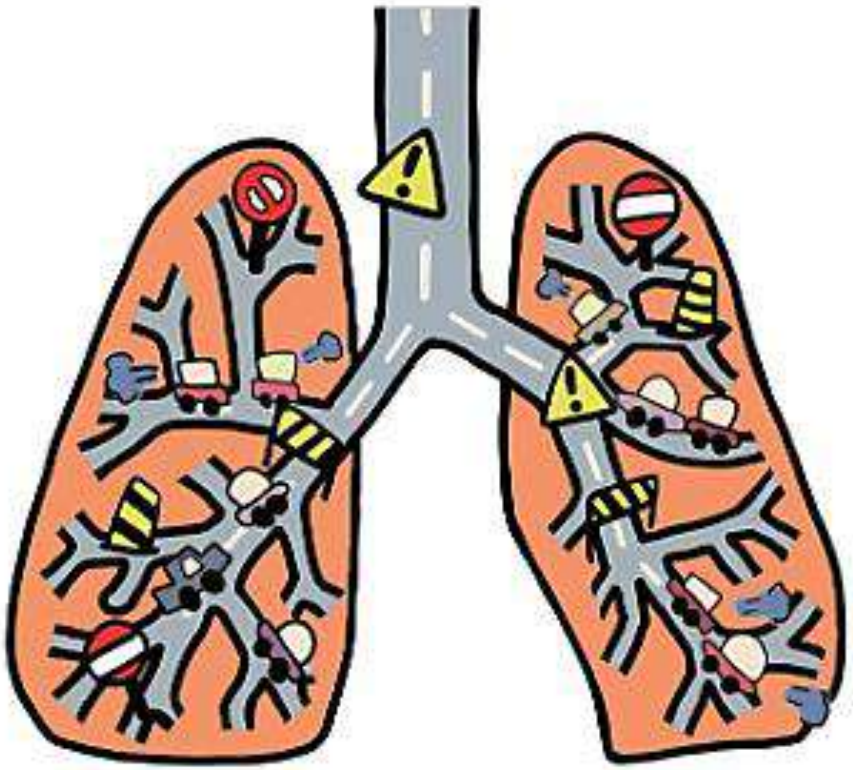
慢性阻塞性肺病急性發作使用高頻震顫治療是否可促進痰液排除？

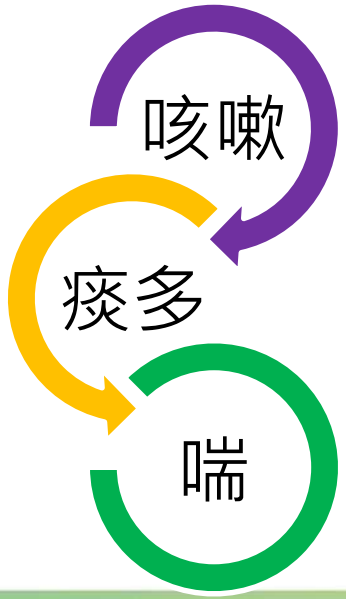
報告人：胡文婷

報告日期：2023/01/10

前言

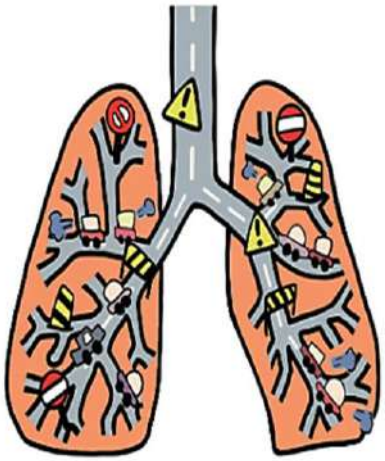


- 慢性呼吸道疾病中，肺阻塞是最常見的老年呼吸道疾病。
- 導致肺泡及小氣道漸進性、結構性的傷害。



前言

ICU/ Ward



HOME

研究探討的問題

P : COPD AE病人

I : 使用高頻胸壁震顫治療

C : 非使用高頻胸壁震顫治療

O : 促進痰液排出

International Journal of Chronic Obstructive Pulmonary Disease Dovepress
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ORIGINAL RESEARCH

Effects of High-Frequency Chest Wall Oscillation on Acute Exacerbation of Chronic Obstructive Pulmonary Disease: A Systematic Review and Meta-Analysis of Randomized Controlled Trials

Hsiao-Ping Huang[1], Kee-Hsin Chen[2–6], Chen-Liang Tsai[7], Wen-Pei Chang[8,9], Sherry Yueh-Hsia Chiu[10,11], Shin-Rou Lin[10,11], Yu-Huei Lin[2]

SCI刊出:2022.11.10

Impact Factor：2.893

Purpose: This study aimed to evaluate the efficacy of high-frequency chest wall oscillation for sputum expectoration and hospital length of stay in patients with acute exacerbations of chronic obstructive pulmonary disease. The improvements in pulmonary function and oxygenation were also investigated.

Patients and Methods: This systematic review and meta-analysis followed the Preferred Reporting Items for Systematic Review and Meta-analyses (PRISMA) guidelines. Automated literature database searches were conducted from the earliest records to March 31, 2022. The methodological quality of the included studies was assessed using the Cochrane Risk of Bias tool (RoB 2.0), and meta-analysis software (RevMan 5.4) was used to analyze the data.

Results: From 5439 identified articles, 13 studies (with 756 patients) were included in this meta-analysis. Compared to other airway clearance techniques, HFCWO significantly increased expectorated sputum volume by 6.18 mL (95% CI: 1.71 to 10.64; $I^2 = 87\%$), shortened hospital stay by 4.37 days (95% CI: −7.70 to −1.05; $I^2 = 84\%$). However, FEV_1 (%), PaO_2, and $PaCO_2$ did not improve significantly.

Conclusion: AECOPD patients may benefit from HFCWO therapy. HFCWO enables AECOPD patients to excrete more sputum and shorten their hospital stays. However, due to heterogeneity among the included research, these results should be interpreted with caution.

Keywords: acute exacerbation of chronic obstructive pulmonary disease, AECOPD, high-frequency chest wall oscillation, HFCWO, sputum expectoration, length of hospital stay


FAITH

FAITH評讀

研究是否找到 (Find) 所有的相關證據？

METHODS

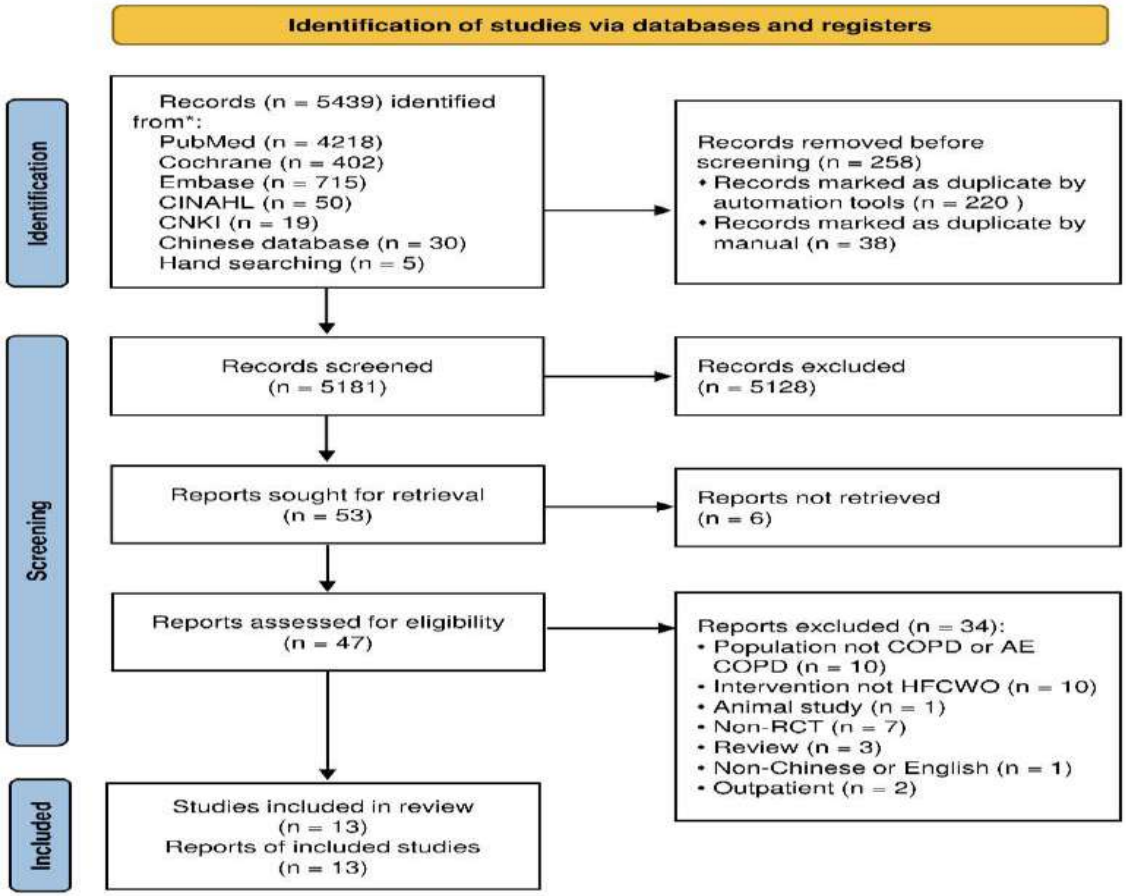
Search Strategy

Cochrane Library, Excerpta Medica Database (Embase), PubMed, Cumulative Index to Nursing and Allied Health Literature (CINAHL), China National Knowledge Infrastructure (CNKI), Airiti Library, and the National Digital Library of Theses and Dissertations in Taiwan were searched from their inception to March 2022 to identify publications of interest. The search terms were keywords, Medical Subject Heading (MeSH) terms, and suitable variants of COPD and HFCWO. Searches were conducted with a combination of terms using Boolean logical operators (AND/OR) as follows: "pulmonary disease, chronic obstructive" [MeSH] OR "Lung Diseases, Obstructive" [MESH] OR "Pulmonary Emphysema" [MESH] OR "Chronic obstructive pulmonary disease" OR "COPD" OR "Acute Exacerbation of chronic obstructive pulmonary disease" OR "AECOPD" OR "Chronic obstructive pulmonary disease exacerbations" OR "Exacerbation" AND "chest wall oscillation" [MeSH] OR "High-frequency chest wall oscillation" OR "HFCWO" OR "pulmonary rehabilitation" OR "Chest physiotherapy" OR "physiotherapy intervention."

FAITH評讀

研究是否找到 (Find) 所有的相關證據？

METHODS



Material and Methods

This systematic review and meta-analysis adhered to the Preferred Reporting Items for Systematic Review and Meta-analyses (PRISMA) statement (the full checklist is given in Supplementary Table 1: PRISMA 2009 checklist).[6]

評讀結果： ☑ 是 ☐否☐不清楚

FAITH評讀

研究是否經過嚴格評讀(Appraisal)？

Quality Assessment

The risk of bias in the studies was evaluated using the revised Cochrane risk of bias tool for randomized trials (RoB 2), which includes five domains: randomization process, deviations from intended interventions, missing outcome data, measurement of the outcome, and selection of the reported result.[7] We rated each domain as "low", "some concerns", or "high" and determined the overall ROB for each study based on the highest risk attributed to any one domain. All studies were independently reviewed by two reviewers. When the two reviewers had opposing opinions, a third researcher was brought into the discussion to assist in reaching a consensus.

評讀結果： ☑ 是 ☐否☐不清楚

FAITH評讀

是否只納入(Included)具良好效度的文章？

RESULT

使用 Cochrane 偏誤風險工具 (RoB 2.0) 評估了納入研究的方法質量

Risk of bias domains

Study	D1	D2	D3	D4	D5	Overall
Chakravorty 2011[10]	!	!	+	+	!	!
Duan 2019[15]	!	+	+	-	!	-
Goktalay 2013[9]	+	+	+	+	!	!
Huang 2013[17]	!	+	+	+	!	!
Li 2017[14]	!	+	+	+	!	!
Li 2020[19]	!	+	+	-	!	-
Liu 2014[11]	!	!	+	+	!	!
Mahajan 2011[12]	!	+	+	+	+	!
Ouyang 2020[20]	!	+	+	-	!	-
Tan 2020[13]	!	+	-	+	!	-
Wang 2021[18]	!	+	+	+	!	!
Xie 2017[16]	!	+	+	+	!	!
Zhang 2019[21]	!	+	+	-	!	-

Domains:
D1: Bias arising from the randomization process.
D2: Bias due to deviations from intended intervention.
D3: Bias due to missing outcome data.
D4: Bias in measurement of the outcome.
D5: Bias in selection of the reported result.

- High
! Some concerns
+ Low

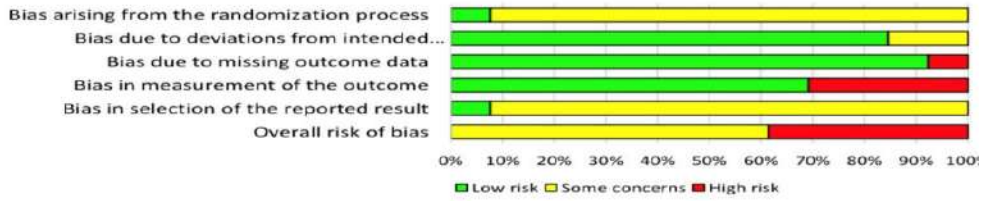


Figure 2 Quality assessment of bias using Cochrane Collaboration 2.0.

評讀結果： ☑ 是 ☐否☐不清楚

FAITH評讀

是否以表格和圖表總結(Total up)試驗結果？

Study or Subgroup	HFCWO Mean	HFCWO SD	HFCWO Total	Control Mean	Control SD	Control Total	Weight	Mean Difference IV, Random, 95% CI
1.1.1 A. Day 1								
Duan 2019[15]	48.09	8.38	43	39.37	9.14	43	17.1%	8.72 [5.01, 12.43]
Huang 2013[17]	43.97	9.62	30	34.7	10.56	30	15.5%	9.27 [4.16, 14.38]
Li 2017[14]	9.1	7.7	15	11.7	2.6	15	16.7%	-2.60 [-6.71, 1.51]
Xie 2017[16]	44.2	9.8	40	34.2	9.7	40	16.5%	10.00 [5.73, 14.27]
Subtotal (95% CI)			**128**			**128**	**65.8%**	**6.31 [0.31, 12.30]**
Heterogeneity: Tau² = 32.59; Chi² = 23.78, df = 3 (P < 0.0001); I² = 87%								
Test for overall effect: Z = 2.06 (P = 0.04)								
1.1.5 B. Day 5								
Tan 2020[13]	35.45	8.63	33	34.58	9.83	36	16.4%	0.87 [-3.49, 5.23]
Wang 2021[18]	48.05	6.23	42	37.46	7.76	42	17.8%	10.59 [7.58, 13.60]
Subtotal (95% CI)			**75**			**78**	**34.2%**	**5.86 [-3.66, 15.38]**
Heterogeneity: Tau² = 43.59; Chi² = 12.94, df = 1 (P = 0.0003); I² = 92%								
Test for overall effect: Z = 1.21 (P = 0.23)								
Total (95% CI)			**203**			**206**	**100.0%**	**6.18 [1.71, 10.64]**
Heterogeneity: Tau² = 26.70; Chi² = 37.34, df = 5 (P < 0.00001); I² = 87%								
Test for overall effect: Z = 2.71 (P = 0.007)								
Test for subgroup differences: Chi² = 0.01, df = 1 (P = 0.94), I² = 0%								

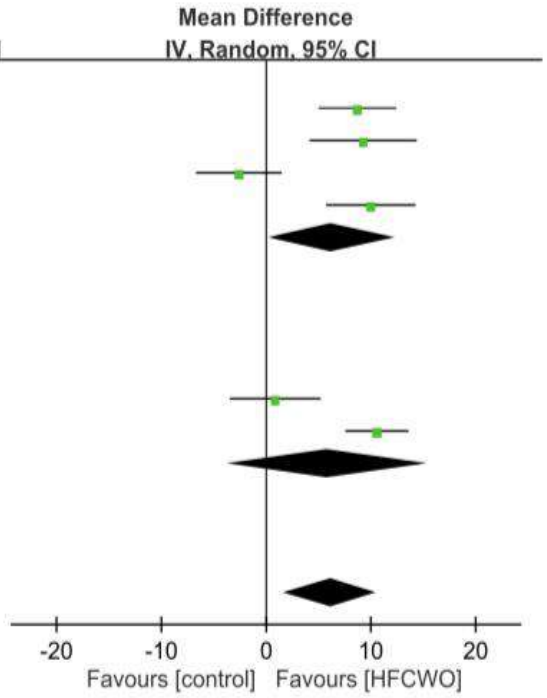


Figure 3 Forest plot of HFCWO vs control group treatment time, outcome: Sputum expectoration.

故進行subgroup分析，執行HFCWO治療天數對COPD病人痰排出有顯著成效(MD6.18, 95%CI [1.71,10.64], p=0.007)

評讀結果：☑ 是 □否□不清楚

FAITH評讀

是否以表格和圖表總結(Total up)試驗結果？

Study or Subgroup	Experimental Mean	SD	Total	Control Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI
1.2.1 HFCWO vs Mechanical vibration								
Duan 2019[15]	48.09	8.38	43	39.37	9.14	43	17.1%	8.72 [5.01, 12.43]
Huang 2013[17]	43.97	9.62	30	34.7	10.56	30	15.5%	9.27 [4.16, 14.38]
Li 2017[14]	9.1	7.7	15	11.7	2.6	15	16.7%	-2.60 [-6.71, 1.51]
Xie 2017[16]	44.2	9.8	40	34.2	9.7	40	16.5%	10.00 [5.73, 14.27]
Subtotal (95% CI)			**128**			**128**	**65.8%**	**6.31 [0.31, 12.30]**
Heterogeneity: Tau² = 32.59; Chi² = 23.78, df = 3 (P < 0.0001); I² = 87%								
Test for overall effect: Z = 2.06 (P = 0.04)								
1.2.2 HFCWO vs Conventional therapy								
Wang 2021[18]	48.05	6.23	42	37.46	7.76	42	17.8%	10.59 [7.58, 13.60]
Subtotal (95% CI)			**42**			**42**	**17.8%**	**10.59 [7.58, 13.60]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 6.90 (P < 0.00001)								
1.2.3 HFCWO vs OPEP								
Tan 2020[13]	35.45	8.63	33	34.58	9.83	36	16.4%	0.87 [-3.49, 5.23]
Subtotal (95% CI)			**33**			**36**	**16.4%**	**0.87 [-3.49, 5.23]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 0.39 (P = 0.70)								
Total (95% CI)			**203**			**206**	**100.0%**	**6.18 [1.71, 10.64]**
Heterogeneity: Tau² = 26.70; Chi² = 37.34, df = 5 (P < 0.00001); I² = 87%								
Test for overall effect: Z = 2.71 (P = 0.007)								
Test for subgroup differences: Chi² = 13.06, df = 2 (P = 0.001), I² = 84.7%								

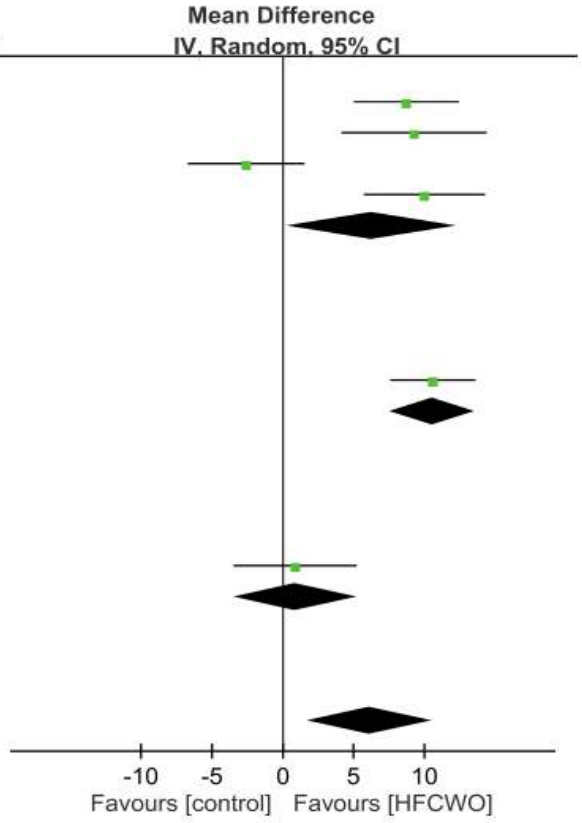


Figure 4 Forest plot of HFCWO vs mechanical vibration, conventional, and OPEP, outcome: Sputum expectoration (mL).

評讀結果： ☑ 是 □否□不清楚

FAITH評讀

是否以表格和圖表總結(Total up)試驗結果？

RESULT

Study or Subgroup	HFCWO Mean	HFCWO SD	HFCWO Total	Control Mean	Control SD	Control Total	Weight	Mean Difference IV, Random, 95% CI
Li 2017[14]	15.3	2	15	16.3	2.7	15	30.9%	-1.00 [-2.70, 0.70]
Li 2020[19]	12.1	3.4	38	16.2	4.3	32	30.5%	-4.10 [-5.94, -2.26]
Liu 2014[11]	21	13	17	26	10	18	12.0%	-5.00 [-12.72, 2.72]
Zhang 2019[21]	10.54	3.14	24	18.87	6.13	20	26.6%	-8.33 [-11.30, -5.36]
Total (95% CI)			**94**			**85**	**100.0%**	**-4.37 [-7.70, -1.05]**

Heterogeneity: Tau² = 8.55; Chi² = 18.98, df = 3 (P = 0.0003); I² = 84%
Test for overall effect: Z = 2.58 (P = 0.010)

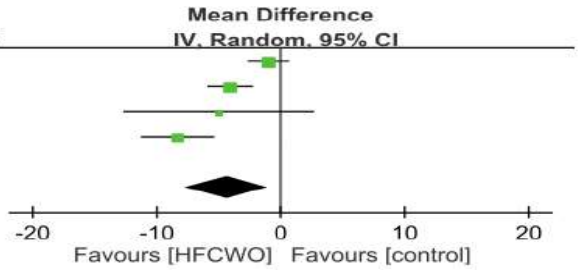


Figure 5 Forest plot of HFCWO versus control group, outcome: Hospital stay (days).

Study or Subgroup	HFCWO Mean	HFCWO SD	HFCWO Total	Control Mean	Control SD	Control Total	Weight	Mean Difference IV, Random, 95% CI
2.1.1 HFCWO vs OPEP								
Tan 2020[13]	7.3	4.6	33	7.4	6.6	36	23.6%	-0.10 [-2.77, 2.57]
Subtotal (95% CI)			**33**			**36**	**23.6%**	**-0.10 [-2.77, 2.57]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 0.07 (P = 0.94)								
2.1.2 HFCWO vs Conventional therapy								
Chakravorty 2011[10]	42.07	15.38	11	42.01	15.96	11	10.8%	0.06 [-13.04, 13.16]
Goktalay 2013[9]	33	10.53	25	33	11.05	25	19.6%	0.00 [-5.98, 5.98]
Ouyang 2020[20]	47.05	3.62	38	37.21	2.05	36	24.6%	9.84 [8.51, 11.17]
Zhang 2019[21]	47.35	9.35	24	39.24	6.33	20	21.4%	8.11 [3.45, 12.77]
Subtotal (95% CI)			**98**			**92**	**76.4%**	**5.96 [1.08, 10.84]**
Heterogeneity: Tau² = 16.22; Chi² = 12.05, df = 3 (P = 0.007); I² = 75%								
Test for overall effect: Z = 2.40 (P = 0.02)								
Total (95% CI)			**131**			**128**	**100.0%**	**4.13 [-1.61, 9.88]**
Heterogeneity: Tau² = 34.51; Chi² = 50.40, df = 4 (P < 0.00001); I² = 92%								
Test for overall effect: Z = 1.41 (P = 0.16)								
Test for subgroup differences: Chi² = 4.57, df = 1 (P = 0.03), I² = 78.1%								

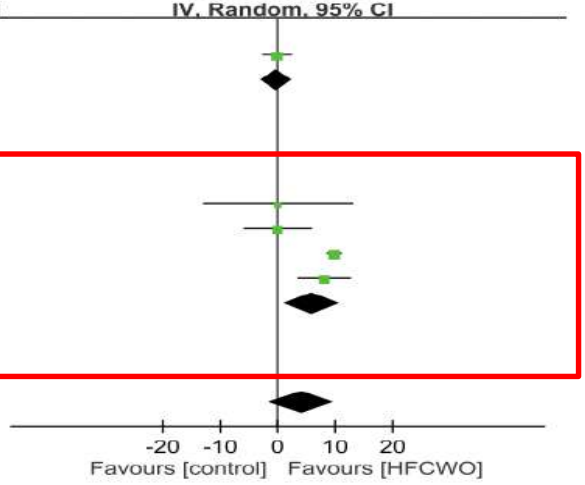


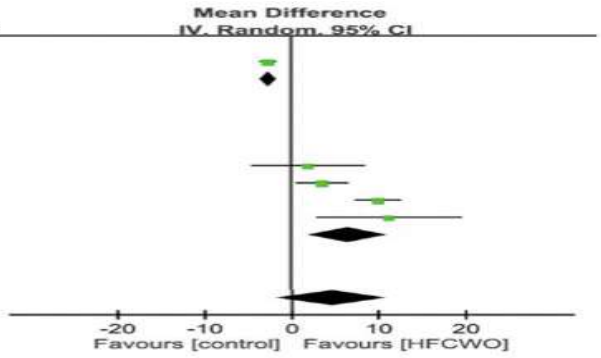
Figure 6 Forest plot of HFCWO versus control group, outcome: FEV_1 (%).

評讀結果： ☑ 是 ☐否☐不清楚

FAITH評讀

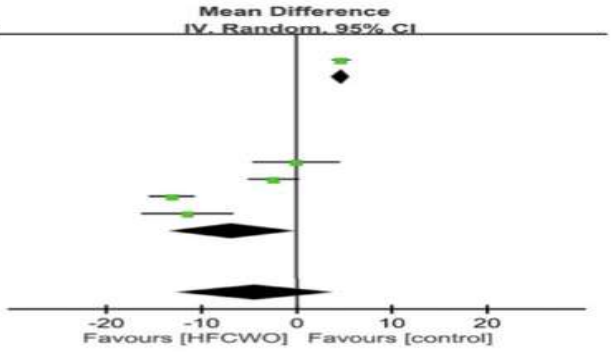
是否以表格和圖表總結(Total up)試驗結果？

Study or Subgroup	HFCWO Mean	HFCWO SD	HFCWO Total	Control Mean	Control SD	Control Total	Weight	Mean Difference IV, Random, 95% CI
4.1.1 HFCWO vs OPEP								
Tan 2020[13]	1.9	1.9	33	4.5	2.1	36	22.4%	-2.60 [-3.54, -1.66]
Subtotal (95% CI)			33			36	22.4%	**-2.60 [-3.54, -1.66]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 5.40 (P < 0.00001)								
4.1.2 HFCWO vs Conventional therapy								
Goktalay 2013[9]	63	9.11	25	61	14.06	25	18.2%	2.00 [-4.57, 8.57]
Li 2020[19]	83.5	6.2	38	79.9	6.5	32	21.5%	3.60 [0.61, 6.59]
Ouyang 2020[20]	88.57	6.91	38	78.51	4.85	36	21.7%	10.06 [7.35, 12.77]
Zhang 2019[21]	89.46	9.58	24	78.13	16.98	20	16.2%	11.33 [2.96, 19.70]
Subtotal (95% CI)			125			113	77.6%	**6.59 [2.02, 11.16]**
Heterogeneity: Tau² = 15.12; Chi² = 13.11, df = 3 (P = 0.004); I² = 77%								
Test for overall effect: Z = 2.83 (P = 0.005)								
Total (95% CI)			158			149	100.0%	**4.57 [-1.81, 10.96]**
Heterogeneity: Tau² = 47.08; Chi² = 92.69, df = 4 (P < 0.00001); I² = 96%								
Test for overall effect: Z = 1.40 (P = 0.16)								
Test for subgroup differences: Chi² = 14.90, df = 1 (P = 0.0001), I² = 93.3%								



B

Study or Subgroup	HFCWO Mean	HFCWO SD	HFCWO Total	Control Mean	Control SD	Control Total	Weight	Mean Difference IV, Random, 95% CI
4.2.1 HFCWO vs OPEP								
Tan 2020[13]	-0.6	1.8	33	-5.3	2.2	36	20.6%	4.70 [3.75, 5.65]
Subtotal (95% CI)			33			36	20.6%	**4.70 [3.75, 5.65]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 9.74 (P < 0.00001)								
4.2.2 HFCWO vs Conventional therapy								
Goktalay 2013[9]	46	7.24	25	46	9.26	25	19.4%	0.00 [-4.61, 4.61]
Li 2020[19]	50.2	5.8	38	52.6	5.5	32	20.3%	-2.40 [-5.05, 0.25]
Ouyang 2020[20]	42.35	5.21	38	55.39	5.26	36	20.3%	-13.04 [-15.43, -10.65]
Zhang 2019[21]	43.54	7.24	24	54.98	8.74	20	19.3%	-11.44 [-16.24, -6.64]
Subtotal (95% CI)			125			113	79.4%	**-6.76 [-13.42, -0.10]**
Heterogeneity: Tau² = 42.53; Chi² = 47.63, df = 3 (P < 0.00001); I² = 94%								
Test for overall effect: Z = 1.99 (P = 0.05)								
Total (95% CI)			158			149	100.0%	**-4.38 [-12.60, 3.84]**
Heterogeneity: Tau² = 84.99; Chi² = 223.13, df = 4 (P < 0.00001); I² = 98%								
Test for overall effect: Z = 1.04 (P = 0.30)								
Test for subgroup differences: Chi² = 11.16, df = 1 (P = 0.0008), I² = 91.0%								



C

Study or Subgroup	HFCWO Mean	HFCWO SD	HFCWO Total	Control Mean	Control SD	Control Total	Weight	Mean Difference IV, Random, 95% CI
Duan 2019[15]	97.35	2.45	43	95.63	2.25	43	10.1%	1.72 [0.73, 2.71]
Goktalay 2013[9]	90	4.63	25	90	5.15	25	1.4%	0.00 [-2.71, 2.71]
Huang 2013[17]	97.49	0.97	30	95.88	1.03	30	38.9%	1.61 [1.10, 2.12]
Li 2017[14]	96	1.7	15	94.1	0.9	15	10.5%	1.90 [0.93, 2.87]
Xie 2017[16]	97.8	1.2	40	95.8	1.1	40	39.2%	2.00 [1.50, 2.50]
Total (95% CI)			153			153	100.0%	**1.78 [1.47, 2.10]**
Heterogeneity: Tau² = 0.00; Chi² = 2.89, df = 4 (P = 0.58); I² = 0%								
Test for overall effect: Z = 11.07 (P < 0.00001)								

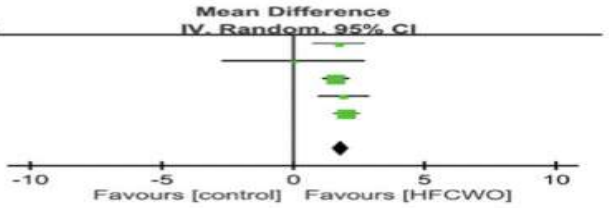


Figure 7 Forest plot of HFCWO versus control group, outcome: ABGs (**A**) PaO_2 (mmHg) (**B**) $PaCO_2$ (mmHg) (**C**) SpO_2 (%).

FAITH評讀

是否以表格和圖表總結(Total up)試驗結果？

Study or Subgroup	HFCWO Mean	HFCWO SD	HFCWO Total	Control Mean	Control SD	Control Total	Weight	Mean Difference IV, Random, 95% CI
Goktalay 2013[9]	3.04	0.88	25	3.28	0.89	25	32.5%	-0.24 [-0.73, 0.25]
Tan 2020[13]	-0.6	0.6	33	-1.3	0.5	36	33.6%	0.70 [0.44, 0.96]
Wang 2021[18]	1.53	0.37	42	2.65	0.42	42	33.9%	-1.12 [-1.29, -0.95]
Total (95% CI)			**100**			**103**	**100.0%**	**-0.22 [-1.51, 1.07]**

Heterogeneity: $Tau^2 = 1.28$; $Chi^2 = 132.60$, $df = 2$ ($P < 0.00001$); $I^2 = 98\%$

Test for overall effect: $Z = 0.34$ ($P = 0.74$)

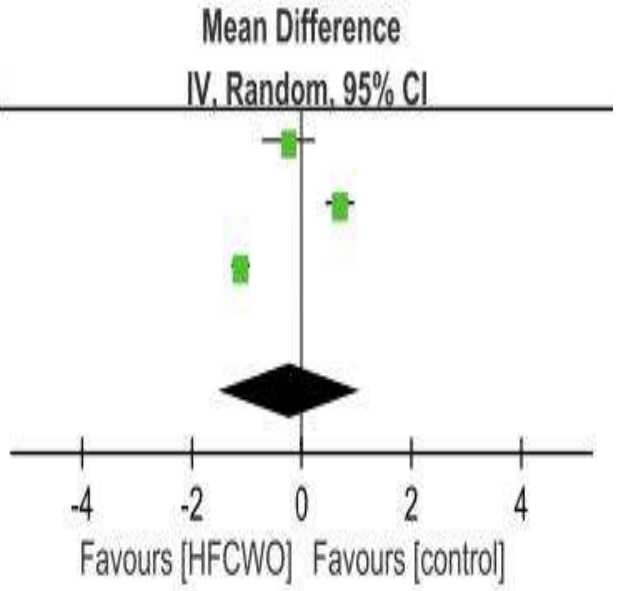


Figure 8 Forest plot of HFCWO versus control group, outcome: Dyspnea assessment.

評讀結果： ☑ 是 □否□不清楚

FAITH評讀

試驗的結果是否相近-異質性 (Heterogeneity)？

Study or Subgroup	HFCWO Mean	SD	Total	Control Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI
1.1.1 A. Day 1								
Duan 2019[15]	48.09	8.38	43	39.37	9.14	43	17.1%	8.72 [5.01, 12.43]
Huang 2013[17]	43.97	9.62	30	34.7	10.56	30	15.5%	9.27 [4.16, 14.38]
Li 2017[14]	9.1	7.7	15	11.7	2.6	15	16.7%	-2.60 [-6.71, 1.51]
Xie 2017[16]	44.2	9.8	40	34.2	9.7	40	16.5%	10.00 [5.73, 14.27]
Subtotal (95% CI)			**128**			**128**	**65.8%**	**6.31 [0.31, 12.30]**
Heterogeneity: Tau² = 32.59; Chi² = 23.78, df = 3 (P < 0.0001); I² = 87%								
Test for overall effect: Z = 2.06 (P = 0.04)								
1.1.5 B. Day 5								
Tan 2020[13]	35.45	8.63	33	34.58	9.83	36	16.4%	0.87 [-3.49, 5.23]
Wang 2021[18]	48.05	6.23	42	37.46	7.76	42	17.8%	10.59 [7.58, 13.60]
Subtotal (95% CI)			**75**			**78**	**34.2%**	**5.86 [-3.66, 15.38]**
Heterogeneity: Tau² = 43.59; Chi² = 12.94, df = 1 (P = 0.0003); I² = 92%								
Test for overall effect: Z = 1.21 (P = 0.23)								
Total (95% CI)			**203**			**206**	**100.0%**	**6.18 [1.71, 10.64]**
Heterogeneity: Tau² = 26.70; Chi² = 37.34, df = 5 (P < 0.00001); I² = 87%								
Test for overall effect: Z = 2.71 (P = 0.007)								
Test for subgroup differences: Chi² = 0.01, df = 1 (P = 0.94), I² = 0%								

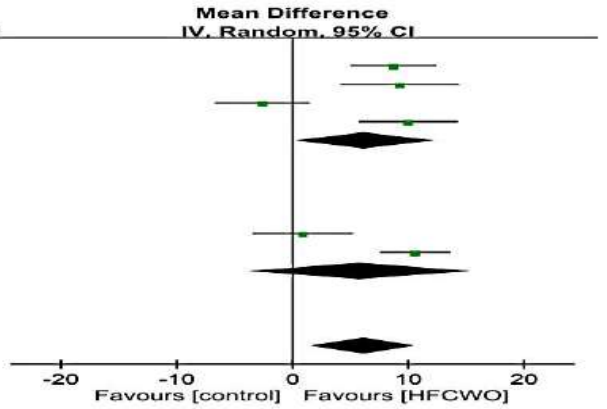


Figure 3 Forest plot of HFCWO vs control group treatment time, outcome: Sputum expectoration.

Study or Subgroup	Experimental Mean	SD	Total	Control Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI
1.2.1 HFCWO vs Mechanical vibration								
Duan 2019[15]	48.09	8.38	43	39.37	9.14	43	17.1%	8.72 [5.01, 12.43]
Huang 2013[17]	43.97	9.62	30	34.7	10.56	30	15.5%	9.27 [4.16, 14.38]
Li 2017[14]	9.1	7.7	15	11.7	2.6	15	16.7%	-2.60 [-6.71, 1.51]
Xie 2017[16]	44.2	9.8	40	34.2	9.7	40	16.5%	10.00 [5.73, 14.27]
Subtotal (95% CI)			**128**			**128**	**65.8%**	**6.31 [0.31, 12.30]**
Heterogeneity: Tau² = 32.59; Chi² = 23.78, df = 3 (P < 0.0001); I² = 87%								
Test for overall effect: Z = 2.06 (P = 0.04)								
1.2.2 HFCWO vs Conventional therapy								
Wang 2021[18]	48.05	6.23	42	37.46	7.76	42	17.8%	10.59 [7.58, 13.60]
Subtotal (95% CI)			**42**			**42**	**17.8%**	**10.59 [7.58, 13.60]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 6.90 (P < 0.00001)								
1.2.3 HFCWO vs OPEP								
Tan 2020[13]	35.45	8.63	33	34.58	9.83	36	16.4%	0.87 [-3.49, 5.23]
Subtotal (95% CI)			**33**			**36**	**16.4%**	**0.87 [-3.49, 5.23]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 0.39 (P = 0.70)								
Total (95% CI)			**203**			**206**	**100.0%**	**6.18 [1.71, 10.64]**
Heterogeneity: Tau² = 26.70; Chi² = 37.34, df = 5 (P < 0.00001); I² = 87%								
Test for overall effect: Z = 2.71 (P = 0.007)								
Test for subgroup differences: Chi² = 13.06, df = 2 (P = 0.001), I² = 84.7%								

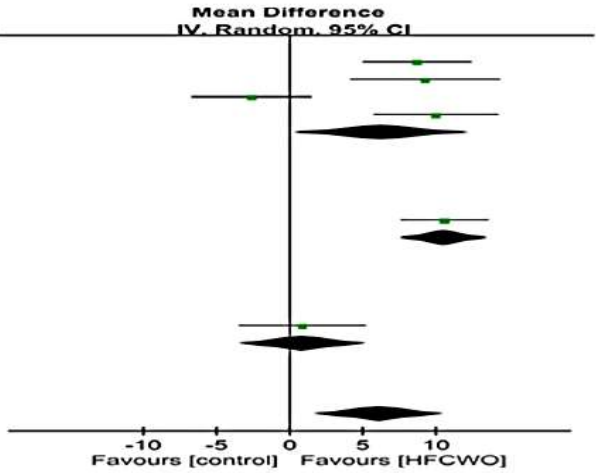


Figure 4 Forest plot of HFCWO vs mechanical vibration, conventional, and OPEP, outcome: Sputum expectoration (mL).

評讀結果：☑ 是 □否□不清楚

FAITH評讀

試驗的結果是否相近-異質性 (Heterogeneity)？

Study or Subgroup	HFCWO Mean	HFCWO SD	HFCWO Total	Control Mean	Control SD	Control Total	Weight	Mean Difference IV, Random, 95% CI
Li 2017[14]	15.3	2	15	16.3	2.7	15	30.9%	-1.00 [-2.70, 0.70]
Li 2020[19]	12.1	3.4	38	16.2	4.3	32	30.5%	-4.10 [-5.94, -2.26]
Liu 2014[11]	21	13	17	26	10	18	12.0%	-5.00 [-12.72, 2.72]
Zhang 2019[21]	10.54	3.14	24	18.87	6.13	20	26.6%	-8.33 [-11.30, -5.36]
Total (95% CI)			**94**			**85**	**100.0%**	**-4.37 [-7.70, -1.05]**

Heterogeneity: Tau² = 8.55; Chi² = 18.98, df = 3 (P = 0.0003); I² = 84%

Test for overall effect: Z = 2.58 (P = 0.010)

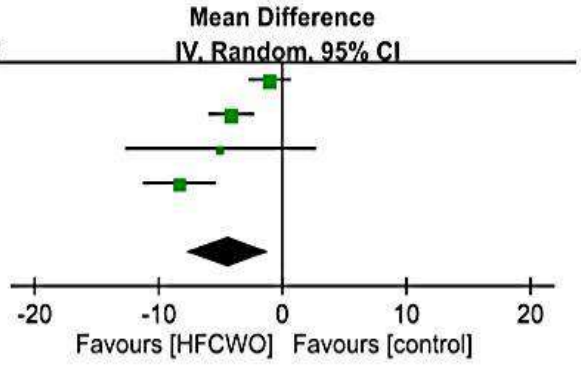


Figure 5 Forest plot of HFCWO versus control group, outcome: Hospital stay (days).

Study or Subgroup	HFCWO Mean	HFCWO SD	HFCWO Total	Control Mean	Control SD	Control Total	Weight	Mean Difference IV, Random, 95% CI
2.1.1 HFCWO vs OPEP								
Tan 2020[13]	7.3	4.6	33	7.4	6.6	36	23.6%	-0.10 [-2.77, 2.57]
Subtotal (95% CI)			**33**			**36**	**23.6%**	**-0.10 [-2.77, 2.57]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 0.07 (P = 0.94)								
2.1.2 HFCWO vs Conventional therapy								
Chakravorty 2011[18]	42.07	15.38	11	42.01	15.96	11	10.8%	0.06 [-13.04, 13.16]
Goktalay 2013[9]	33	10.53	25	33	11.05	25	19.6%	0.00 [-5.98, 5.98]
Ouyang 2020[20]	47.05	3.62	38	37.21	2.05	36	24.6%	9.84 [8.51, 11.17]
Zhang 2019[21]	47.35	9.35	24	39.24	6.33	20	21.4%	8.11 [3.45, 12.77]
Subtotal (95% CI)			**98**			**92**	**76.4%**	**5.96 [1.08, 10.84]**
Heterogeneity: Tau² = 16.22; Chi² = 12.05, df = 3 (P = 0.007); I² = 75%								
Test for overall effect: Z = 2.40 (P = 0.02)								
Total (95% CI)			**131**			**128**	**100.0%**	**4.13 [-1.61, 9.88]**
Heterogeneity: Tau² = 34.51; Chi² = 50.40, df = 4 (P < 0.00001); I² = 92%								
Test for overall effect: Z = 1.41 (P = 0.16)								
Test for subgroup differences: Chi² = 4.57, df = 1 (P = 0.03), I² = 78.1%								

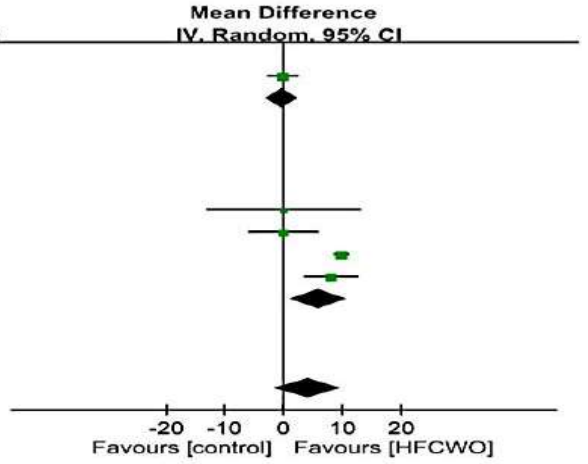


Figure 6 Forest plot of HFCWO versus control group, outcome: FEV$_1$ (%).

FAITH評讀

試驗的結果是否相近-異質性 (Heterogeneity)？

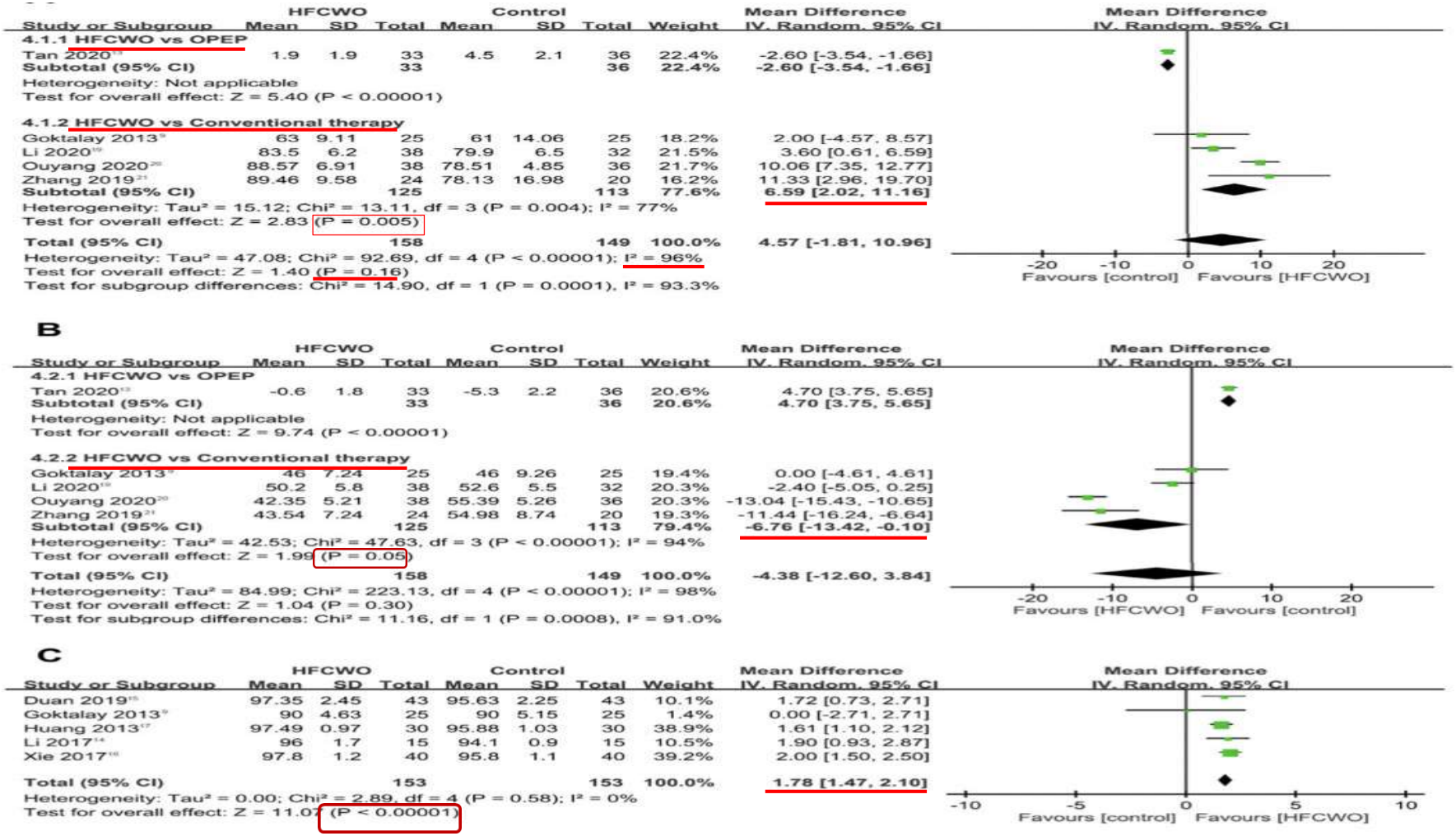


Figure 7 Forest plot of HFCWO versus control group, outcome: ABGs (**A**) PaO_2 (mmHg) (**B**) $PaCO_2$ (mmHg) (**C**) SpO_2 (%).

FAITH評讀

試驗的結果是否相近-異質性 (Heterogeneity)？

Study or Subgroup	HFCWO Mean	SD	Total	Control Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI
Goktalay 2013[9]	3.04	0.88	25	3.28	0.89	25	32.5%	-0.24 [-0.73, 0.25]
Tan 2020[13]	-0.6	0.6	33	-1.3	0.5	36	33.6%	0.70 [0.44, 0.96]
Wang 2021[18]	1.53	0.37	42	2.65	0.42	42	33.9%	-1.12 [-1.29, -0.95]
Total (95% CI)			**100**			**103**	**100.0%**	**-0.22 [-1.51, 1.07]**

Heterogeneity: $Tau^2 = 1.28$; $Chi^2 = 132.60$, df = 2 ($P < 0.00001$); $I^2 = 98\%$

Test for overall effect: Z = 0.34 (P = 0.74)

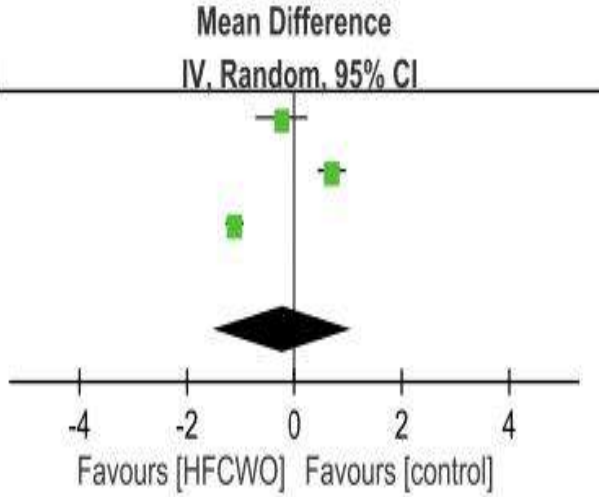


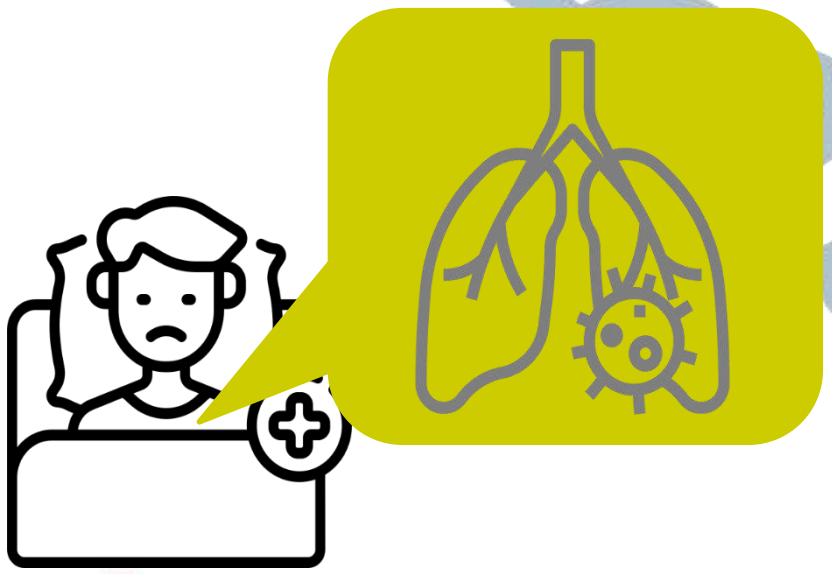
Figure 8 Forest plot of HFCWO versus control group, outcome: Dyspnea assessment.

評讀結果： ☑ 是 ☐否☐不清楚

研究結果

·COPDAE使用高頻震盪治療與痰液排出有關

·COPDAE使用高頻震盪治療與縮短住院時間有關



成本分析

項目	CPT	HFCWO	比較
人力成本	4.18 元 x360 分 =1504.8元	4.18元x16分=66.88元	HFCWO優於CPT,因不需護理師
人力時數	2位護理師x每次15分x一天12次=360分	1位呼吸治療師操作x2分鐘x2次(穿與拆卸)x4次=16分	HFCWO優於CPT, 儀器操作期間可以降低護理服務時數的成本
物料成本	無	拋棄式背心可自費或採酒精消毒重複使用則不收費。	CPT不用物料成本，醫療院所採消毒後重覆使用，降低病人自費負擔
儀器成本	無	HFCWO：550000萬/10年	**使用HFCWO 1.7年可以平衡購入價格。550000/320112=1.7年**
醫療給付	無	247點x4=988元	使用一年HFCWO可獲健保給付金額為988x27天x12月=**320112元/年**
費用總計	1504.8元	66.88元 (未含儀器價格)	CPT支出費高於HFCWO； 長期效益上HFCWO優於CPT
優點	便宜	昂貴	-
缺點	耗費人力、時間、舒適度低、扣擊方式不一致	省人力、省時、舒適度高、震顫頻率一致	-

註: 護理工時平均約251元/小時(251/60=4.18元/分)；呼吸治療時薪與護理相同; HFCWO使用年限7年。

研究限制

- 這項研究排除COPD門診患者
- 在高頻振盪干預措施會因持續時間、頻率不同，結果不同

感 謝 聆 聽

Let’s Vote !

是否贊成將高頻震盪治療納入本院COPD急性發作病人使用常規？

同意	20票
仍需考慮	0票
不同意	0票