Is Nintendo Wii an Effective Intervention for Individuals With Stroke?

A Systematic Review and Meta-Analysis

Gary Cheok MSc a,b, Dawn Tan ClinDocPTa,*, Aiying Low MSc a, Jonathan Hewitt PhD c

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引言人: 吳珮琪 物理治療師

指導者：戴仲宜護理長

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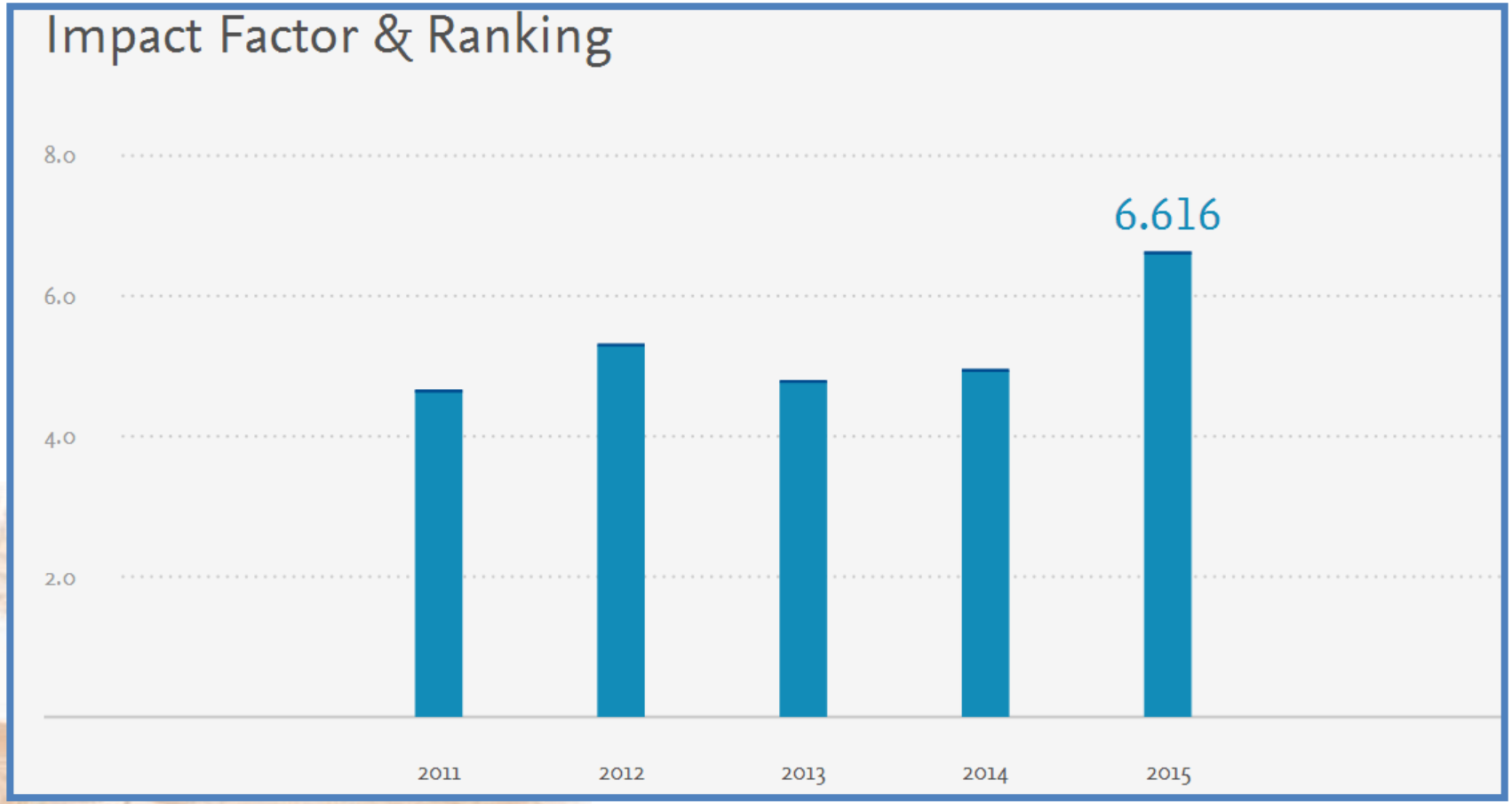
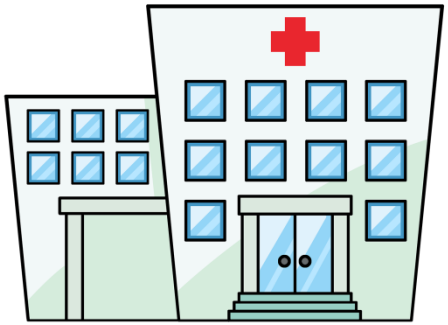
Impact Factor & Ranking



背景資料 Background knowledge

- long-term disability
  - Upper and lower limb paresis
  - Poor balance and postural instability
  - Easily fall
  - ADL dependent
  - Decreased activity

背景資料 Background knowledge



Acute phase

0-6 months

Sub acute phase

7-12 months

Intensive, repetitive, and task-oriented training

Nintendo Wii 用於物理治療介入的優點

- 可在多元情境中進行重複的互動式訓練，功能導向訓練，並提高患者的練習動機
  - Wii 遊戲機在一次療程中可提供 109.7 次重心轉移的練習次數(相對於傳統物理治療32次)

    Peters, D. M., McPherson, A. K., Fletcher, B., McClenaghan, B. A., & Fritz, S. L. (2013). Counting repetitions: an observational study of video game play in people with chronic poststroke hemiparesis. *Journal of Neurologic Physical Therapy*, *37*(3), 105-111.

- 可以在治療時間之外，額外練習

Appraisal sheet

Is Nintendo Wii an Effective Intervention for Individuals With Stroke?
A Systematic Review and Meta-Analysis

Appraisal Tool [統合分析 Meta-Analysis]

- 步驟1:探討研究的問題為何?(PICO)
- 步驟2:研究的品質為何?(內在效度)(FAITH)
- 步驟3:研究結果之意義為何?(效益)

步驟1:探討研究的問題為何?

- 研究族群 / 問題 (Population/ Problem)
  Adults with stroke of any chronicity
- 介入措施 (Intervention)
  [Nintendo Wii +standard care]
- 比較 (Comparison)
  [standard care] and [other exercise interventions + standard care]
- 結果 (Outcomes)
  Global function (Functional Independence Measure, FIM)
  Balance (Berg balance scale, Timed Up and Go, posture sway)

Appraisal sheet

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- 步驟1:探討研究的問題為何?(PICO)
- 步驟2:研究的品質為何?**(內在效度)**

  (Find, Appraisal, Includes, Table, Heterogeneity)
- 步驟3:研究結果之意義為何?(效益)

F - 研究是否找到所有的相關證據？

最好的狀況是？

良好的文獻搜尋至少應包括二個主要的資料庫(如：Medline, Cochrane 考科藍實證醫學資料庫, EMBASE 等)，並且加上文獻引用檢索(參考文獻中相關研究、Web of Science, Scopus 或 Google Scholar)、試驗登錄資料等。文獻搜尋應不只限於英文，並且應同時使用 MeSH 字串及一般檢索詞彙(text words)。

Search Strategy

Two authors independently searched the AMED, CINAHL, EMBASE, HMIC, MEDLINE, PsycINFO, and Cochrane databases from inception to July 2014. The following search terms and their synonyms were used: stroke, Nintendo Wii, physical therapy. Full details of search terms and results of the searches performed are listed in Appendix 1 (see Supplementary data). Where details of potentially

文中並未提及是否限制發表語文

F – 研究是否找到 (Find) 所有的相關證據？

- 納入與排除標準

收錄RCT 研究

- Functional Independence Measure(FIM)
- Barthel Index
- Timed Up and Go test (TUG)
- Berg Balance Scale (BBS)

(1) Randomized controlled trials (RCTs) comparing the addition of Nintendo Wii to standard care with standard care and RCTs that compared Wii against exercise interventions investigating patients with stroke of any chronicity were considered. Non-RCTs were excluded, as the sample sizes in those studies were small. Additionally, without any randomization there would be a possibility of bias in the results.

(2) Studies that used quantitative outcomes to investigate the effectiveness of Wii interventions on global function, balance, mobility, falls, or fear of falling were included. Examples of global function include the Functional Independence Measure (FIM),[11] and Barthel Index (BI).[12] Measures of functional mobility and balance include the Timed Up and Go (TUG) test,[13,14] Berg Balance Scale (BBS),[15] and Functional Reach Test.[16] Fear of falling can be quantified by the Falls Efficacy Scale.[17]

評讀結果： ■是 □否 □不清楚

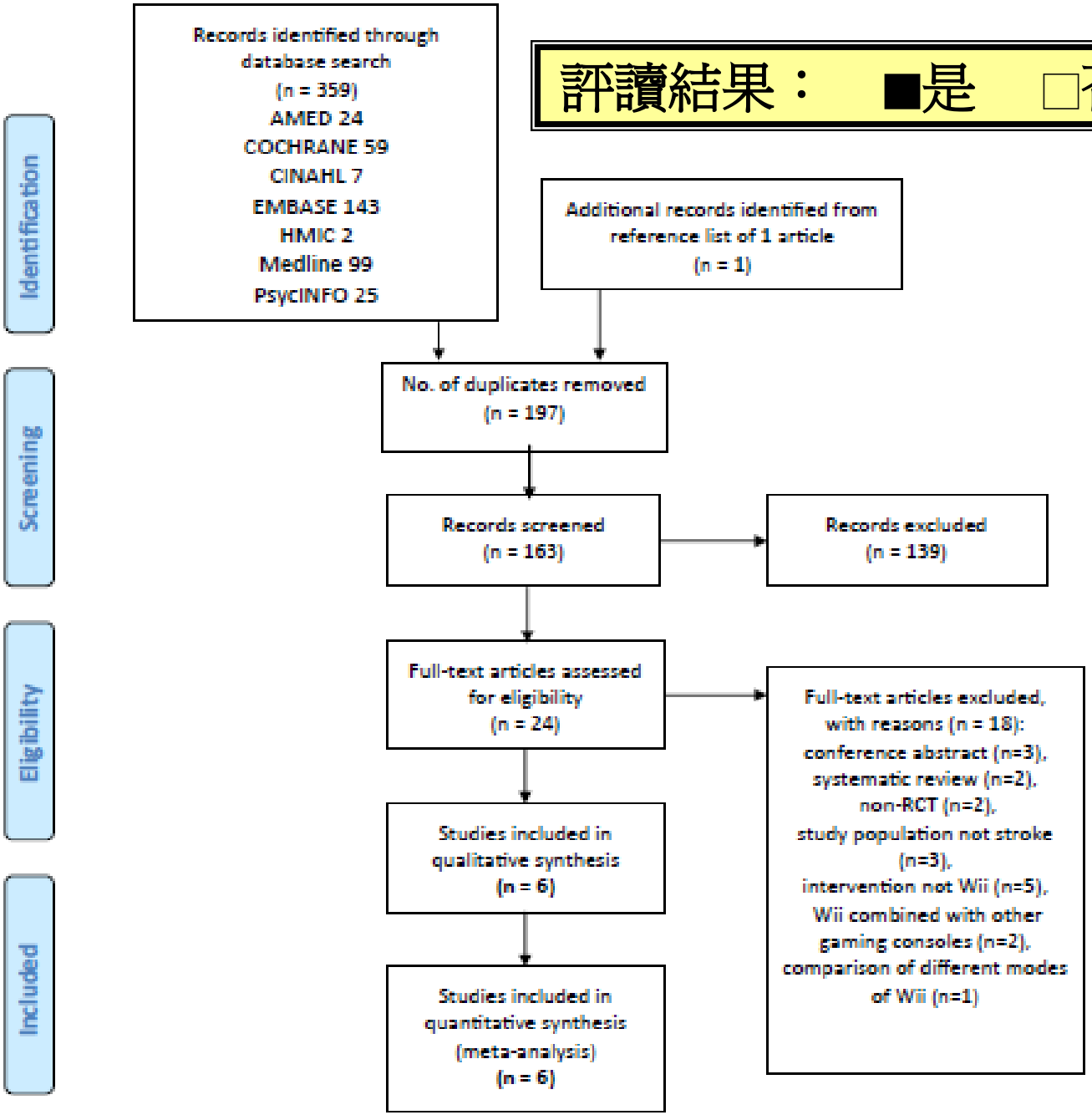


Fig. 1. Selection of studies using the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analyses) flowchart.

A - 文獻是否經過嚴格評讀 (Appraisal)？

- 說明所使用的文獻品質評讀標準

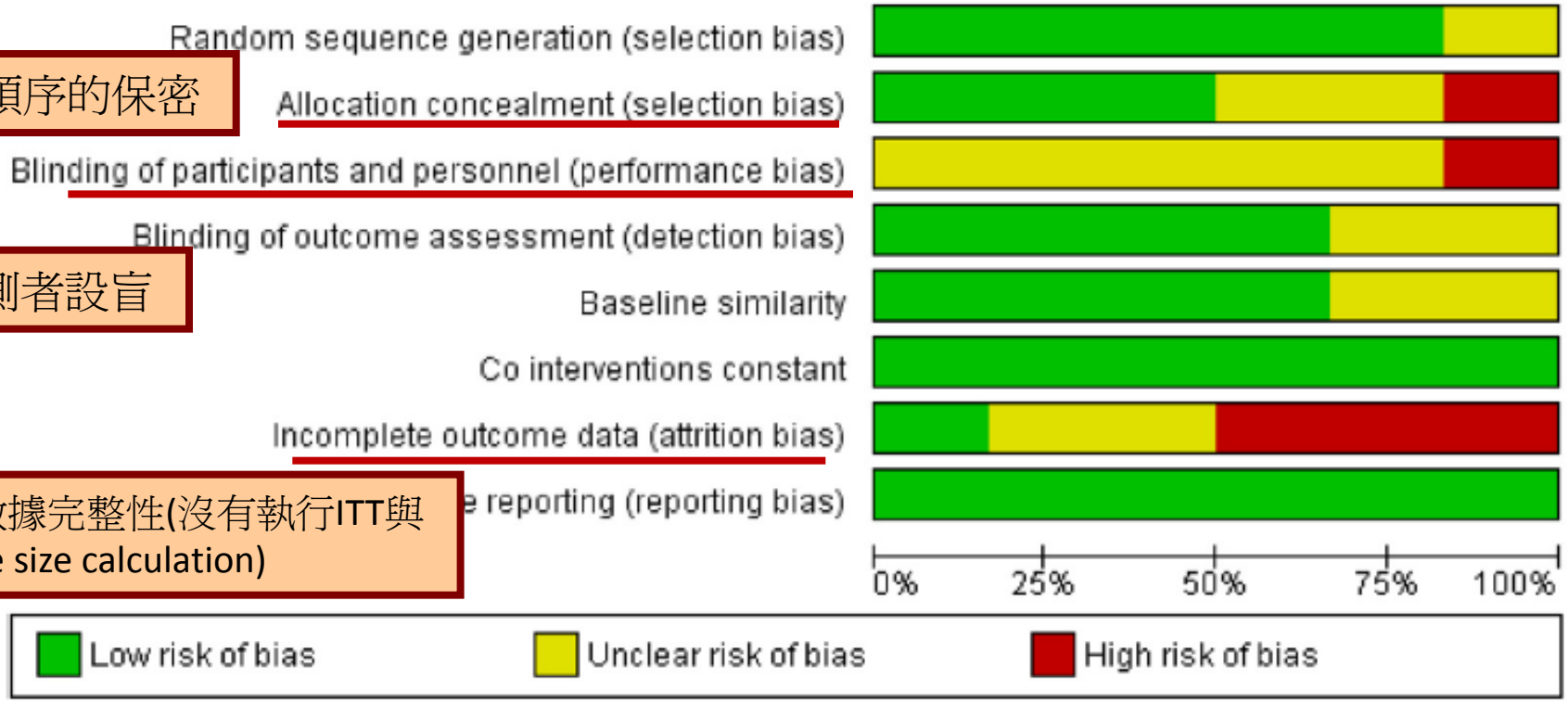
- *Assessment of Methodological Quality*

The Cochrane Collaboration's risk of bias assessment tool[18] and the Physiotherapy Evidence Database (PEDro) scale[19] were used to determine the methodological quality of each included study. Two reviewers (GC and AY) independently rated the studies and any disagreement was resolved by consensus with a third reviewer (JH). The Cochrane tool assessed the following types of biases: selection, performance, and detection. The PEDro is a 10-point scale, with 11 criteria that assess the internal validity of RCTs and whether sufficient statistical information for the interpretation of results was reported. The first question of the PEDro scale assesses external validity, and is not used to calculate the total score. The interpretation of quality scores is as follows: 9 to 10, excellent; 6 to 8, good; 4 to 5, fair; and less than 4, poor.[20]

Cochrane Collaboration's risk of bias (RoB)assessment tool
Physiotherapy Evidence Database (PEDro) scale

A - 文獻是否經過嚴格評讀 (Appraisal)？

- Cochrane Collaboration’ s risk of bias(RoB) assessment tool 分析結果



分派順序的保密

受測者設盲

結果數據完整性(沒有執行ITT與sample size calculation)

Fig. 2. Risk of bias graph. Judgment of each risk of bias presented as percentage.

A - 文獻是否經過嚴格評讀 (Appraisal)？

- 列出每篇研究品質的評讀結果

Physiotherapy Evidence Database (PEDro) scale

Table 1
Key Characteristics of Included Studies

Study/PEDro Score	No. Randomized (No. of Dropouts Before Baseline Assessment)
Additional Wii versus standard care	
Barcala et al[22] 2013/8	20 (0)
Cho et al[23] 2012/5	24 (2)
Kim et al[24] 2012/3	20 (3)
Wii versus other forms of exercise intervention	
Hung et al[25] 2014/7	30 (3)
Morone et al[26] 2014/7	50 (3)
Saposnik et al[27] 2010/4	22 (5)

評讀結果：■是 □否 □不清楚

I - 是否只納入具良好效度的文章？

- **Physiotherapy Evidence Database (PEDro) scale**
  - **Excellent:9-10**
  - **Good:6-8**
  - **Fair:4-5**
  - **Poor:<3**

Table 1
Key Characteristics of Included Studies

	Study/PEDro Score	No. Randomized (No. of Dropouts Before Baseline Assessment)
	Additional Wii versus standard care	
Excellent	Barcala et al[22] 2013/8	20 (0)
Fair	Cho et al[23] 2012/5	24 (2)
Poor	Kim et al[24] 2012/3	20 (3)
	Wii versus other forms of exercise intervention	
Good	Hung et al[25] 2014/7	30 (3)
Good	Morone et al[26] 2014/7	50 (3)
Fair	Saposnik et al[27] 2010/4	22 (5)

評讀結果：□是 ■否 □不清楚

T - 作者是否以表格和圖表「總結」試驗結果？

Wii+ standard care / standard care

Table 2
Interventions, Outcomes, and Major Findings

Reference	Intervention Group	Control	No. of Sessions & Frequency (d/wk/no. of wk or mo)	Follow-up	Outcome Measure	Major Findings
Additional Wii versus standard care						
Barcala et al 2013	Conventional physical therapy 60 min × 2 sessions for 5 wk plus Wii Fit 30 min × 2 sessions a week for 5 wk	Conventional physical therapy 60 min × 2 sessions for 5 wk	10 sessions 2/wk/5 wk	0 and 7 wk	BBS TUG FIM Stabilometric and Baropodometric examination with a pressure plate (Medicapteurs, Pusyo model; Balma, France)	- Both groups demonstrated statistically significant ($P < .05$) greater control of static and dynamic balance, lesser time needed for TUG, improved BBS and FIM scores - Intergroup analysis revealed no statistically significant differences between groups ($P > .05$)
Cho et al 2012	Virtual reality balance training 30 min × 3 sessions a wk for 6 wk plus physical therapy (30 min), occupational therapy (30 min) and speech therapy (if appropriate) × 5 sessions a wk for 6 wk	Physical therapy (30 min), occupational therapy (30 min) and speech therapy (if appropriate) × 5 sessions a wk for 6 wk	18 sessions 3/wk/6 wk	0, 6 wk, and 3 mo	BBS TUG Postural sway velocity with force plate system (Metitur Ltd, Jyväskylä, Finland)	- BBS significantly improved from 39.09 to 43.09 in intervention group ($P < .05$), and 41.09 to 43.90 in control group ($P < .05$) - TUG significantly improved from 21.74 s to 20.40 s in intervention group ($P < .05$), and from 19.60 s to 19.08 s in control group ($P < .05$) - For intergroup comparison, the changes in BBS and TUG were statistically greater in the intervention group than the control group ($P < .05$) - Postural sway velocity was not significantly improved for both groups
Kim et al 2012	Wii sports (15 min tennis, 15 min boxing) and general exercise for 30 min and electrical stimulation to tibialis anterior on affected side for 15 min × 3 sessions a wk for 3 wk	General exercise for 30 min and electrical stimulation to tibialis anterior on affected side for 15 min × 3 sessions a wk for 3 wk	9 sessions 3/wk/3 wk	0 & 3 wk	PASS MMAS FIM	- Improvements in PASS and MMAS was significantly greater in intervention group ($P < .05$) - No significant improvement in FIM for both groups

MMAS, Modified Motor Assessment Scale; PASS, Postural Assessment Scale.

表二、 總結各文獻的介入方式，結果評估與主要發現並列出P值

Wii +Standard intervention/ other forms of exercise + standard intervention

Table 3
Study Characteristics

Reference	Intervention Group	Control	No. of Sessions & Frequency (d/wk/no. of wk or mo)	Follow-up	Outcome Measure	Major Findings
Wii versus other forms of exercise intervention						
Hung et al 2014	Routine rehabilitation (continuation of participants' outpatient rehabilitation before enrollment into study; consists of gait correction, endurance training, strengthening, and range of motion exercises) plus 30 min Wii Fit training, 2 sessions per wk × 12 wk	Routine rehabilitation (continuation of participants' outpatient rehabilitation before enrollment into study; consists of gait correction, endurance training, strengthening, and range of motion exercises) plus 30 min conventional weight-shifting exercises, 2 sessions per wk × 12 wk	24 sessions 2/wk/12 wk	0, 3, & 6 mo	Stability Index FR TUG Falls Efficacy Scale-Internationa PACES	- Intervention group enjoyed training more than the control group (PACES score 79.15 ± 7.49 versus 72.47 ± 7.63, respectively, $P = .03$) - Findings indicate better improvement in stability index for intervention group but this gain was not maintained at 3-mo follow-up - Both groups showed significant improvement in TUG, FR but there was no statistical difference between groups
Morone et al 2014	Standard physiotherapy plus 20 min Wii Fit, 3 sessions per wk × 4 wk	Standard physiotherapy plus 20 min of balance therapy (focused on trunk stabilization, weight transfer to paretic leg, and exercise with Freeman board for balance and proprioception), 3 sessions per wk × 4 wk	12 sessions 3/wk/4 wk	0, 1, & 2 mo	BI Functional Ambulatory Categ ry BBS	- All outcome measures significantly improved in both groups - BBS and BI were significantly better in intervention group than control group
Saposnik 2010	8 sessions of 60 min of Wii play over 14-d period plus standard rehabilitation for stroke (an average of 1 h of physiotherapy and 1 h of occupational therapy per d).	8 sessions of 60 min of leisure activities, such as playing cards, bingo, or Jenga over a 14-d period (an average of 1 h of physiotherapy and 1 h of occupational therapy per d).	8 sessions	0, 2, & 4 wk	Serious adverse events Borg perceived exertion scale WMFT BBT SIS	- No serious adverse events - 3 participants in intervention group and 2 participants in control reported exertion fatigue (Borg scale >13) - Intervention group performed significantly better in WMFT - No significant difference between groups for BBT and SIS

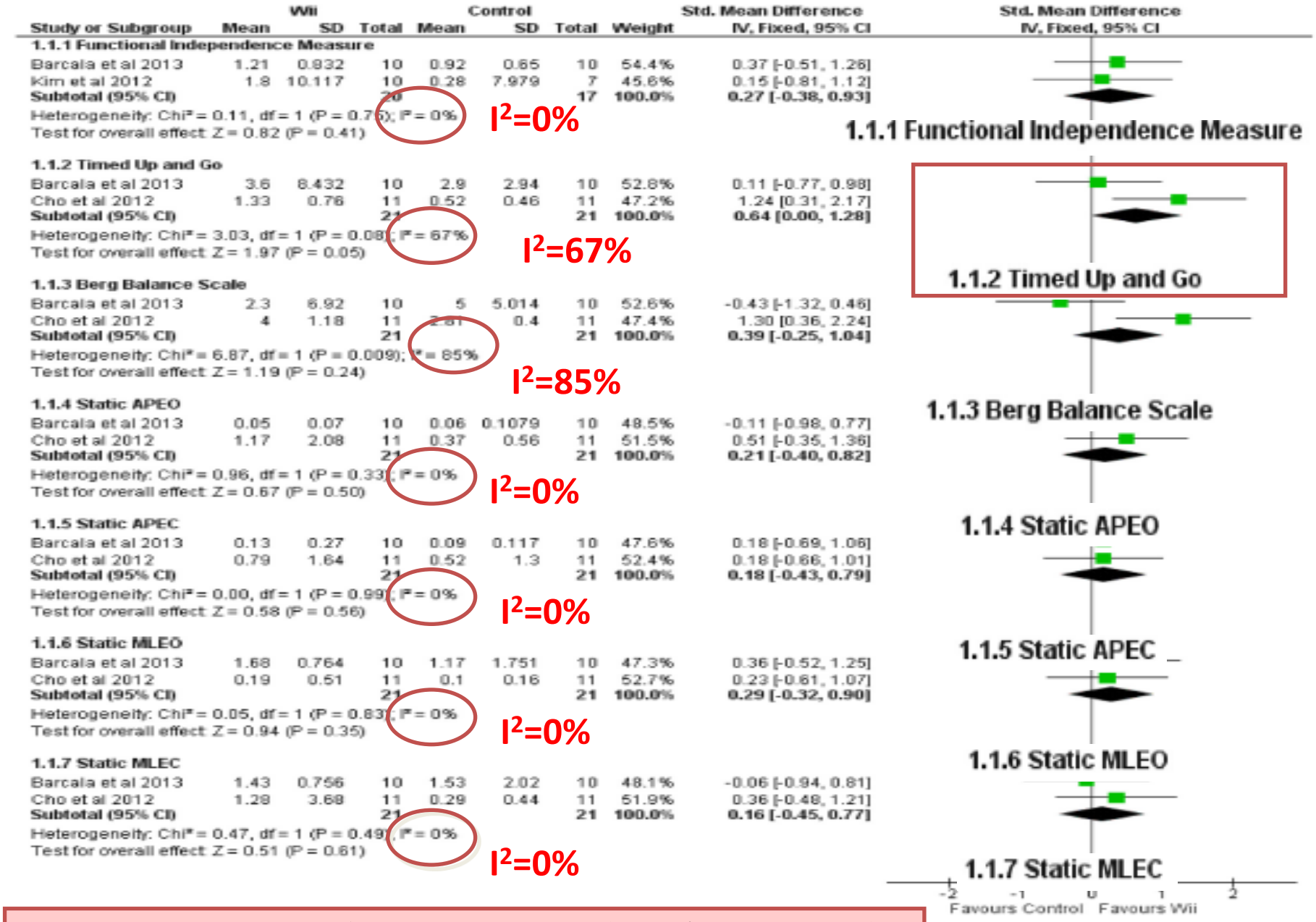
Conventional weight-shifting exercises

balance therapy

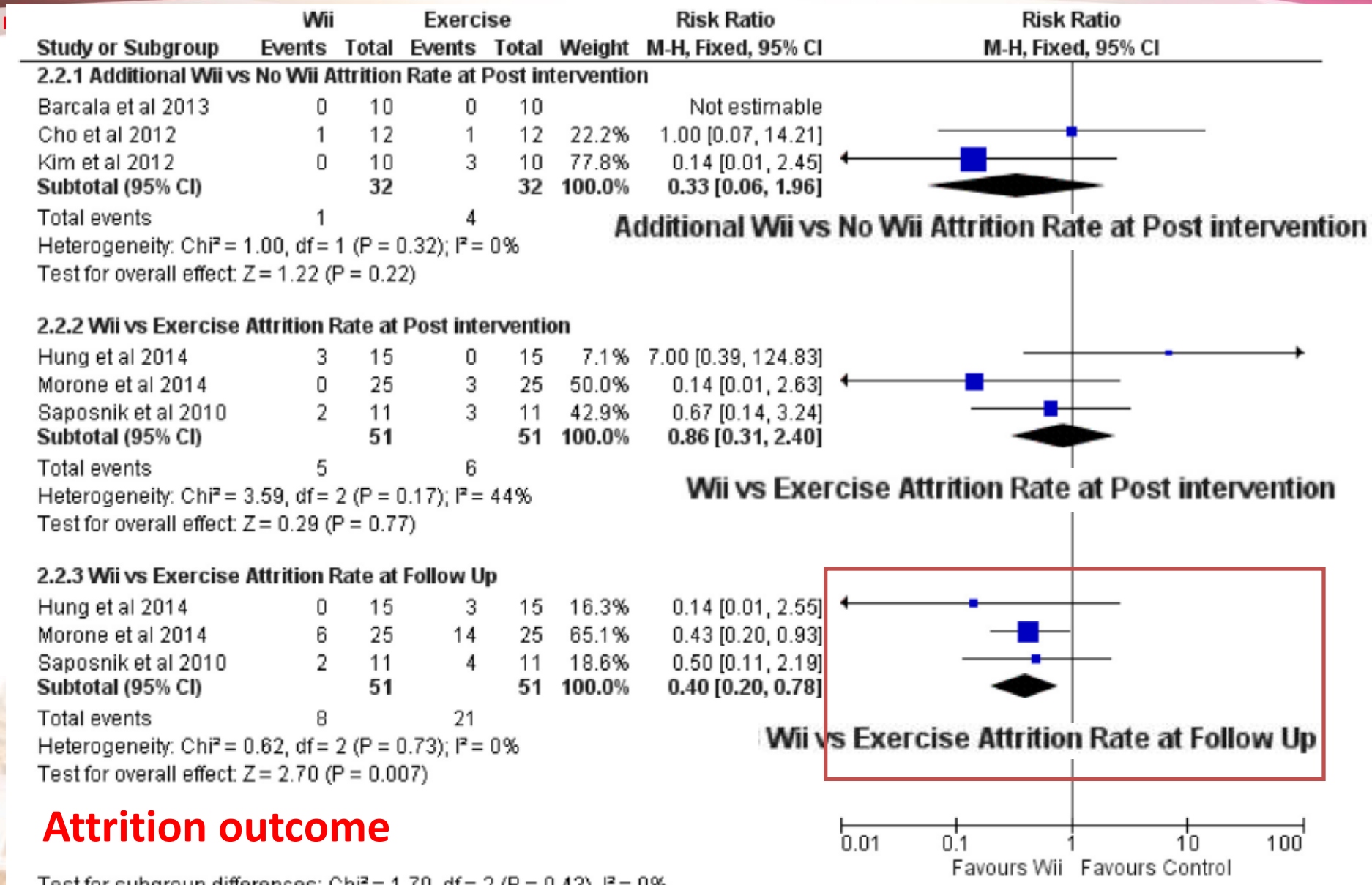
Recreational therapy

BBT, Box and Block Test; FR, functional reach; PACES, Physical Activity Enjoyment Scale; SIS, Stroke Impact Scale; WMFT, Wolf Motor Function Test.

表三、 總結各文獻的介入方式，結果評估與主要發現並列出P值



圖三 以森林圖呈現各項outcome經過統合分析的結果



Attrition outcome

評讀結果：■是 □否 □不清楚

H - 試驗的結果是否相近 - 異質性 (Heterogeneity)？

- 分析研究結果是否具異質性，及造成異質性可能的原因探討。

Balance quantified by the BBS

Data were available for the additional Wii versus no additional Wii comparison for 42 participants from 2 trials.[23,24] The pooled mean difference using the random effects model showed that Wii did not have any substantial impact on BBS (0.17 points, CI −3.19–3.52, P = .92) (Figure 3). There was high heterogeneity between the trials (P = .15, I^2 = 51%).

評讀結果：□是 □否 ■不清楚

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結果為何？

- **使用何種評估方式，療效有多大？**
  - 標準的物理治療加上WII的介入能顯著減少介入組TUG的時間，但pooled MD=0.8s,小於慢性中風病人組群中TUG 最小可測得的差異量(2.9s)
    - 作者認為，這個差異可能是由於測量誤差所造成
  - WII的介入在FIM 功能性量表上看不出差異，可能是由於量表的特性所導致

Discussion

- 過去的研究顯示WII對平衡功能有改善效果
  - the Wii group showed improvement in BBS by 5 points versus standard exercises

Morone G, Tramontano M, Iosa M, et al. The efficacy of balance training with video game-based therapy in subacute stroke patients: A randomized controlled trial. Biomed Res Int 2014;2014:580861.

- 本篇研究則沒有同樣結果，有可能是因為本篇研究受測者為慢性中風病人，而非亞急性期中風病人

Discussion

- WII介入的最佳強度計量仍然不明，
  - 根據過去研究顯示中風病人需16小時的練習才能在功能上看出進步
  - 本篇研究所引用的文獻所給的WII gaming劑量並不足夠，有可能是導致效果不佳的原因
    - Timed up and go

Barcala et al, 2013	1 hour of Wii game play/week
Cho et al,2012	1.5 hours of Wii activity /week.

Q&A交流與討論時間

中風病人除常規復健課程之外，對於功能的維持，平衡的改善，增加 Nintendo Wii是否為有效的訓練方式?

不同意 2人

需考慮 41 人

同意 5 人

The FIM® Instrument Items

Motor

1. Self-care
Eating
Dressing - Up.
Grooming
Dressing - Lo.
Bathing
Toileting

2. Sphincter Control
Bowel Management
Bladder Management

3. Transfers
Bed, Chair, Wheelchair
Toilet
Tub, Shower

4. Locomotion
Walk/Wheelchair
Stairs

Cognitive

5. Communication
Comprehension
Expression

6. Social Cognition
Social Interaction
Problem Solving
Memory

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謝謝聆聽!