穿戴式裝置與行為改變技術對增加高齡女性身體活動及減少靜態行為之影響：隨機對照研究

A randomized controlled trial of wearable accelerometer-based feedback and behavior change techniques to increase physical activity and reduce sedentary behavior in older women

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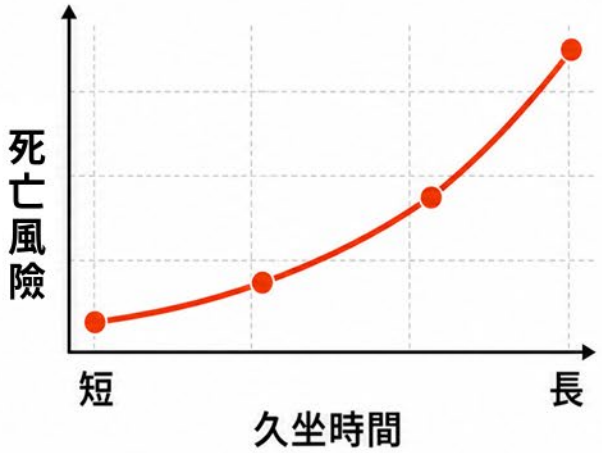
研究背景與動機

- 高齡女性在晚年普遍面臨失能與多重慢性病。
- 80歲以上的女性中，將近60%至少一項失能，且身體功能明顯率退。

→ 因此身體活動（PA）及可改變的行為是重要的介入目標（Rillamas-Sun, E., et al. 2018）。

身體活動量 vs 心血管疾病

靜態行為 vs 全死因死亡率



高齡女性挑戰

(Nguyen et al., 2024)。

研究背景與動機

1

傳統運動介入

可增加
身體活動量（PA）

2

**長期行為
維持效果有限**

介入結束後，
常難以持續自主運動。

3

**參與率與
遵從性不足**

即使是低成本、
有監督的方案，
參與與持續執行仍有限。

4

**需要更全面性的
介入策略**

提升高齡女性的
身體活動參與，
並支持長期行為改變。

(Room et al., 2021; Neil-Sztramko et al., 2022; Meredith et al., 2023; Lenouvel et al., 2023)

研究背景與動機

1 穿戴式科技的潛力

- 促進身體活動（PA）
- 減少久坐行為（SB）
- 客觀監測活動量
- 追蹤日常行為

2 相較傳統運動方案的優勢

穿戴式科技
持續監測與數據

- 提升動機
- 自我監測
- 有助長期遵從性

3 關鍵不只是裝置本身

穿戴式裝置 + 行為改變技巧（BCTs） → 更佳介入效果

BCTs 範例

- 目標設定
- 回饋與自我監控
- 提醒與行動計畫

僅使用裝置 < 裝置 + BCTs

穿戴式裝置需結合行為改變技巧，才能更有效促進身體活動並減少久坐行為。

文獻探討

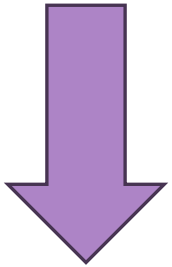
作者 (年份)	研究對象	介入內容	身體活動結果	靜態行為結果
Barwais (2013)	成人	穿戴裝置 + 行為改變	輕度身體活動 ↑ 中高強度身體活動 ↑	靜態行為 ↓
Schuna (2014)	成人	穿戴裝置+行為改變	身體活動 ↑	靜態行為 ↓
Ashe (2015)	高齡者	穿戴式裝置 + 行為介入	身體活動↔	靜態行為↔
Lyons (2017)	高齡者	穿戴式裝置+行為介入	身體活動↔	靜態行為↔

過去研究同時研究身體活動與靜態行為的改變，但結果**不一致**
→成人研究：發現輕度身體活動、中高強度身體活動改善且靜態行為降低
→高齡者研究：發現總身體活動量或靜態行為無顯著改變

研究缺口

多數研究來自西方，亞洲研究較少

高齡女性相關研究不足



研究目的：
透過12的健康信念模式課程+穿戴式裝置回饋提升高齡女性身體活動量減少靜態行為。

名詞操作性定義

一、高齡女性
年滿65歲及以上之成年人 (全國法規資料庫，2019)。

二、身體活動
人們清醒時由骨骼肌肉產生的需要消耗能量的任何身體動作(Caspersen et al., 1985)。按照Troiano (2008) 等，以ActiGraph wGT3X-BT三軸加速規(Pensacola, FL, USA)測量輕度身體活動(100-2019 CPM)及中高強度身體活動(2020-5999 CPM) 時間。

三、靜態行為
久坐行為型態是以每日 ≥30 分鐘連續久坐段落的次數與總持續時間，以及每日 1 分鐘久坐中斷次數來表示 (Troiano et al., 2008) 。

- ✓ 研究參與者均已簽訂知情同意書
- ✓ 並經臺北市立大學研究倫理委員會審查通過

研究方法-研究對象及研究流程

納入標準

年齡 ≥65 歲，居住於社區、願意配穿戴式裝置、可獨立行走、視力正常、近三個月未達每週 150 分鐘中等強度 PA，且未從事阻力訓練

N=74
2023/01-02月於里民活動中心招募參與者

(1) 過去一年曾骨折者（n = 3）
(2) MMSE分數低於 24 分者（n = 2)
(3) 可能影響研究之疾病者，如心血管或神經系統相關疾病（n = 2）

Mini-Mental State Examination (MMSE) (Gou et al., 1988)

N=48
進行隨機分組

因資料不完整、對研究無興趣、拒絕後側、受傷 (n=6)

N=42
最後納入樣本 (實驗組n=22, 控制組n=20)

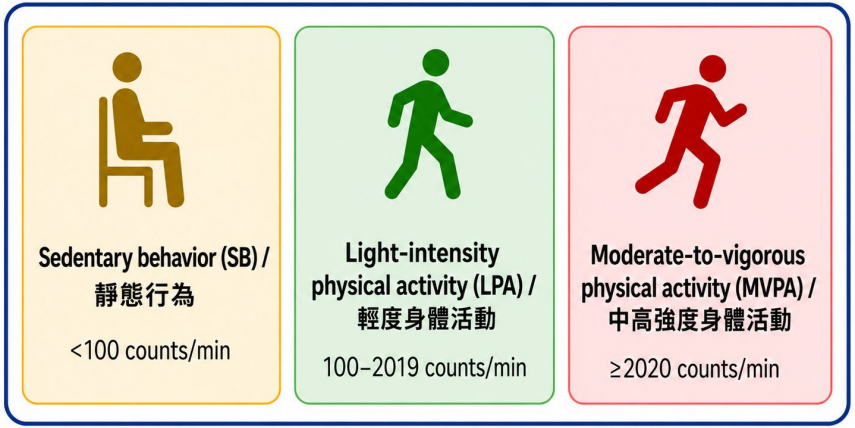
研究方法-身體活動與靜態行為測量

三軸加速規

(GT3X+ ActiGraph, Pensacola, Florida)

於腰部連續配戴七天
至少≥4 有效日
(三個平日+一個週末)
除水中活動，睡眠時間也須配戴

三軸加速規切點



(Troiano et al., 2008)

研究方法-身體功能測量

握力 (Handgrip Strength)

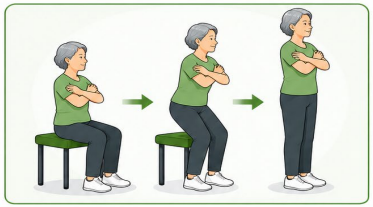
儀器垂直於身體，用慣用手測量兩次取最佳成績

(Taekema et al., 2010 ; Abizanda et al., 2012)

5 次坐站 (5-Times Sit-to-Stand)

雙手交叉胸前，以最快速度完成 5 次坐站。評估下肢肌耐力。

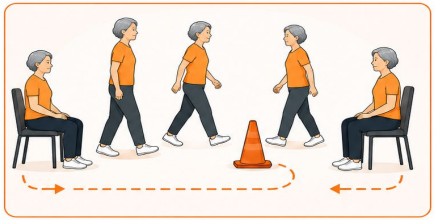
(Buatois et al., 2008)



3三公尺走路速度 (3-m Timed Up and Go)

公尺標誌物再繞回坐下。評估動態平衡與靈敏度。

(Bischoff et al., 2003; Hubbard et al., 2009;Butaet al., 2016



研究方法-介入方法-行為改變技術

實驗組

加速規成績單
讓參與者了解自己的身體活動數據

12周團體課程
進行身體活動、靜態行為、睡眠等健康相關課程

訊息提醒
課後進行重點整理，為參與者客製個人目提醒高齡者中斷靜態行為進行身體活動等資訊

目標設定
標:如>7000步/天

個別化諮詢
擬定個別化行動計畫

控制組

會接受健康老化相關議題的課程，目的在維持參與者的研究參與動機，但沒有提供改善身體活動或改變靜態行為的認知教育及行為策略

研究方法-資料處理與分析

描述性統計	平均數 標準差	• 年齡、BMI • MMSE分數 • 身體活動量(LPA/MVPA) • 身體功能
獨立樣本t檢定	檢視兩組差異	
共變數分析	檢視兩組身體活動、每日步數、靜態行為差異	
使用 IBM SPSS 22 統計軟體 統計顯著水準設定為 $p < .05$ ActiLife軟體6.0處理三軸加速規數據		

研究結果-參與者基本資料

研究結果-實驗組與控制組12周身體活動與靜態行為結果

- ANCOVA 結果顯示，介入組在 12 週後的總身體活動量與每日步數顯著高於控制組；平均每日連續30分鐘坐著不動的行為次數與時間顯著低於控制組；LPA、MVPA、靜態行為總時間，以及平均每日至少1分鐘中斷久坐的次數則無顯著差異。

變項	實驗組 0 週	實驗組 12 週	控制組 0 週	控制組 12 週	p	η^2
Total PA	333.70 ± 15.36	339.28 ± 17.17	340.51 ± 16.00	318.02 ± 12.06	**0.000***	0.45
LPA	312.41 ± 15.30	316.56 ± 17.09	318.00 ± 14.29	301.19 ± 10.65	0.360	0.02
MVPA	21.28 ± 2.72	22.72 ± 4.15	22.51 ± 3.97	16.83 ± 2.85	0.079	0.08
每日步數	7463.27 ± 460.80	8198.12 ± 606.98	7846.46 ± 670.38	6758.07 ± 564.40	**0.011***	0.16
靜態行為總時間	562.82 ± 16.05	538.98 ± 18.32	577.96 ± 14.33	580.54 ± 15.70	0.063	0.09
平均每日連續30分鐘坐著不動的行為次數	2.05 ± 0.284	2.01 ± 0.227	1.84 ± 0.204	4.21 ± 0.286	**0.000***	0.52
平均每日連續30分鐘坐著不動的時間	81.65 ± 11.83	80.95 ± 9.34	76.32 ± 8.80	183.95 ± 14.56	**0.000***	0.51
平均每日至少1分鐘中斷久坐的次數	72.47 ± 2.24	70.94 ± 2.72	65.28 ± 2.07	72.74 ± 1.71	0.054	0.09

顯著差異

註：採共變數分析（ANCOVA）比較兩組差異；*$p < .05$。Total PA = 總身體活動量；LPA = 輕度身體活動；MVPA = 中高強度身體活動。

討論

v 本研究主要發現

→**活動量提升**：實驗組每日總身體活動量與步數顯著高於控制組。

→ **久坐型態改善**：減少了長時間久坐的頻率與總時間，成功打破久坐慣性。

v 與過去研究一致性

→**結果一致**：本研究證實「行為反饋」結合「行為改變技術」能效促進高齡者身體活動，強調行為改變介入對行為維持的重要性。

每日步數與總身體活動量的提升，與較佳的身體功能表現及較低的慢性疾病風險相關。

(Michie et al., 2009; Paterson & Warburton, 2010; Cadmus-Bertram et al., 2015; Liu et al., 2020)

討論

→為什麼步數增加但 LPA/MVPA 不顯著：

主要增加日常生活中的零散走動，足以反映在步數與總量，但強度尚未達到連續且穩定的LPA或MVPA分鐘數。

→為什麼久坐型態會改變：

加速規成績單與文字訊息提醒能讓實驗組對「久坐」產生警覺，從而增加起身頻率，這對降低心血管風險與死亡率具重要價值。

結論

穿戴式裝置與行為改變技術，可提升每日總身體活動量與步數，並改善久坐行為型態，特別是減少長時間未中斷的久坐行為。

未來研究方向與研究限制

- **未來研究建議**
  進行較長期追蹤、納入更大且更多樣化的樣本，並採用適合高齡者的相對強度評估方式，以更準確反映身體活動改變

- **研究限制**
  1. 對於體能與步態較特殊的高齡者，可能產生誤判，低估 SB、LPA 與 MVPA 之間的差異。
  2. 三軸加速規無法測量水中活動，故有可能低估參與者身體活動。
  3. 本研究招募對象為具高度參與意願的社區女性，其健康狀況或運動習慣可能優於一般高齡族群，限制了結果的推論性 。

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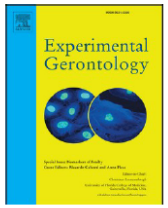

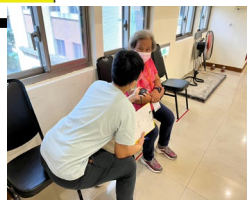

A randomized controlled trial of wearable accelerometer-based feedback and behavior change techniques to increase physical activity and reduce sedentary behavior in older women☆

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報告結束，請多多指教

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