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Wrist-Worn Wearable in Home Cardiac Rehabilitation: A Systematic Review and Meta-Analysis

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Objective

- To evaluate the effectiveness of wrist-worn wearable–guided CR in patients with cardiovascular disease (CVD) participating in Phase II or Phase III CR.

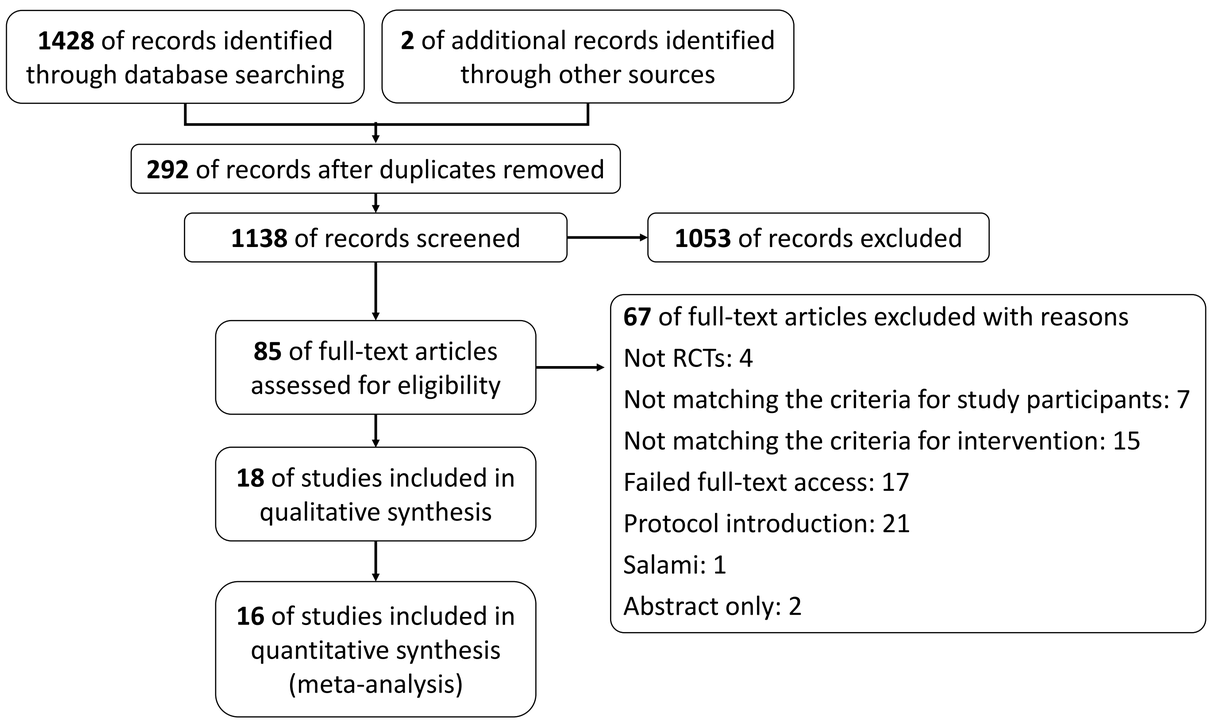
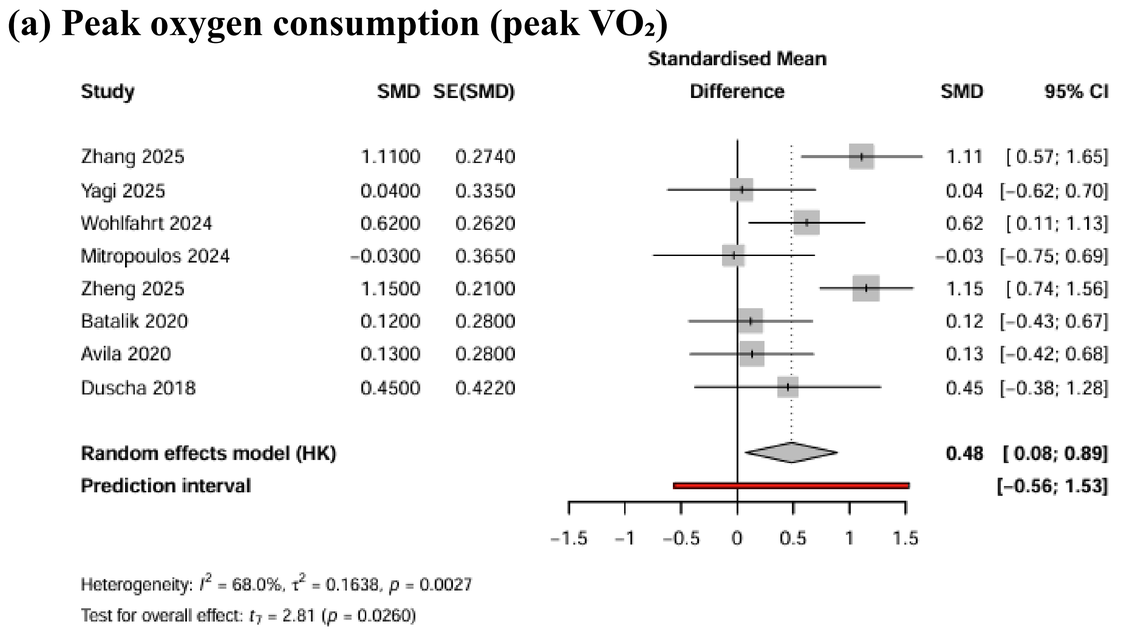
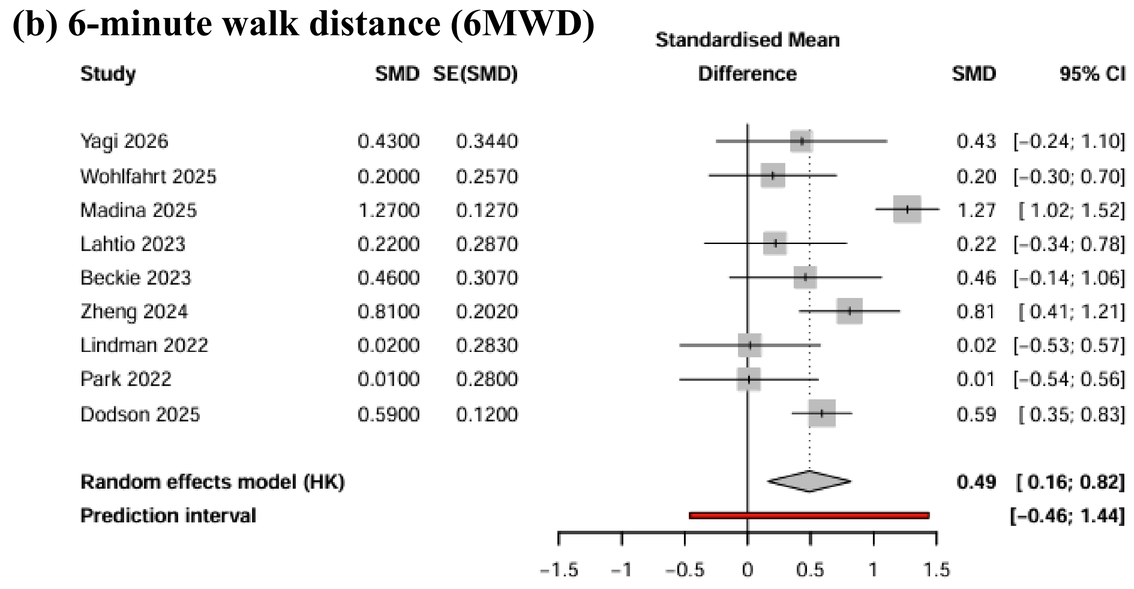


Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Flow Diagram of Study Selection

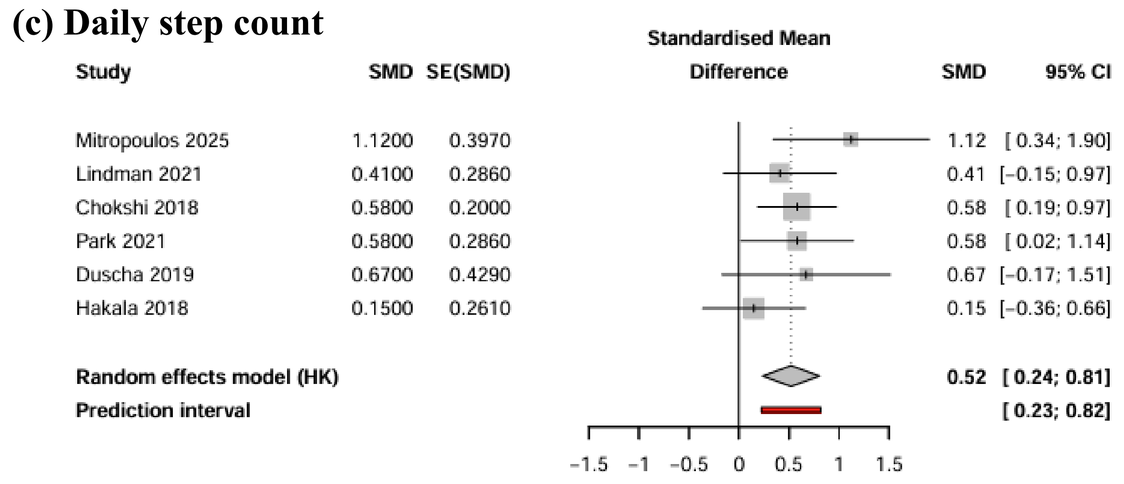
(a) Peak oxygen consumption (peak VO_2)



(b) 6-minute walk distance (6MWD)



(c) Daily step count



(d) Waist circumference

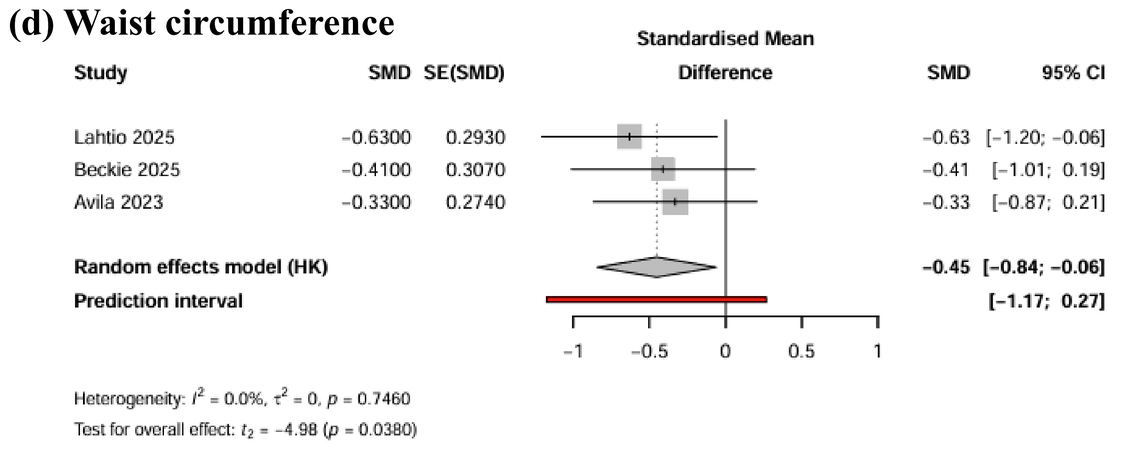


Figure 2. Forest Plots of Significant Outcomes in Wrist-Worn Wearable—Based Home Cardiac Rehabilitation

Method

I. Study Design

- Systematic review and meta-analysis of randomized controlled trials published between January 1, 2015, and December 31, 2025
- The review process was performed in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines

II. PICO framework

Population

- Adult (≥18 years) patients with CVD who were eligible for Phase II or Phase III CR

Intervention

- Wrist-worn wearable device-guided home-based CR

Comparison

- Usual care or Center-based CR

Outcome

Primary

- Peak oxygen consumption (peak VO_2)
- 6-minute walk distance (6MWD)
- Daily step count

Secondary

- Body mass index (BMI)
- Waist circumference
- Anaerobic threshold (AT)
- Grip strength
- Quality of life (QoL)

III. Statistical Analysis

- Random-effects meta-analyses were conducted using standardized mean differences (SMD) and mean differences (MD)
- Subgroup analysis
  - Age, sex, intervention duration, timing of CR initiation, exercise type, feedback modality, device type
- Meta-regression

Result

- Eighteen randomized controlled trials were included in the systematic review, and 16 were eligible for quantitative meta-analysis.
- Total of 1,498 participants with CVD participating in Phase II–III CR programs.

I. Primary Outcome

- Wearable-based home CR significantly increased peak VO_2, 6MWD and daily steps.
  - Peak VO_2: SMD=0.48; MD=▲2.01 mL/kg/min (p <0.05)
  - 6MWD: SMD=0.49; MD=▲31.16 m (p <0.05)
  - Daily steps: SMD=0.52; MD=▲1,447 steps/day (p <0.01)

II. Secondary Outcome

- Wearable-based home CR significantly reduced waist circumference.
- No statistically significant effects were observed for BMI, AT, grip strength, or QoL.
  - Waist circumference: SMD=–0.45; MD=▼2.48 cm (p <0.05)

III. Subgroup Analysis

- Greater improvements in peak VO_2 were observed when CR was initiated in Phase II rather than Phase III, particularly when the interventions primarily consisted of aerobic exercise (p <0.01).
  - Phase II vs Phase III: SMD 0.76 (95% CI −0.07 to 1.60) vs 0.48 (95% CI 0.48 to 0.89) (p <0.05),
  - Aerobic vs combined exercise: SMD 0.62 (95% CI 0.13 to 1.11) vs 0.48 (95% CI 0.08 to 0.89) (p < 0.01)

IV. Meta-regression

- A higher proportion of female participants was significantly associated with greater improvements in peak VO_2 (β = 0.027, p < 0.05)

Conclusion

- Wrist-worn wearable–based home CR significantly enhances exercise capacity, functional walking performance, and physical activity in patients undergoing Phase II–III cardiac rehabilitation, with additional benefits in central adiposity. Early initiation and emphasis on aerobic training may further optimize functional recovery.
- These findings support wearable-guided home CR as a clinically meaningful and scalable rehabilitation strategy.

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