The Remote Exercise SWEDEHEART trial

REMOTE EXERCISE SWEDEHEART

A real-world cluster randomized crossover clinical trial on exercise-based cardiac telerehabilitation after myocardial infarction

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Acknowledgements

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Background

- Exercise as part of cardiac rehabilitation is a class I recommendation after myocardial infarction with established benefits on prognosis, physical and mental functioning and HRQoL.

- Participation and completion remain suboptimal, leaving a substantial gap between evidence and clinical practice.

ESC European Society of Cardiology
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ESC GUIDELINES

2026 ESC Guidelines on cardiac rehabilitation

Developed by the task force on cardiac rehabilitation of the European Society of Cardiology (ESC)

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Patients with acute and chronic coronary syndromes		
Exercise training, as part of CR, is recommended in patients after ACS or with CCS to reduce cardiovascular mortality, MI, and all-cause hospitalization.	I	A
Exercise training, as part of CR, is recommended in patients after ACS or with CCS to improve mental functioning (anxiety and depression), HRQoL, physical functioning (VO_2peak), and to lessen healthcare costs.	I	B1

Background

- Cardiac telerehabilitation may improve access and should be considered as an alternative to centre-based CR.
- Evidence is mainly from small, single-centre RCTs with heterogenous interventions and limited follow-up.
- Real-world evidence on participation, safety, and effectiveness remains scarce.
- Remote Exercise SWEDEHEART is a real-world cluster randomized crossover trial evaluating participation, safety, and clinical effectiveness of cardiac telerehabilitation.

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Recommendation Table 29 — Recommendations for the delivery of cardiac rehabilitation (see Evidence Table 29)

Recommendations	Class[a]	Level[b]
Centre-based CR is recommended in patients with an indication for CR to improve health outcomes.[53,113,310,600]	I	B1
CTR or hybrid CTR should be considered as alternatives to centre-based CR in patients with acute and chronic coronary syndromes (including those post-PCI or post-CABG) to improve physical functioning (exercise capacity), HRQoL, and risk factor control.[556,567,589,591,603]	IIa	B1

Bäck and Wilhelm et al, 2026 ESC Guidelines on cardiac rehabilitation; Shi et al, 2024; Pagliari et al, 2024; Kizilkilic et al, 2026

Methods

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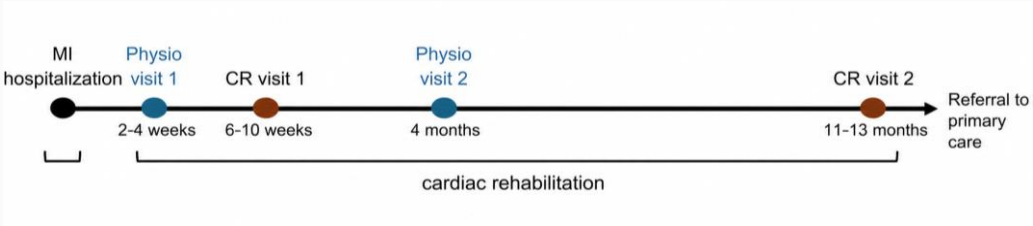
Inclusion criteria

- Diagnosis of type 1 MI included in the SWEDEHEART registry.
- Age 18-79 years at discharge from hospital

Exclusion criteria

- Patients with incomplete coronary revascularization
- Severe heart failure (NYHA class III–IV)
- Severe valve disease or serious arrythmias
- Pathological exercise test
- Inability to understand or speak Swedish
- More than 6 months between discharge from hospital and screening



Overview of routine post-MI follow-up in Sweden as registered in SWEDEHEART

Methods

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Screening-based intention to treat analysis set (S-ITT)

- All screened patients who fulfilled inclusion and with no exclusion criteria according to site screening lists, irrespective of trial-specific consent.

Registry-based intention-to-treat analysis set (R-ITT)

- All patients with a registry-based physiotherapy visit who fulfilled study inclusion criteria according to SWEDEHEART.

The primary outcome was the difference between intervention and control periods in the mean number of completed exercise sessions in the S-ITT population (repeated in the R-ITT population).

A supportive responder analysis evaluated exercise completion, defined as attendance at ≥18 sessions over a 4-months period.

Methods

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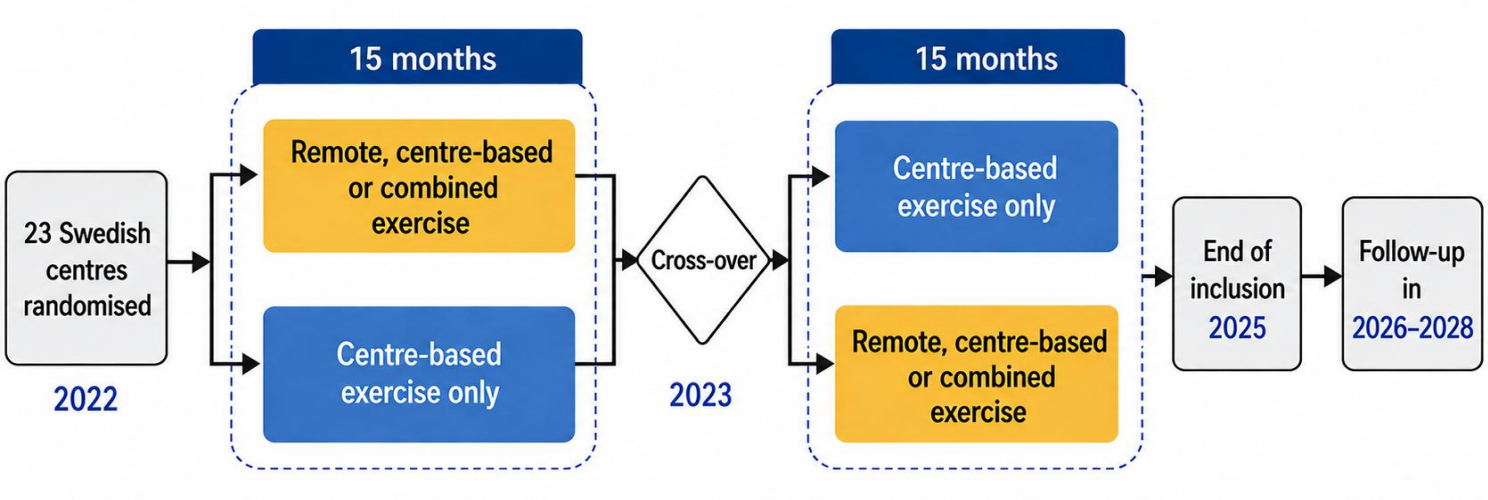

- **S-ITT:** Of 4,787 patients screened, 3,202 patients were eligible, and **3,112** were included
- **R-ITT:** In SWEDEHEART, **7,171** patients were included

Intervention

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- Patient assessments were performed at the CR centre before and after the exercise programme.
- The exercise programme comprised individually tailored aerobic and resistance exercise performed during 60 min, twice a week for three months (a total of 24 sessions).
- The telerehabilitation programme was delivered through a real-time group-based video meeting, by connecting the physiotherapist to patients exercising at home.

Statistics and sample size estimation

- The primary model was based on individual data, using a mixed effect linear model with fixed factors treatment and period, and normally distributed random effects for cluster and cluster-period.
- The model was fitted using REML and the inferences use Satterthwaite degrees of freedom.
- A number of sensitivity analyses were performed.
- Power simulations estimated 80% power to detect an increase of 0.4 sessions per patient in the R-ITT population, based on SWEDEHEART data and the pilot study.

Characteristics of patients

Variable	N	INTERVENTION (n=3283)	CONTROL (n=3888)
Age, median (IQR), years	7171	67 (59 - 73)	67 (58 - 73)
Female, n (%)	7171	804 (24.5)	934 (24.0)
Type of MI: NSTEMI, n (%)	7171	1927 (58.7)	2318 (59.6)
PCI before discharge, n (%)	7164	2828 (86.3)	3356 (86.4)
CABG before discharge, n (%)	7161	272 (8.3)	295 (7.6)
Left ventricular ejection fraction, n (%)			
Normal (>=50%)	6923	2049 (64.4)	2481 (66.3)
Slightly reduced (30-49%)		706 (22.2)	814 (21.8)
Moderately reduced (30-39%)		337 (10.6)	344 (9.2)
Severely reduced (<30%)		89 (2.8)	103 (2.8)
Previous disease, n (%)			
MI	7146	504 (15.4)	655 (16.9)
Stroke	7134	132 (4.0)	167 (4.3)
PCI	7141	489 (14.9)	673 (17.4)
Diabetes	7136	691 (21.0)	833 (21.4)
Hypertension	7145	1853 (56.6)	2206 (57.0)
Medication at discharge			
Betablockers	7169	2301 (70.1)	2683 (69.0)
Statins	7171	3150 (95.9)	3737 (96.1)
ACEi/ARB	7171	2763 (84.2)	3258 (83.8)

Number of exercise sessions - Screening-based population (S-ITT)

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Patients	INTERVENTION			CONTROL		
	N	Sessions	Mean (SD)	N	Sessions	Mean (SD)
All eligible screened patients	1447	5781	**4.0 (8.3)**	1665	6312	**3.8 (8.1)**
Entered in case report form (CRF)	342	5781	**16.9 (8.5)**	352	6312	**17.9 (7.4)**
Screened eligible, no case report form data[1]	1105	0	0	1313	0	0

[1]Patients without case report form data were included in the S-ITT population and counted as 0 recorded exercise sessions.

Exercise programme completion

- Intervention, n=200
  (13,8% of all screened patients; 58,5% in CRF)
- Control, n=226
  (13,6% of all screened patients; 64,2% in CRF)

Number of exercise sessions by mode

- Intervention: **remote, 2192 (37,9%)**
- Intervention: centre-based, 3589 (62,1%)
- Control: centre-based, 6312 (100%)

Number of exercise sessions - Registry-based population (R-ITT)

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Outcome	INTERVENTION			CONTROL		
	N	Sessions	Mean (SD)	N	Sessions	Mean (SD)
Sessions in SWEDEHEART	3283	17692	**5.4 (9.2)**	3888	19169	**4.9 (8.9)**

Exercise programme completion

Intervention group, n=604 (18.4%)

Control group, n=663 (17.1%)

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Primary endpoint - Screening-based population (S-ITT)

Variable	Estimate (95% CI)	p-value
Number of exercise sessions within 122 days from start	**0.048 (-0.89; 0.99)**	**0.92**
Number of exercise sessions, cluster as fixed factor	-0.10 (-1.1; 0.87)	0.83
Number of exercise sessions, linear model for cluster-period means	-0.074 (-1.1; 0.95)	0.88
Percent responders (at least 18 sessions)	0.0048 (-3.4; 3.4)	1.00
Percent responders, linear model for cluster-period means	-0.39 (-3.8; 3.1)	0.81

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Primary endpoint - Registry-based population (R-ITT)

Variable	Estimate (95% CI)	p-value
Number of exercise sessions within 122 days from start	**0.29 (-0.35; 0.93)**	**0.35**
Number of exercise sessions, cluster as fixed factor	0.18 (-0.44; 0.80)	0.55
Number of exercise sessions, linear model for cluster-period means	0.32 (-0.31; 0.96)	0.30
Percent responders (at least 18 sessions)	0.84 (-1.9; 3.5)	0.52
Percent responders, linear model for cluster-period means	0.50 (-2.1; 3.1)	0.69

Secondary endpoint - Exercise-related adverse events

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Centre-based exercise

- 4.9 AE / 1,000 patient-hours
- 0.5 SAE / 1,000 patient-hours

Remotely delivered exercise

- 2.8 AE / 1,000 patient-hours
- 0.2 SAE / 1,000 patient-hours

Distribution of AEs by exercise mode, n=51

Adverse event	Centre-based exercise, n	Remote exercise, n
Angina pectoris[1]	11	1
Hypotension[1]	13	0
Musculoskeletal conditions	5	3
Dizziness	2	2
Nausea	2	2
Decreased exercise tolerance	1	2
Intermittent claudication	0	3
Fatigue	0	3
Other	0	1
Total	34	17

[1] Related SAEs included in this table:
centre-based exercise: angina pectoris, n=2; hypotension, n=1
remotely delivered exercise: angina pectoris, n=1

Secondary endpoint – exercise capacity

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Aerobic capacity, Watts	N	INTERVENTION	CONTROL
Start of exercise programme, mean (SD)	5662	95.0 (35.0)	96.1 (36.3)
End of exercise programme, mean (SD)	3861	109.8 (38.3)	109.9 (38.5)
Change, mean (SD)	3842	**10.8 (20.5)**	**10.5 (19.8)**

Exercise capacity improved to a similar and clinically relevant extent in both groups, with no evidence of a between-group difference

Conclusions

- In this nationwide, real-world, cluster-randomized crossover trial, offering remotely delivered exercise as an alternative to centre-based exercise did not increase the mean number of completed exercise sessions or programme completion after MI.

- Remotely delivered exercise was used when available; exercise capacity improved similarly in both groups, and serious exercise-related adverse events were uncommon.

- Telerehabilitation should be viewed as an additional patient-centred option, rather than a replacement for centre-based cardiac rehabilitation, or a stand-alone solution to poor participation.