

1 **European Journal of Cardiovascular Nursing**
2 **Caregiver presence in a home-based cardiac rehabilitation programme improves**
3 **the health-related quality of life of patients with heart failure**
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17 **Short Title: Caregiver participation in REACH-HF**
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19 **Abstract**

20 Rehabilitation Enablement in CHronic Heart Failure (REACH-HF) is a home-based
21 cardiac rehabilitation intervention designed for patients with heart failure and their
22 caregivers. We present a pooled analysis of patients > 18 years with a confirmed
23 diagnosis of HF recruited to two REACH-HF randomised controlled trials. Where
24 identified by patients and they consented to participate, caregivers were randomly
25 assigned with patients to receive the REACH-HF intervention plus usual care or usual
26 care alone. Our analysis demonstrated that compared to control group, the REACH-HF
27 group had a greater gain in their disease-specific health related quality of life at follow
28 up.

29 **Novelty**

- 30 • Involvement of caregivers (such as a family member or friend) alongside patients
31 in a cardiac rehabilitation programme can enhance patient's gain in health-
32 related quality of life.

- 1 • Understanding the significance of the caregiver role and the impact of including
2 caregivers, can inform how we design and deliver interventions in heart failure.

3
4 Individuals living with heart failure (HF) frequently depend upon family or friend
5 caregivers for support with managing their illness (1). Our 2019 meta-analysis of
6 randomised trials indicated no additional benefit in the outcomes of patients with HF
7 when their caregivers were formally involved in self-management interventions (2).
8 However, our review noted the limited quality and quantity of evidence addressing the
9 value of caregiver involvement in HF care. This research letter seeks to address this
10 uncertainty by reporting a secondary analysis combining two randomised controlled
11 trials (RCTs) (3,4) of a home-based cardiac rehabilitation (CR) programme on the
12 health-related quality of life (HRQoL) of HF patients according to whether the patient
13 was supported by a caregiver or not.

14 Rehabilitation Enablement in CHronic Heart Failure (REACH-HF) is a home-based CR
15 programme delivered over 12-weeks by trained healthcare facilitators. Components of
16 the intervention include: a Heart Failure Manual for patients, Family and Friends
17 Resource for caregivers, progress tracker, exercise DVD, and relaxation CD. The
18 REACH-HF intervention was evaluated in two separate trials: a multicentre trial (across
19 4 UK sites) that recruited 216 HF patients with reduced ejection fraction (HFrEF, left
20 ventricular ejection fraction <45%) and a single centre pilot trial that recruited 50 HF
21 patients with preserved ejection fraction (HFpEF, left ventricular ejection fraction ≥45%).
22 Further details of the REACH-HF intervention and the participants and outcome findings
23 of both trials are reported in detail elsewhere (3, 4, 5). At study entry, patients were
24 asked to nominate if they had a caregiver, i.e., a family member or friend, who provides
25 unpaid support. Where identified by patients and consented to participate, caregivers
26 were randomly assigned with patients to receive the REACH-HF intervention plus usual
27 care (REACH-HF group) or usual care alone (control group). The expectation of
28 involving caregivers in the REACH-HF intervention was to develop knowledge about
29 self-management in heart failure and how to maintain their own health and wellbeing
30 and to support patients' engagement with the intervention (5).

1 The two trials randomised patients to receive either REACH-HF plus usual care
2 (REACH-HF group) or usual care alone i.e., no CR and a medical management
3 approach (control group) (3, 4) and assessed the primary outcome of the Minnesota
4 Living with Heart Failure Questionnaire (MLwHFQ). This was assessed at baseline (pre-
5 randomisation) and 4 and 6-months post randomisation. Pooling the individual patient
6 MLwHFQ data across trials, we sought to address the question of whether patients (n =
7 266) participating in the REACH-HF intervention, achieved a better outcome when they
8 had caregiver support (n =117). MLwHFQ scores at follow up between REACH-HF
9 versus control groups were compared using multivariable linear regression analysis for
10 comparison adjusting for baseline score and stratification variables (trial site & baseline
11 plasma N-terminal proB-type natriuretic peptide levels (≤ 2000 vs. >2000 pg/ml), and
12 previous atrial fibrillation/atrial flutter (as shown to be different between groups, see
13 Table 1). To assess the impact of caregiver involvement, we incorporated an interaction
14 term (caregiver present vs no caregiver present x REACH-HF vs control group).
15 Separate analyses were conducted for MLwHFQ total score and MLwHFQ physical and
16 emotional sub-scores at both 4- and 6-months follow-up. An interaction term p-value of
17 ≤ 0.05 was pre-determined to indicate statistical significance.

18 Of the 266 HF trial participants, 117 (44%) caregivers were identified and consented to
19 participate with the patient, 48% in the REACH-HF intervention group (63/132) and 40%
20 in the control group (54/134). With the exception of the presence of previous atrial
21 fibrillation/atrial flutter (41.6% vs 55.5%), there was no significant difference in the
22 characteristics or medical history of patients with or without a caregiver. Caregivers
23 were typically the partner (75%) of the patient and retired (68%). Compared to patients,
24 caregivers were younger (mean 64 vs 70 years) and more likely to be female (78% vs
25 28%) (Table 1).

26 At 4-months follow-up, a greater improvement (p =0.015) in treatment effect (i.e.
27 REACH-HF group vs control group) in HRQoL was seen in those patients with a
28 caregiver (mean total MLwHFQ score: -12.2, 95% CI = -5.6 to -18.8) compared to
29 patients without a caregiver (mean total MLwHFQ score: -1.9, 95% CI: 3.0 to -6.8)
30 (Table 2). This HRQoL effect in favour of caregiver participation was also seen for both

1 the MLwHFQ physical and emotional sub-scores. A similar direction of effect was also
2 seen at 6-months follow-up but not statistically significant (Table 2). A summary of
3 patient MLwHFQ scores (total and sub-score) in REACH-HF and control group by
4 caregiver recruitment at baseline, 4 and 6-months follow-up can be viewed as an online
5 supplementary table and demonstrates greater improvements within the intervention
6 group on the MLwHFQ.

7 Our analysis demonstrated that presence of a caregiver enhanced the HRQoL of
8 patients participating in a CR intervention. We believe this benefit reflects both the
9 design and delivery of the REACH-HF intervention. We included caregivers in the
10 development of the intervention including the Family and Friends Resource and we
11 emphasised the importance of actively involving caregivers in the facilitator training of
12 healthcare staff (6). A key strength of our analysis is that it is based on pooled individual
13 patient data analysis of two randomised trials of the REACH-HF home-based CR
14 intervention in both HF_rEF and HF_pEF patients. However, we need to acknowledge
15 some potential limitations of our analysis. First, this comparison of patient outcomes
16 between those with and without an identified caregiver is effectively observational and
17 therefore subject to bias and confounding. However, as reported above, there was little
18 difference in characteristics of patients with and without a caregiver and we adjusted for
19 previous atrial fibrillation/flutter (see Table 2). Second, as this is a multi-component
20 intervention it is likely that the intervention was tailored to the needs of each patient-
21 caregiver dyad. Third, this analysis focused on disease-specific HRQoL and not other
22 secondary outcomes collected in the primary trials including patient's physical activity,
23 stress and anxiety. Fourth, this analysis was not pre-specified but rather driven by the
24 findings of our previous systematic review and meta-analysis (2). Finally, it is interesting
25 to note that although more than a half of trial patients (149 of 266, 56%) participated
26 with a caregiver, a substantial proportion of patients without an identified caregiver
27 participating in the trial, were married, in a civil partnership or living with another. These
28 later patients may therefore have received some form of caregiver support albeit without
29 the formal context of the REACH-HF intervention. This also may indicate the need for

1 greater understanding amongst healthcare professionals about how caregivers can be
2 engaged in self-management interventions.

3 In conclusion, our results support the value of identifying caregivers to participate in
4 rehabilitation interventions for HF patients in the short-term. Involvement of caregivers
5 following the COVID-19 pandemic has become even more important with growing
6 pressures on healthcare systems to deliver self-management services as well as
7 ongoing requirement for some patients to continue to socially distance to minimise the
8 risk of infection limiting their access to healthcare. Further evidence from appropriately
9 designed trials is required to confirm the benefits of involving caregivers in the
10 development and delivery of rehabilitation and self-management interventions for HF.

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21 **Data availability statement**

22 The data underlying this article will be shared on reasonable request to the
23 corresponding author.

25 **Declaration of conflicting interests**

26 RST was co-chief investigator for the REACH-HF trials.
27 RST is a member of the ACNAP Scientific Committee.

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1 Table 1. Characteristics of patients by caregiver recruitment

Patients (n = 266)	Patient without a caregiver recruited n (%) N = 149	Patient with a caregiver recruited n (%) N = 117	P-value	Total N=266
Gender n (%)				
Male	109 (73.1)	83 (70.9)	0.149	192 (72.18)
Age (years) Mean (SD)	70.6 (10.9)	70.6 (10.1)	0.475	70.56 (0.65)
Ethnic group: white	138 (92.6)	116 (99.1)	0.492	254 (95.49)
Relationship status n (%)			0.639	
Single	22 (14.7)	9 (7.6)		31 (11.65)
Civil partnership	2 (1.3)	1 (0.8)		3 (1.13)
Widowed/surviving civil partner	35 (23.4)	11 (9.4)		46 (17.29)
Married	74 (49.6)	92 (78.6)		166 (62.41)
Divorced/civil partnership dissolved	16 (10.7)	4 (3.4)		20 (7.52)
Domestic residence n (%)				
Lives alone	58 (38.9)	15 (12.8)	0.832	73 (27.44)
Live with another	91 (61)	102 (87.1)		193 (72.56)
HFpEF diagnosis n (%)	25 (18.94)	25 (18.66)	0.953	50 (18.80)
NYHA Status:			0.621	
NYHA I	26 (17.4)	19 (16.2)		45 (16.92)
NYHA II	92 (61.7)	65 (55.5)		157 (59.02)
NYHA III	30 (20.1)	33 (28.2)		63 (23.68)
NYHA IV	1 (0.6)	-		1 (0.38)
Cause of heart failure* n (%)			0.283	
Ischaemic	64 (42.9)	58 (49.5)		122 (45.86)
Non-ischaemic	71 (47.6)	55 (47)		126 (47.37)
Unknown	5 (3.3)	3 (2.5)		8 (3.01)
Not Classified	9 (6)	1 (0.8)		10 (3.76)
Number of comorbidities n (%)			0.667	
0	82 (55)	56 (47.8)		138 (51.88)
1	45 (30.2)	45 (38.4)		90 (33.83)
2	14 (9.4)	12 (10.2)		26 (9.77)
3	8 (5.3)	2 (1.7)		10 (3.76)
4	-	2 (1.7)		2 (0.75)

Previous myocardial infarction	34 (22.8)	42 (35.9)	0.202	76 (28.57)
Previous atrial fibrillation/atrial flutter	62 (41.6)	65 (55.5)	0.026*	127 (47.74)
Hypertension	64 (42.9)	55 (47)	0.332	119 (44.74)
Diabetes mellitus	45 (30.2)	30 (25.6)	0.628	75 (28.20)
Chronic renal impairment	27 (18.1)	19 (16.2)	0.320	46 (17.29)
Time since diagnosis of heart failure (years)			0.941	
<1	40 (26.8)	33 (28.2)		79 (29.69)
1 to 2	30 (20.1)	18 (15.3)		48 (18.04)
>2	70 (53)	66 (56.4)		136 (51.12)
Main activity n (%)			0.808	
In employment or self-employment	26 (17.4)	11 (9.4)		37 (13.91)
Unemployed	5 (3.4)	5 (4.3)		10 (3.76)
Unpaid Occupation (carer, housework, student)	1 (0.7)	1 (0.8)		2 (0.75)
Retired (medical/disability/age)	117 (78.5)	100 (85.5)		217 (81.58)
Education n (%)				
Post-school	68 (45.6)	59 (50.4)	0.459	127 (47.74)
Degree	36 (24.2)	35 (29.9)	0.372	71 (26.69)
Pro-BNP levels n(%)				
≤2000 pg/mL	120 (80.5)	95 (81.2)	0.923	215 (80.83)
>2000 pg/mL	29 (19.5)	22 (18.8)	0.923	51 (19.17)

*significant difference between patients without a caregiver and patients with a caregiver

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1 **Table 2 Comparison of REACH-HF vs control group treatment effect on**
 2 **MLwHFQ score in patients without and with a caregiver**

	REACH-HF vs control group treatment effect* Mean (95% CI) N patients		Interaction** Mean (95% CI) N, p-value
	<u>Without a caregiver</u>	<u>With a caregiver</u>	
4-months follow up			
MLwHFQ Total	-1.9 (3.0 to -6.8) 132	-12.2 (-5.6 to -18.8) 108	-10.15 (-2.01 to -18.30) 240, 0.015
MLwHFQ Physical	-0.9 (1.4 to -3.4) 133	-6.0 (-3.0 to -9.0) 108	-4.79 (-0.95 to -8.63) 241, 0.015
MLwHFQ Emotional	-0.5 (1.0 to -2.0) 133	-3.7 (-1.6 to -5.7) 108	-3.28 (-0.73 to -5.83) 241, 0.012
6-months follow up			
MLwHFQ Total	-0.1 (5.5 to -5.8), 122	-10.7 (-4.1 to -17.2), 105	-8.04 (0.54 to -16.64) 227, 0.066
MLwHFQ Physical	0.4 (3.4 to -2.6) 123	-4.3 (-1.1 to -7.5) 105	-3.33 (1.01 to -7.67) 228, 0.132
MLwHFQ Emotional	-0.3 (1.3 to -2.1), 123	-3.0 (-0.9 to -5.2) 105	-2.04 (0.69 to -4.77) 228, p = 0.142

3 *REACH-HF vs control group difference adjusted for MLwHFQ baseline score and
 4 stratification variables (trial site & baseline plasma N-terminal proB-type natriuretic
 5 peptide levels (≤ 2000 vs. >2000 pg/ml), and adjusted for atrial fibrillation/atrial flutter.

6 **interaction effect and P-value is the comparison of treatment effect (i.e. REACH
 7 group vs control group) of patients with a recruited caregiver vs. patients with no
 8 caregiver.

9 Note: the lower the MLwHFQ score the higher the HRQoL

Caregiver presence in a home-based cardiac rehabilitation programme



12 week intervention



Facilitated home visits



Exercise programme



Self-management resource



Guided relaxation

Pooled analysis of two randomised controlled trials: REACH-HF multi-centre trial (HFrEF patients) and REACH-HF pilot trial (HFpEF)



149

Patients **with** a caregiver



117

Patients **without** a caregiver

Outcome Measure:
Minnesota Living with Heart
Failure Questionnaire*

*reduction in score: improvement
in health related quality of life

Compared to controls
REACH-HF group patients
with a recruited caregiver
had greater gain in health
related quality of life

4 months

MLHFQ score:
A reduction of 10.15
points, $p = 0.015$

6 months

MLHFQ Score:
A reduction of
8.04 points, $p = 0.066$



These results support the value of recruiting caregivers to participate in rehabilitation interventions for HF patients in the short-term

Graphical Abstract
180x120 mm (.43 x DPI)

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