



PLATFORM OF LABORATORIES FOR ADVANCES IN CARDIAC EXPERIENCE

**ROMA**

Centro Congressi  
di Confindustria

**Auditorium  
della Tecnica**

**9<sup>a</sup> Edizione**

**30 Settembre  
1 Ottobre  
2022**

**FRAGILITÀ, CARENZE NUTRIZIONALI E RIABILITAZIONE NEL  
PAZIENTE CARDIOPATICO**

**L'ATTIVITÀ FISICA: UN «NUOVO  
FARMACO» NEL PAZIENTE SCOMPENSATO  
ANZIANO**

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***Unità Operativa di Cardiologia-UTIC- Centro di Telemedicina***

***Italian National Research Centre on Aging - Ancona***



## 9 Multidisciplinary team management for the prevention and treatment of chronic heart failure



### 2021 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure

Developed by the Task Force for the diagnosis and treatment of acute and chronic heart failure of the European Society of Cardiology (ESC)

With the special contribution of the Heart Failure Association (HFA) of the ESC

Recommendations	Class <sup>a</sup>	Level <sup>b</sup>
Exercise is recommended for all patients who are able in order to improve exercise capacity, QOL, and reduce HF hospitalization. <sup>c</sup> 324–328,335–337	I	A
A supervised, exercise-based, cardiac rehabilitation programme should be considered in patients with more severe disease, frailty, or with comorbidities. <sup>95,324–327,338</sup>	IIa	C



# Exercise training meta-analysis of trials in patients with chronic heart failure (ExTraMATCH)

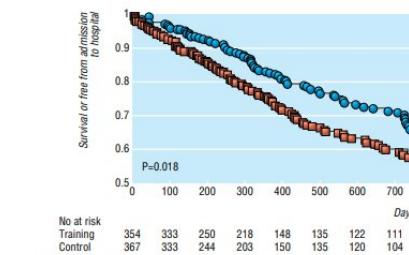
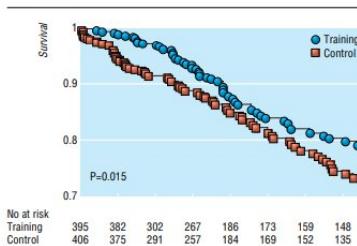
**Table 1** Characteristics of studies included in meta-analysis

Study	Location	No in groups (training, control)	Duration of training programme (days)	Mean (SD) duration of follow up (days)	Description of training programme	Intensity of programme
Belardelli et al, 1999 <sup>9</sup>	Italy	50, 49	420	1144 (461)	Supervised cycling, 60 minutes three days a week for eight weeks, then two days a week	60% peak oxygen consumption
Dubach et al 1997 <sup>10</sup>	Switzerland	24, 26	56	261 (106)	Supervised walking, two hours daily; supervised cycling 40 minutes four days a week	80% peak oxygen consumption
Giannuzzi et al, 1997 <sup>11</sup>	Italy	46, 42	168	206 (35)	Supervised cycling, 30 minutes three days a week for two months, then home based 30 minutes for three days a week and walking for 30 minutes	80% peak heart rate
Hambrecht et al, 1995 <sup>12</sup>	Germany	34, 35	168	159 (22)	Supervised and home based walking, calisthenics, cycling 40-60 minutes a day	70% peak oxygen consumption
Kilavuori et al, 2000 <sup>13</sup>	Finland	12, 15	182	2284 (1213)	Supervised cycling 30 minutes three days a week for three months, then home based training (walking, cycling, rowing, and swimming)	50-60% peak oxygen consumption
McKelvie et al, 2002 <sup>2</sup>	Canada	90, 91	364	557 (219)	Supervised aerobic (cycling, treadmill, arm) and resistance training 30 minutes three days a week for three months, then home based aerobic training three days a week	60-70% peak heart rate
Zanelli et al, 1997 <sup>14</sup>	Italy	76, 79	364	304 (140)	Supervised aerobic (cycling, treadmill, arm) and resistance training 30 minutes two days a week and home based cycling three days a week for two months, then only home based aerobic training five days a week	70% peak oxygen consumption
Wielenga et al, 1999 <sup>15</sup>	Netherlands	41, 39	84	1440 (917)	Supervised cycling, walking, ball game 30 minutes three days a week for eight weeks, then two days a week	60% peak heart rate
Willenheimer et al, 1998 <sup>16</sup>	Sweden	22, 30	112	1623 (797)	Supervised interval cycling training (90 second exercise and 30 second rest) for 15-45 minutes two days a week	80% peak oxygen consumption or grade 15 Borg scale
Total		395, 406	213 (135)	705 (729)		

- 9 reports
- 801 patients
- 395 in exercise training program
- 406 control group

**Objective:** to determine the effect of exercise training on survival in patients with heart failure due to left ventricular systolic dysfunction.

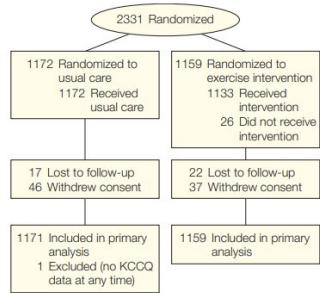
LVEF media 27% nei due gruppi

**Fig 2** Funnel plot for detection of publication bias**Fig 3** Kaplan-Meier cumulative two year survival (top) and Kaplan-Meier cumulative two year survival or free from admission to hospital (bottom)



# Effects of Exercise Training on Health Status in Patients With Chronic Heart Failure

## HF-ACTION Randomized Controlled Trial



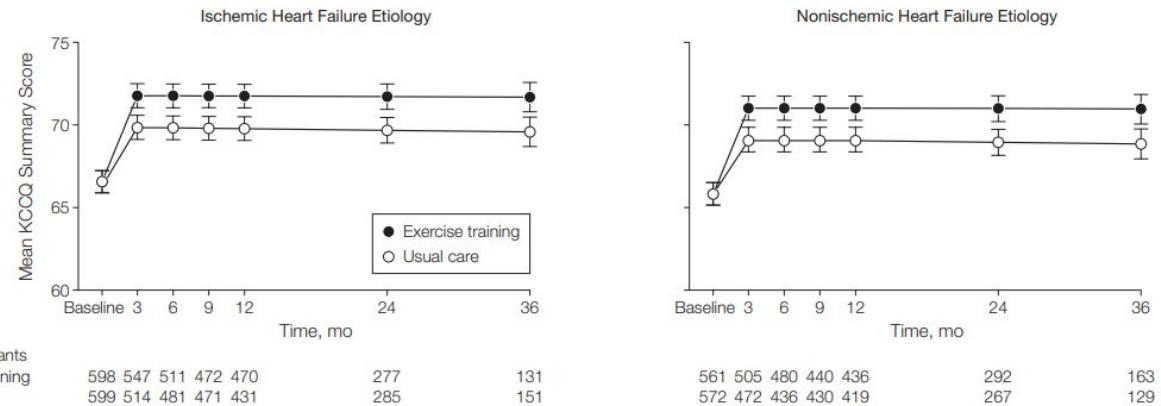
KCCQ indicates Kansas City Cardiomyopathy Questionnaire.

LVEF < 35%

LVEF media 24% nei due gruppi

**Objective:** to test the effects of exercise training on health status among patients with heart failure

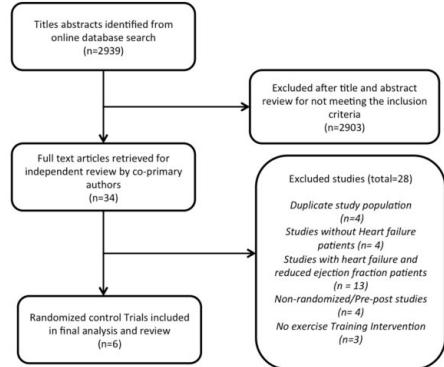
**Figure 2.** Predicted Mean Health Status Trajectories by Treatment Group



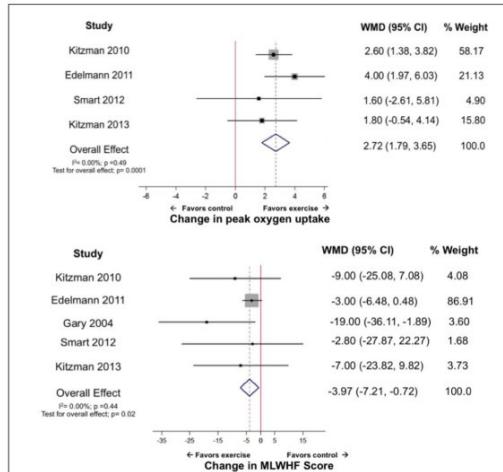
*P*=.001 for treatment effect for both ischemic and nonischemic heart failure. Error bars indicate standard errors at each time point.



## Exercise Training in Patients with Heart Failure and Preserved Ejection Fraction: A Meta-analysis of Randomized Control Trials

**Figure 1.**

Flow diagram for inclusion of studies in the Meta-analysis



**Objective:** to evaluate the effects of exercise training on CRF, quality of life and diastolic function in patients with HFPEF.

**Figure 2.**

Forest Plot showing effect of exercise training on cardiorespiratory fitness, measured as peak oxygen uptake (ml/kg/min) and quality of life, estimated using Minnesota living with heart failure (MLWHF) score, among participants with heart failure and preserved ejection fraction. WMD indicated weighted mean difference.



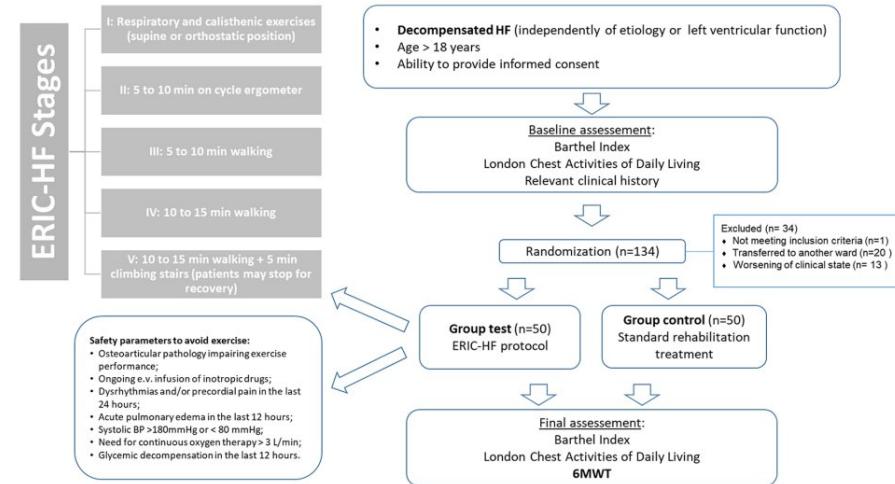
Original Paper

**European Journal of  
Cardiovascular  
Nursing**
**ESC**  
 European Society  
 of Cardiology

## Early rehabilitation in cardiology – heart failure: The ERIC-HF protocol, a novel intervention to decompensated heart failure patients rehabilitation

Bruno Miguel Delgado<sup>1,2,3</sup>, Ivo Lopes<sup>4</sup>, Bárbara Gomes<sup>5</sup>  
 and André Novo<sup>3,6</sup>

**Objective:** To evaluate the safety and feasibility of an aerobic exercise training programme in functional capacity of decompensated heart failure patients.

**Table 4.** Comparison of outcomes.

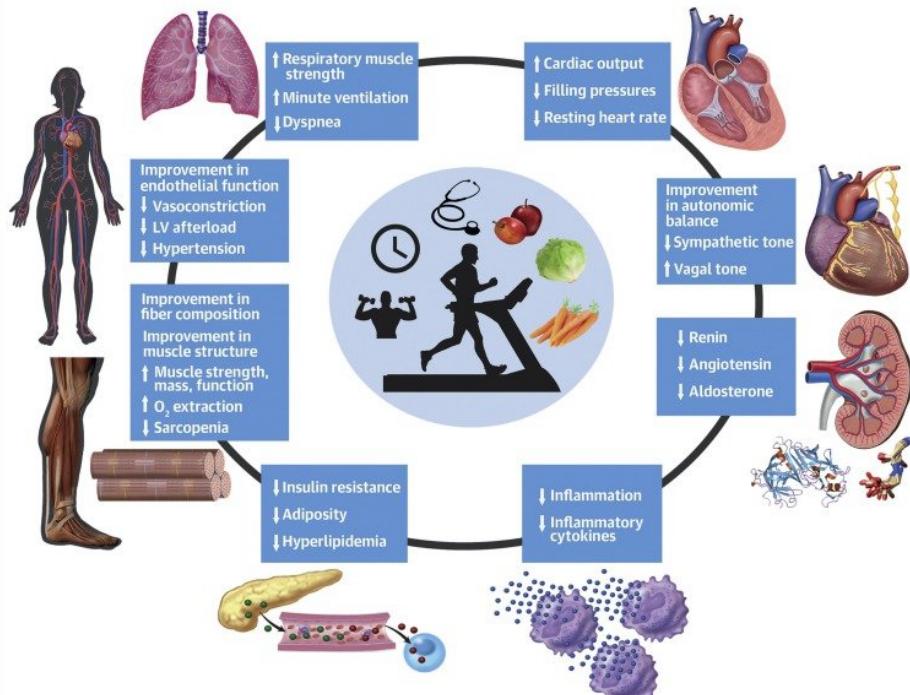
Parameter	Training group	Control group	Difference	P value
Barthel at discharge	96±6	92±14	4	0.072
LCADL at discharge	12±4	16±7	4	0.003
6MWT	287.6±128.9	233.4±110.4	54.2	0.026

LCADL: London chest activity of daily living; 6MWT: six minute walking test.

# FISIOPATOLOGI



## CENTRAL ILLUSTRATION: Mechanisms of Beneficial Effects of Exercise Training and Cardiac Rehabilitation in Patients With Heart Failure



Bozkurt, B. et al. J Am Coll Cardiol. 2021;77(11):1454-69.

## Journal of the American College of Cardiology

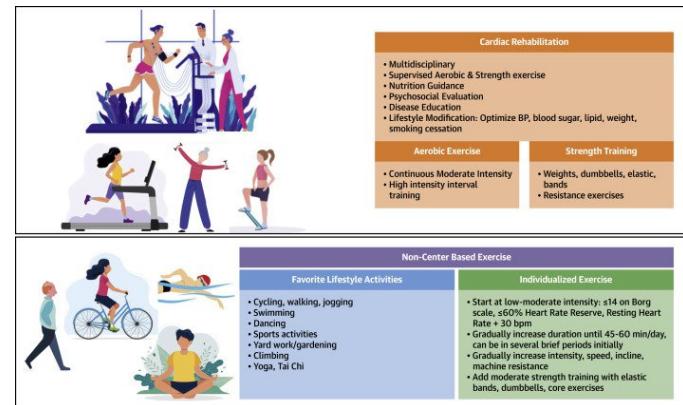
Volume 77, Issue 11, 23 March 2021, Pages 1454-1469



The Present and Future  
JACC Expert Panel

## Cardiac Rehabilitation for Patients With Heart Failure: JACC Expert Panel

Biykem Bozkurt MD, PhD <sup>a</sup>, Gregg C. Fonarow MD <sup>b</sup>, Lee R. Goldberg MD, MPH <sup>c</sup>, Maya Guglin MD <sup>d</sup>, Richard A. Josephson MS, MD <sup>e</sup>, Daniel E. Forman MD <sup>f</sup>, Grace Lin MD <sup>g</sup>, JoAnn Lindenfeld MD <sup>h</sup>, Chris O'Connor MD <sup>i,j</sup>, Gurushер Panjwani MD <sup>k</sup>, Ileana L. Piña MD, MPH <sup>l,m</sup>, Tina Shah MD <sup>n</sup>, Shashank S. Sinha MD, MSc <sup>l,j</sup>, Eugene Wolfel MD <sup>o</sup>, ACC's Heart Failure and Transplant Section and Leadership Council





# L'ATTIVITÀ FISICA: UN «NUOVO FARMACO» NEL PAZIENTE SCOMPENSATO ANZIANO

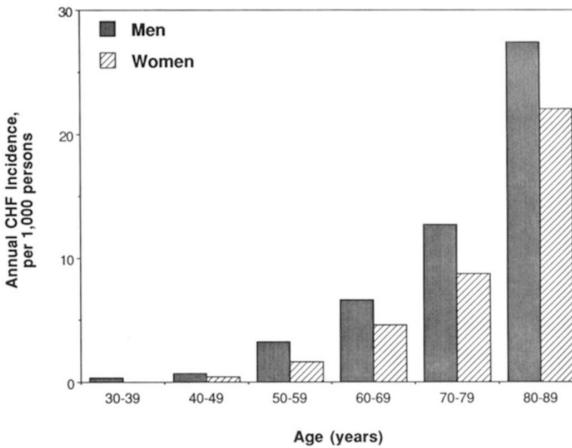
## SCOMPENSO CARDIACO: PREVALENZA PER ETÀ

Glob Heart. 2013 March 1; 8(1): 77–82. doi:10.1016/j.ghart.2012.12.006.

### The epidemiology of congestive heart failure: the Framingham Heart Study perspective

Syed S. Mahmood and Thomas J. Wang

Cardiology Division, Department of Medicine, Massachusetts General Hospital, Harvard Medical School, Boston MA

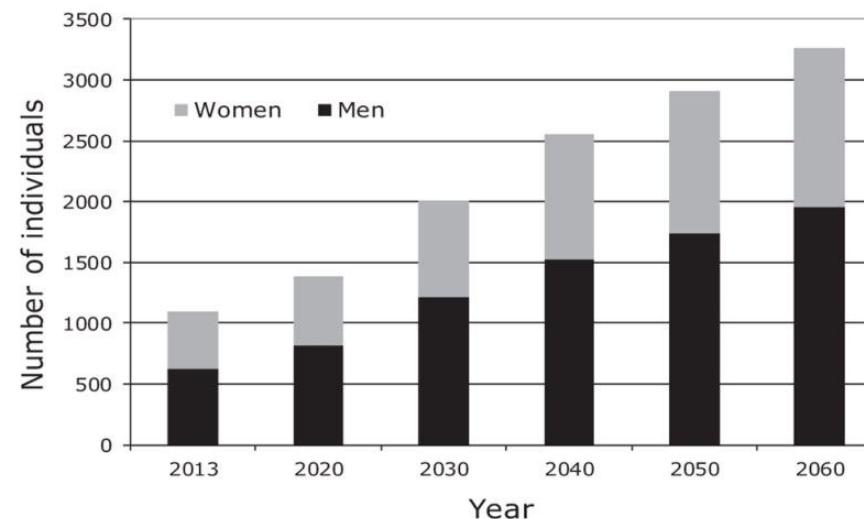


Scand Cardiovasc J. 2017 Aug; 51(4): 183–189.

Published online 2017 Apr 3.

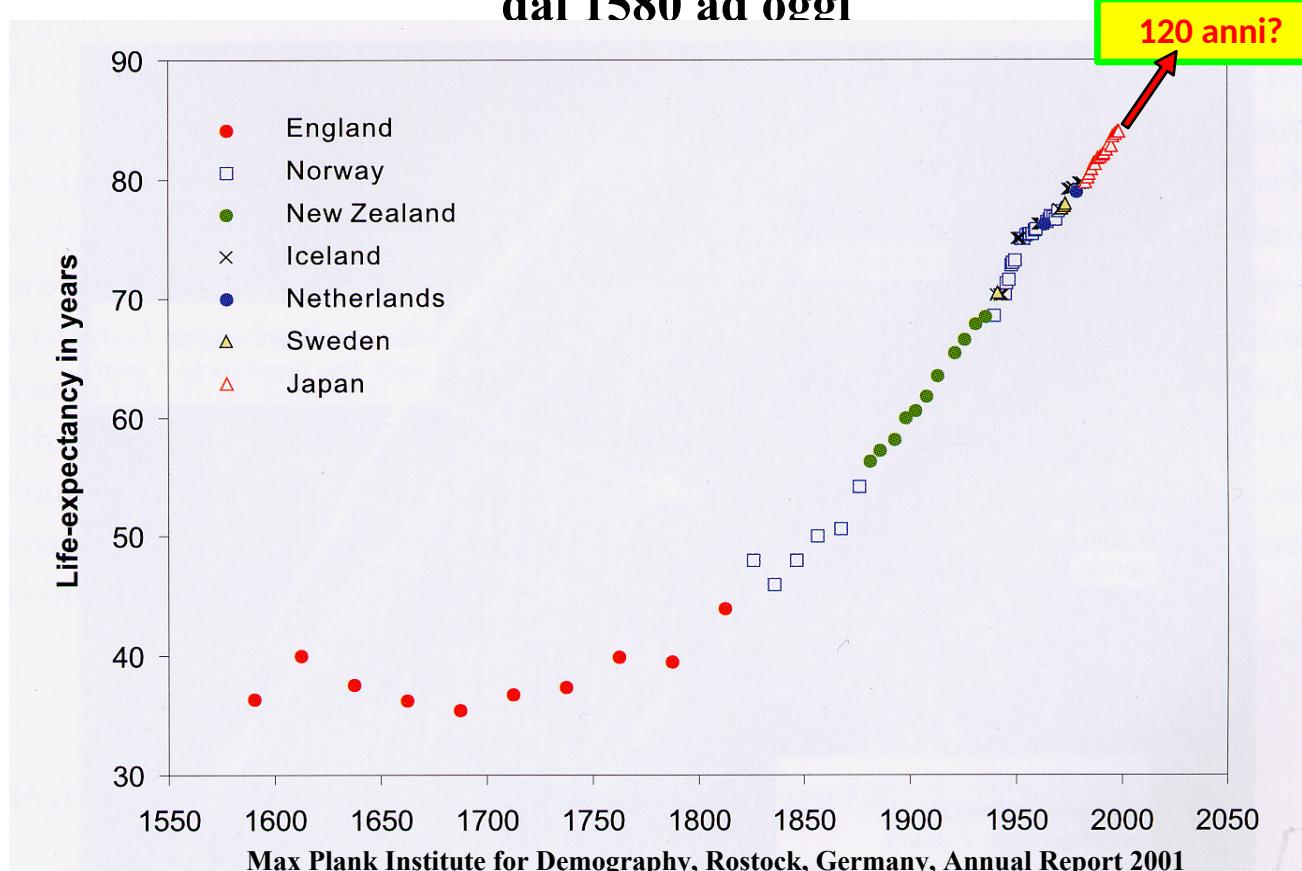
doi: [10.1080/14017431.2017.1311023]

### Prevalence of heart failure in the elderly and future projections: the AGES-Reykjavík study





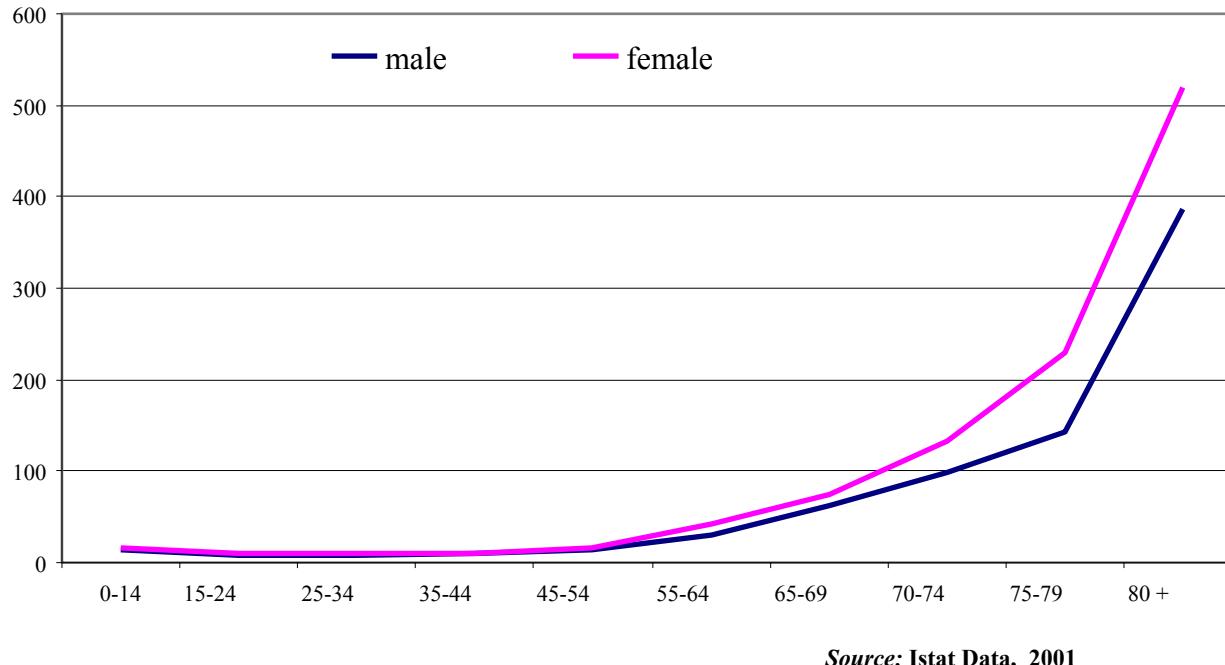
# Aspettativa di vita osservata per le donne, dal 1580 ad oggi





# Disability and Age

**Disabled persons by sex and age.  
based on 1.000 persons**



*Source: Istat Data, 2001*

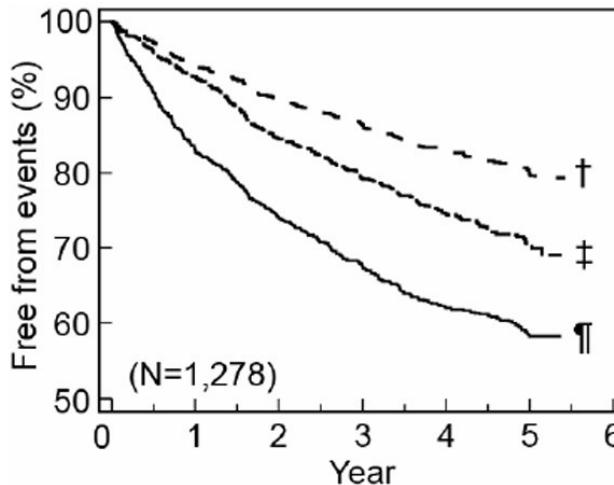


Vasc Health Risk Manag. 2008 Feb; 4(1): 103–113.

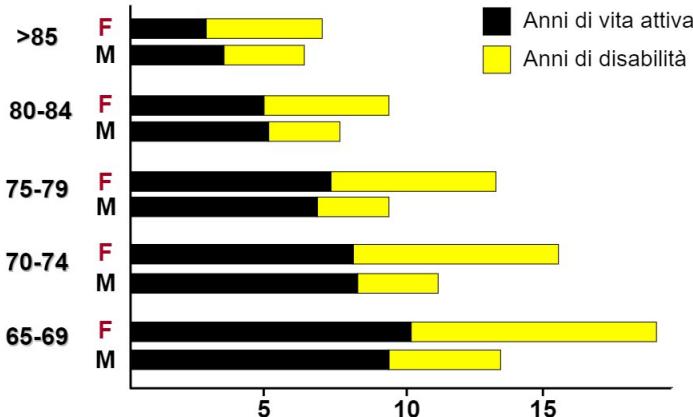
PMCID: PMC2464764

PMID: [18629369](#)

## Chronic heart failure in Japan: Implications of the CHART studies

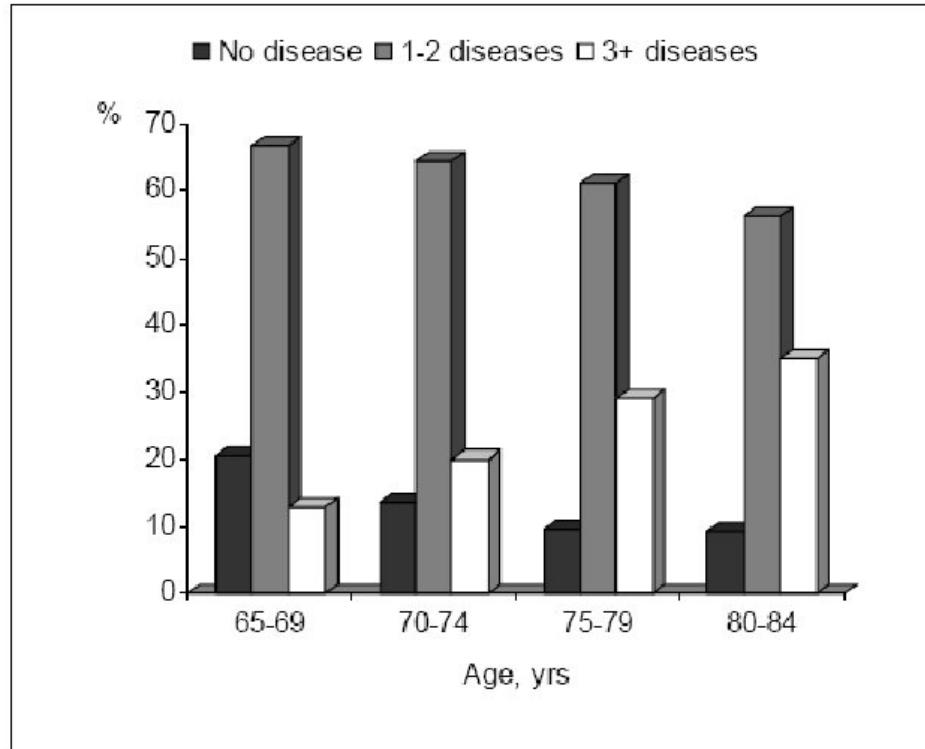


### Aspettativa di vita attiva e disabile





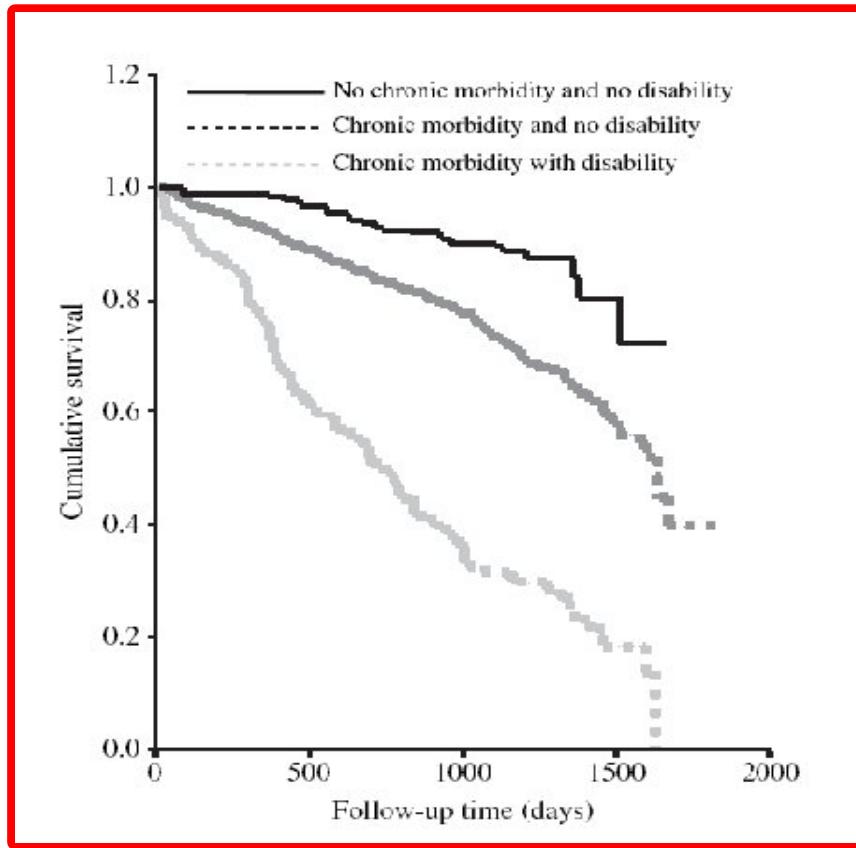
## Age specific prevalence of old persons affected by no disease, 1-2 diseases, and 3+ diseases *(Italian Longitudinal Study on Aging, 1996)*



Marengoni A., Karolinska  
Institutet, 2008



## Curve di sopravvivenza per soggetti affetti da un numero di malattie croniche con o senza altre infermità





# “Anziano Fragile”

**Soggetti di età avanzata, cronicamente affetti da patologie multiple, con stato di salute instabile, frequentemente disabili, in cui gli effetti dell'invecchiamento e delle malattie sono spesso complicati da problematiche di tipo socio-economico.**

**Rischio elevato di rapido deterioramento della salute e dello stato funzionale ed elevato consumo di risorse.**

**Nell'ambito delle patologie cardiovascolari la Fragilità modula gli effetti della cardiopatia sulla prognosi.**

Linee Guida della Società Italiana di Gerontologia e Geriatria sulla Valutazione Multidimensionale nell'anziano fragile ([www.sigg.it](http://www.sigg.it))



## Untangling the Concepts of Disability, Frailty, and Comorbidity: Implications for Improved Targeting and Care

### COMORBIDITA'

Presenza contemporanea di ≥2 malattie croniche o condizioni

### FRAGILITA'

Sindrome clinica caratterizzata da perdita di peso, fatica, bassa performance motoria, anomalie andatura ed equilibrio, deficit cognitivo

### DISABILITA'

Compromissione fisica o mentale che limita ≥1 attività della vita quotidiana

**Comorbilità, fragilità e disabilità condizionano l'intensità dell'approccio al paziente anziano, sia sul piano diagnostico che su quello terapeutico**

Fried LP et al. J Gerontol 2004



# COME FAR PRATICARE ATTIVITÀ FISICA AI PAZIENTI ANZIANI FRAGILI SCOMPENSATI?





## HHS Public Access

Author manuscript

*Clin Geriatr Med.* Author manuscript; available in PMC 2020 November 01.

Published in final edited form as:

*Clin Geriatr Med.* 2019 November ; 35(4): 517–526. doi:10.1016/j.cger.2019.07.008.



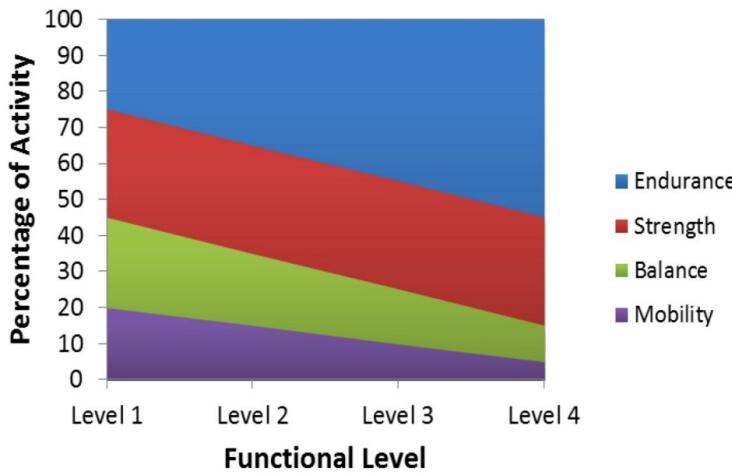
### **Cardiac Rehabilitation in Older Adults with Heart Failure: Fitting a Square Peg in a Round Hole**

- Post-hospitalization syndrome
- Rapid muscle loss and debility related to hospitalization, immobility and acute illness likely contribute this syndrome
- Intolerance of conventional CR strategies
- Multimorbidity
- Polypharmacy
- Cognitive impairment
- Depression
- Social and Financial Resources



## Rehabilitation Therapy in Older Acute Heart Failure Patients (REHAB-HF) Trial: Design and Rationale

**Hypothesis**—Targeting physical frailty with a multi-domain structured physical rehabilitation intervention will improve physical function and reduce adverse outcomes among older patients experiencing a HF hospitalization.



Performance Levels for Strength, Balance, Mobility and Endurance

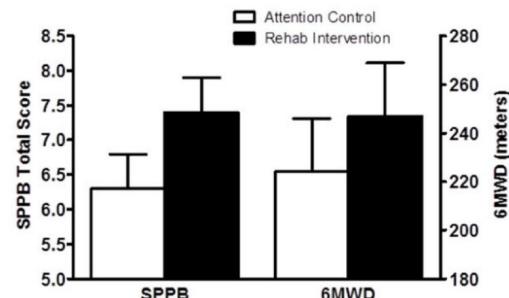
	Level 1	Level 2	Level 3	Level 4
<b>Strength:</b> Rise from chair without hand support	unable	at least once	5 times in > 15 but < 60 seconds	5 times in ≤ 15 seconds
<b>Balance:</b> Standing	unable with feet together for 10 seconds	with feet together for 10 seconds	unsupported and reach forward 10 inches	on 1 leg for 10 seconds
<b>Endurance:</b> Continuous walking	< 2 minutes	≥ 2 but < 10 minutes	≥ 10 but < 20 minutes	≥ 20 minutes
<b>Mobility:</b> Gait speed	≤ 0.4 m/s	> 0.4 but ≤ 0.6 m/s	> 0.6 but ≤ 0.8 m/s	> 0.8 m/s

Figure 1.

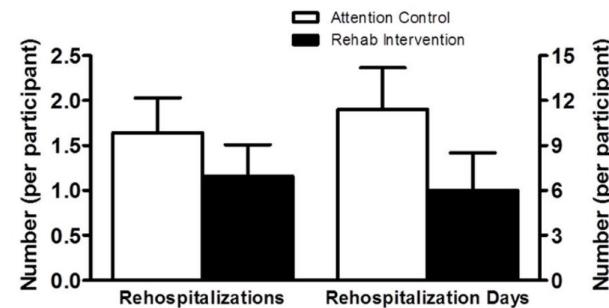
Approximate percent of exercise time in each physical function domain based on functional level.



## A Novel Rehabilitation Intervention for Older Patients with Acute Decompensated Heart Failure: The REHAB-HF Pilot Study



**Figure 1.**  
 Comparison of the Short Physical Performance Battery (SPPB) and 6-Minute Walk distance (6MWD). At three months following hospital discharge the intervention effect size was +1.1 units for the SPPB score ( $7.4 \pm 0.5$  vs  $6.3 \pm 0.5$  units) and +23 meters for the 6MWD ( $247 \pm 22$  vs  $224 \pm 22$  meters). Comparisons made with analysis of covariance, with the 3-month value as the outcome and the baseline value as the covariate.



**Figure 2.**  
 Comparison of 6-month all-cause rehospitalizations and rehospitalization days. The 6-month all-cause rehospitalization rate was 29% lower in the intervention group ( $1.16 \pm 0.35$  vs  $1.64 \pm 0.39$ ), yielding an effect size = -0.48 hospitalizations. The number of 6-month all-cause rehospitalization days were 47% lower per participant ( $6.0 \pm 2.5$  vs  $11.4 \pm 2.8$ ), yielding an effect size of -5.4 days. Rehospitalization outcomes were tracked and analyzed for all 27 participants (Rehab n=15; Control n=12). Comparisons made with analysis of covariance with HF category (ejection fraction <45% or >45%) and baseline SPPB score as covariates.



Età media 83 anni

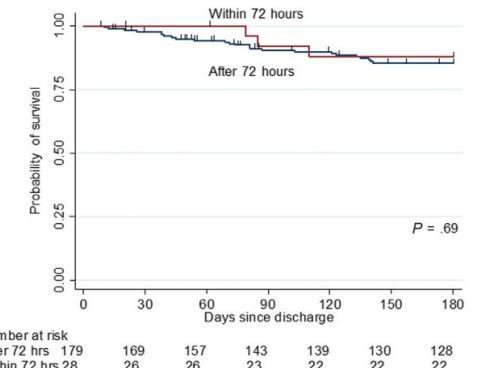
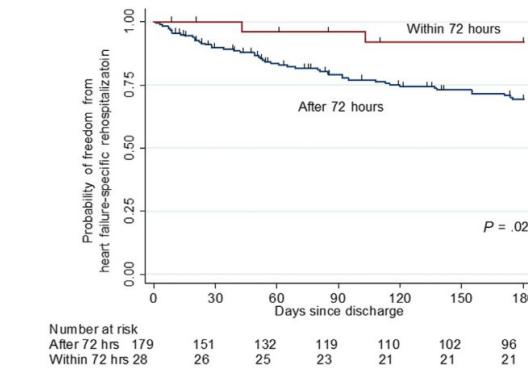
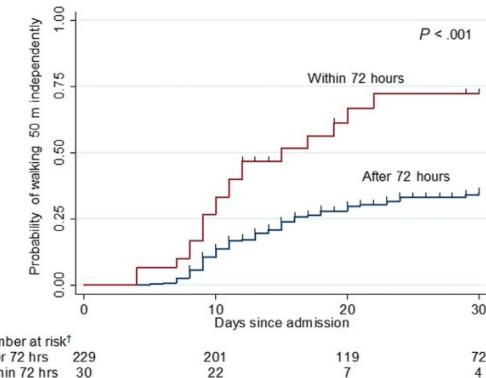
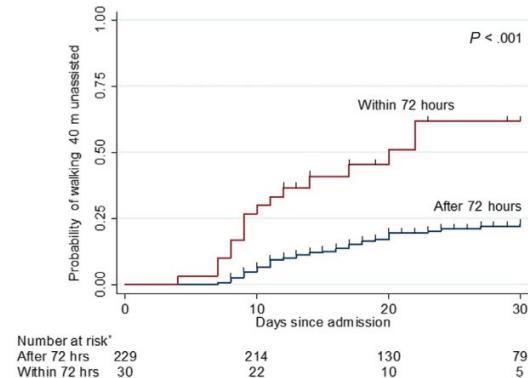
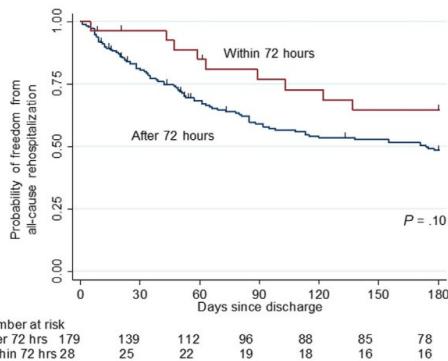


American Heart Journal  
Volume 230, December 2020, Pages 44-53



Clinical Investigation

## Early rehabilitation in older patients hospitalized with acute decompensated heart failure: A retrospective cohort study





[www.impactaging.com](http://www.impactaging.com)

AGING, March 2016, Vol 8 No 3

Research Paper

## Exercise: a “new drug” for elderly patients with chronic heart failure

Roberto Antonicelli<sup>1\*</sup>, Liana Spazzafumo<sup>2\*</sup>, Simonetta Scalvini<sup>3\*</sup>, Fabiola Olivieri<sup>4,5</sup>, Maria Vittoria Matassini<sup>6</sup>, Gianfranco Parati<sup>7,8</sup>, Donatella Del Sindaco<sup>9</sup>, Raffaella Gallo<sup>10</sup>, and Fabrizia Lattanzio<sup>11</sup>

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<sup>11</sup>*Scientific Direction, INRCA-IRCCS National Institute, Ancona, Italy*

\*These authors equally contributed to this work

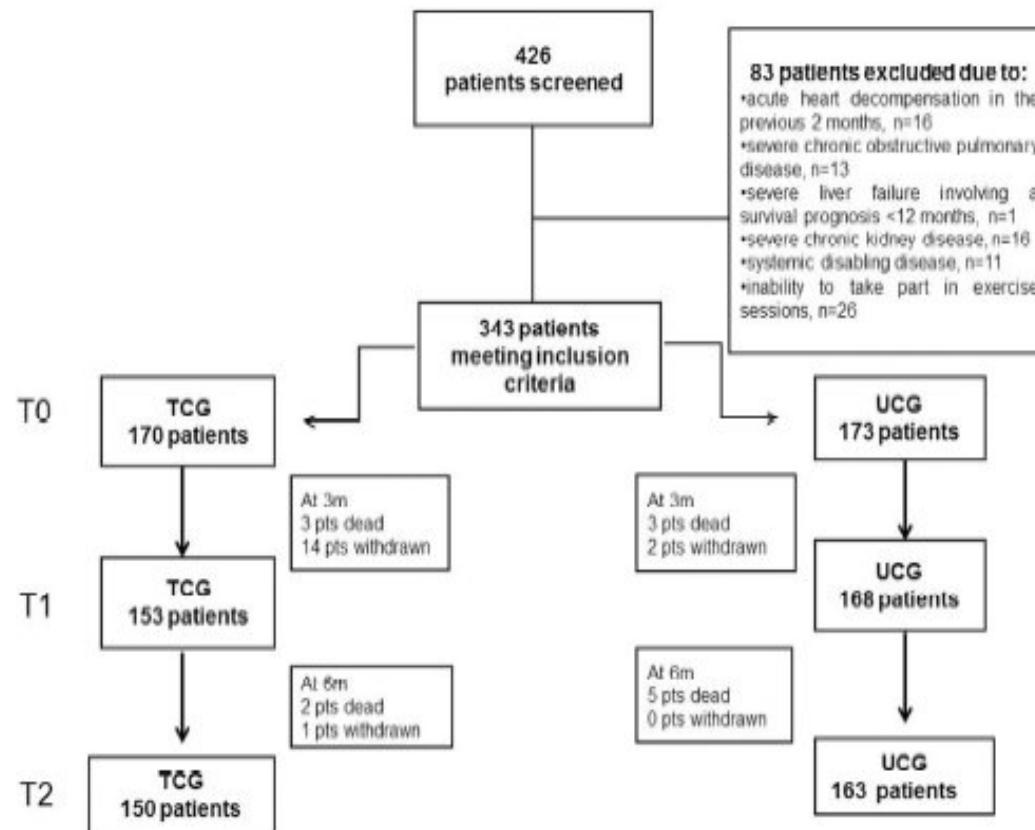


Figure 1. The flow of the 426 consecutive CHF patients enrolled for the study. TCG=training care group; UCG=usual care group.

**Table 1. Baseline demographic and clinical characteristics of the groups studied**

	TCG (n=170)	UCG (n=173)	Total (n=343)	P value
<b>Age years, mean±SD</b>	76.21±5.21	77.60±6.02	76.90±5.67	0.145
<b>Males, n (%)</b>	103 (60.6%)	92 (53.2%)	195 (56.9%)	0.166
<b>BMI, kg/m<sup>2</sup></b>	26.6±4.4	25.1±5.5	26.8±4.6	0.031
<b>Systolic arterial pressure, mmHg</b>	127.1±15.6	124.9±16.2	126.0±16.0	0.423
<b>Diastolic arterial pressure, mmHg</b>	71.2±9.4	73.6±11.2	72.3±10.3	0.168
<b>6MWT, metres</b>	299±120	270±120	285±121	0.153
<b>LVEF, %</b>	47.9±13.3	49.0±13.4	48.4±13.4	0.166
<b>MLHFQ, score</b>	42.0±14.9	46.8±16.8	44.3±16.0	0.074
<b>NT-proBNP, pg/ml</b>	1236 (2038) <sup>§</sup>	618 (520) <sup>§</sup>	806 (820) <sup>§</sup>	0.110*
<b>Informal support services</b>	170 (100%)	156 (90%)	326 (95%)	<0.001

\*Variable was log transformed, § median (interval).

BMI: body mass index, calculated as weight in kilograms divided by the square of the height in metres ( $\text{kg}/\text{m}^2$ ); LVEF: Left ventricular ejection fraction; 6MWT: Six Minute Walk Test; MLHFQ: Minnesota Living with Heart Failure Questionnaire; NT-proBNP: N-terminal portion of brain-type natriuretic peptide. TCG=training care group; UCG=usual care group. Informal support services: child or child-in-law, other relative, spouse or partner, and friend/neighbour.



Table 2. 6MWT distance in TCG and UCG patients

	TCG	UCG	P value*
6MWT (metres)			
T0	299±120	270±120	
T1	380.7±120.3	300.6±125.7	<0.001
T2	394.1±123.6	301.2±125.8	

\*ANOVA for repeated measures. T0: baseline; T1: 3-month follow-up; T2: 6-month follow-up; 6MWT: Six Minute Walk Test; MLHFQ: Minnesota Living with Heart Failure questionnaire; NT-proBNP: N-terminal portion of brain-type natriuretic peptide. TCG=training care group; UCG=usual care group. Continuous data are expressed as mean ± SD and categorical data as number and percentage.



Table 3a. Effect of exercise on hospitalization (Cox model)

	TCG (n=150)	UCG (n=163)	P	HR (95%CI)
All-causes hospitalizations	25 (15.2%)	60 (36.8%)	<0.001	2.91 (1.70-4.97)

TCG=training care group; UCG=usual care group.

Table 3b. Effect of exercise on hospitalization, adjusted for clinical covariates

	B	HR	95%CI	P value
UCG vs. TCG	0.583	1.792	1.048-3.065	0.033
Age	-0.017	0.983	0.932-1.036	0.524
Gender	0.129	1.138	0.652-1.985	0.650
ADL	-0.003	0.997	0.934-1.063	0.917
IADL	0.023	1.023	0.965-1.084	0.446
BMI	-0.061	0.941	0.888-0.996	0.037
6MWT	-0.002	0.998	0.996-0.999	0.044
MLHFQ	0.004	1.004	0.989-1.018	0.630

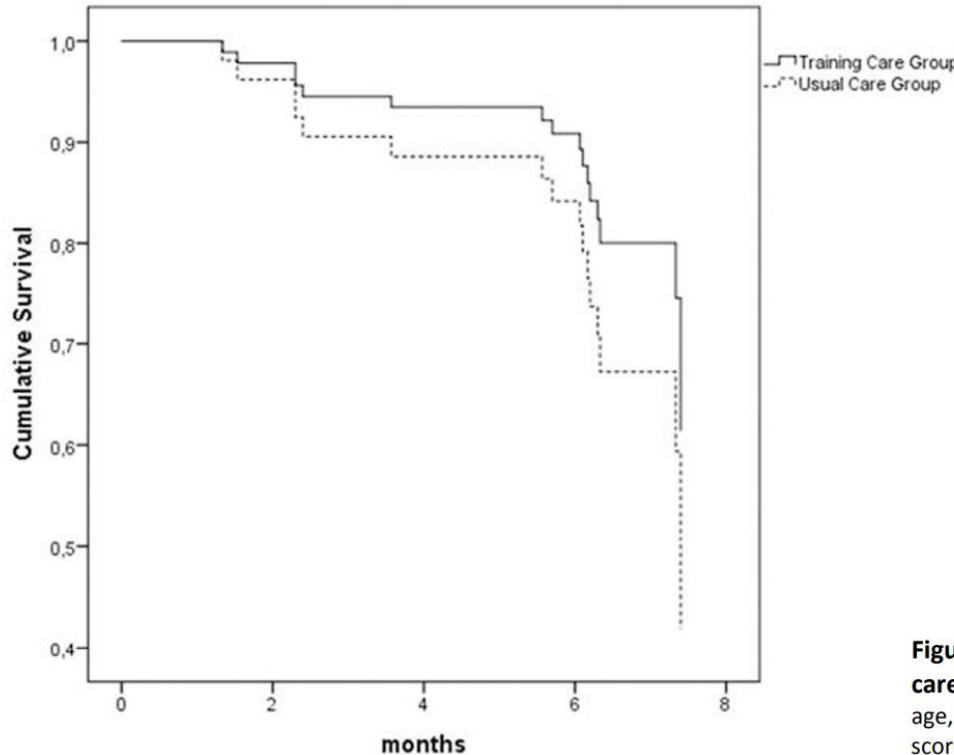
B= beta coefficient. BMI=body mass index; ADL=activities of daily living. IADL=Instrumental activities of daily living. 6MWT=6 Minute Walk Test; MLHFQ=Minnesota Living with the Heart Failure Questionnaire. HR=hazard ratio. TCG=training care group; UCG=usual care group.



**Table 4. Change in secondary endpoints (MLHFQ and NT-proBNP) at 3 months and 6 months in the two groups**

	TCG	UCG	P value*
<b>MLHFQ</b>			
T0	42.0±14.9	46.8±16.8	<0.001
T1	29.9±9.8	34.7±9.3	
T2	28.6±12.3	44.5±12.3	
<b>NT-proBNP- pg/ml</b>			
T0	1236 (2038) <sup>§</sup>	618 (520) <sup>§</sup>	<0.001
T1	350 (137)	290 (241)	
T2	440 (208)	2143 (1638)	

\*ANOVA for repeated measures. T0: baseline; T1: 3-month follow-up; T2: 6-month follow-up; MLHFQ: Minnesota Living with Heart Failure Questionnaire; NT-proBNP: N-terminal portion of brain-type natriuretic peptide. TCG=training care group; UCG=usual care group.



**Figure 2a. Effect of exercise training and usual care on rehospitalization.** Cox model adjusted for age, gender, BMI, 6MWT distance, ADL, IADL, and QoL score. TCG=training care group; UCG=usual care group.



La vita è come andare in bicicletta.  
Per mantenere l'equilibrio devi muoverti.

Albert

Einstein