XI Reunión. Estado del Arte en
INSUFICIENCIA CARDIACA
PRÁCTICA CLÍNICA Y MODELOS ORGANIZATIVOS
Sede: Hotel Meliá MaríaPita, A Coruña
A CORUÑA 27-28 SEPTIEMBRE 2024

XI Meeting. State of the Art in
HEART FAILURE
CLINICAL PRACTICE AND ORGANIZATIONAL MODELS
Venue: Hotel Meliá MaríaPita, A Coruña
ACoruñaHF2024
A CORUÑA 27-28 SEPTEMBER 2024

Usefulness of devices for remote monitoring of heart failure

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CIBER-CV

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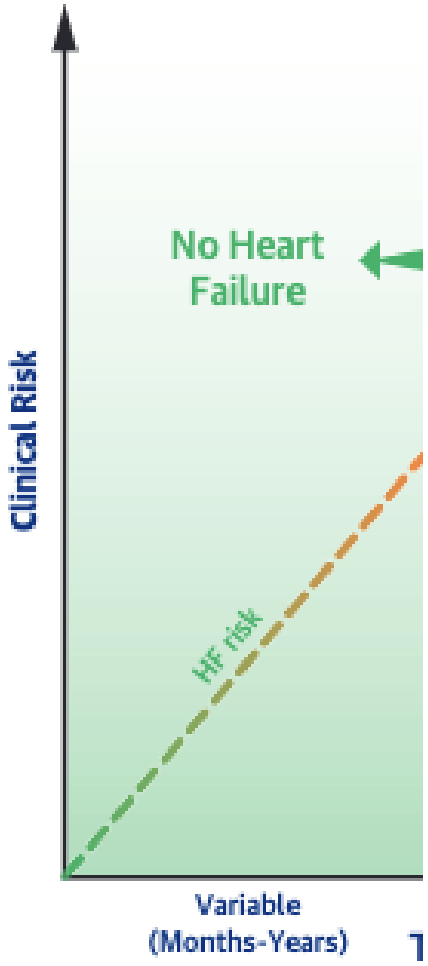
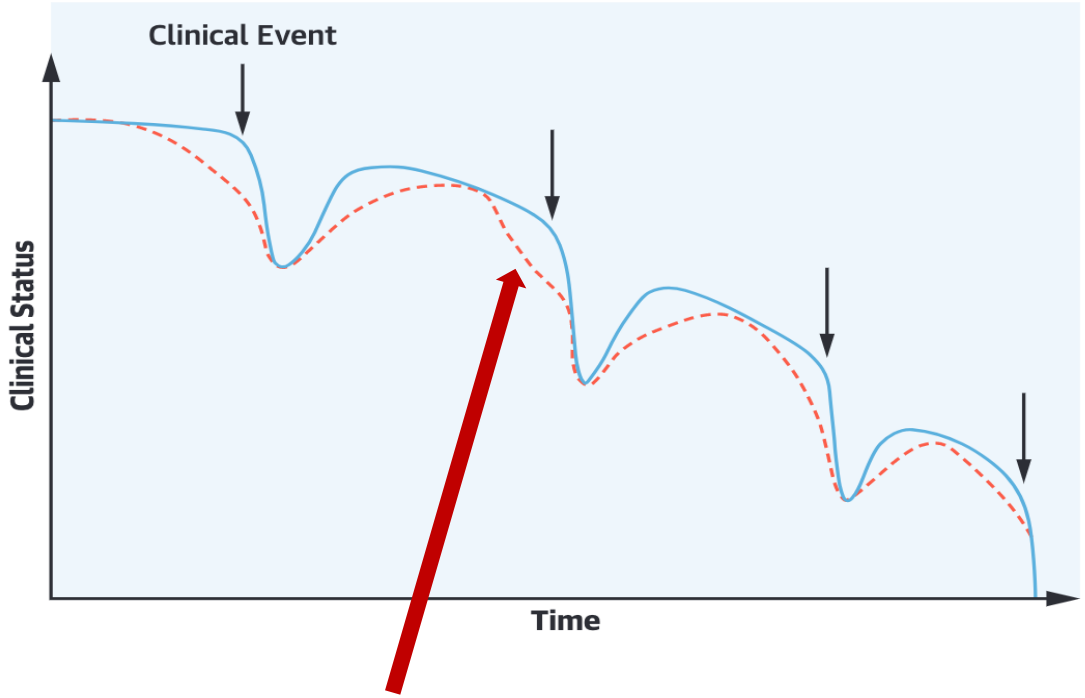
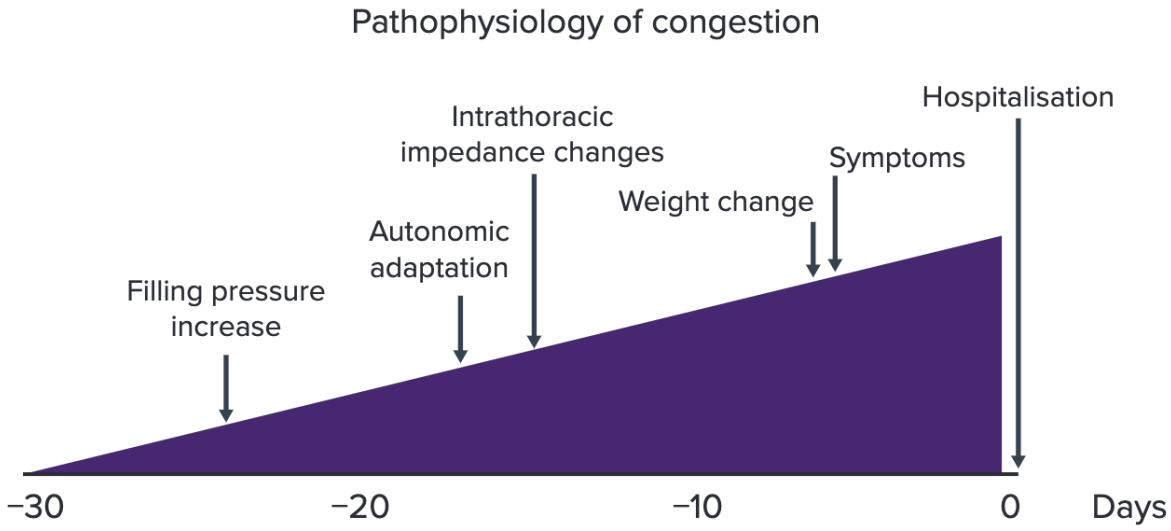
Worsening Heart Failure (WHF)



Greene SJ. JACC 2023;81(4):413–24.

Worsening Heart Failure (WHF)



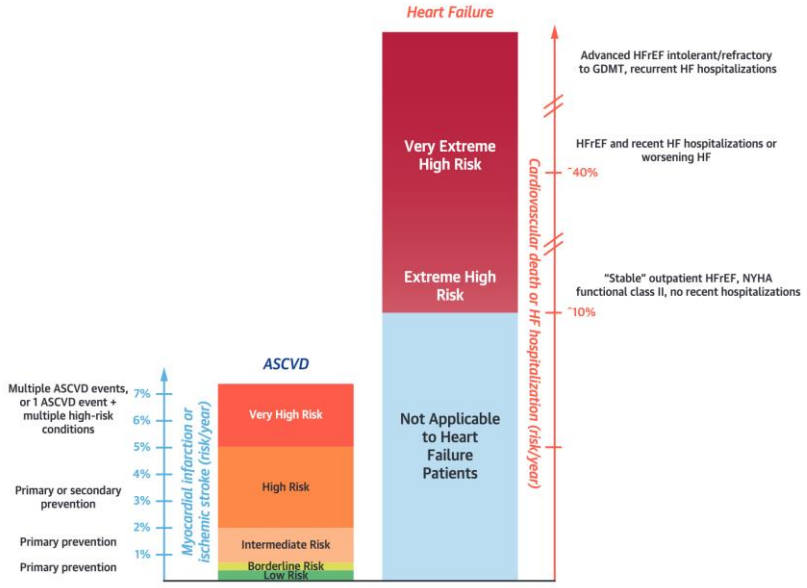


Subclinical deterioration prior to HF event

López-Azor JC. Card Fail Rev. 2022;8:e13. Published 2022 Apr 21
Adamson PB. Curr Heart Fail Rep 2009;6:287–92
Gheorghiade M. Am J Cardiol. 2005;96:11G-17G

Implications of WHF

- Associated with worse prognosis and progressive multiorgan deterioration.
- More than 1 million admissions for HF in the USA and Europe per year.
- Readmissions up to 24% in the first month and 50% after 6 months.
- One out of every 6 patients admitted for HF dies within 30 days of hospitalization.



Ejection fraction	Intrahospital mortality	1 year mortality	HF readmission	Readmission for any cause
Reduced	3,4%	22 100 patients-year	29 100 patients-year	48 100 patients-year
Mildly reduced	2,1%	17 100 patients-year	19 100 patients-year	35 100 patients-year
Preserved	2,2%	17 100 patients-year	17 100 patients-year	42 100 patients-year

Kaplon-Cieslicka A. Eur J Heart Fail. 2022;24(2):335-50
Metra, M. Eur J Heart Fail 2023. Jun;25(6):776-791
Greene SJ. JACC 2023;81(4):413–24

Remote monitoring in HF

- Great promise in the management of HF patients, alerting to **subclinical changes** that allow intervention before decompensation.
- Great development during the pandemic. Avoids barriers to access to the healthcare system.
- Special interest comes from:
  - Impact of decompensation on prognosis.
  - Interventions that sought to reduce readmissions (e.g., early post-discharge reviews) proved effective.

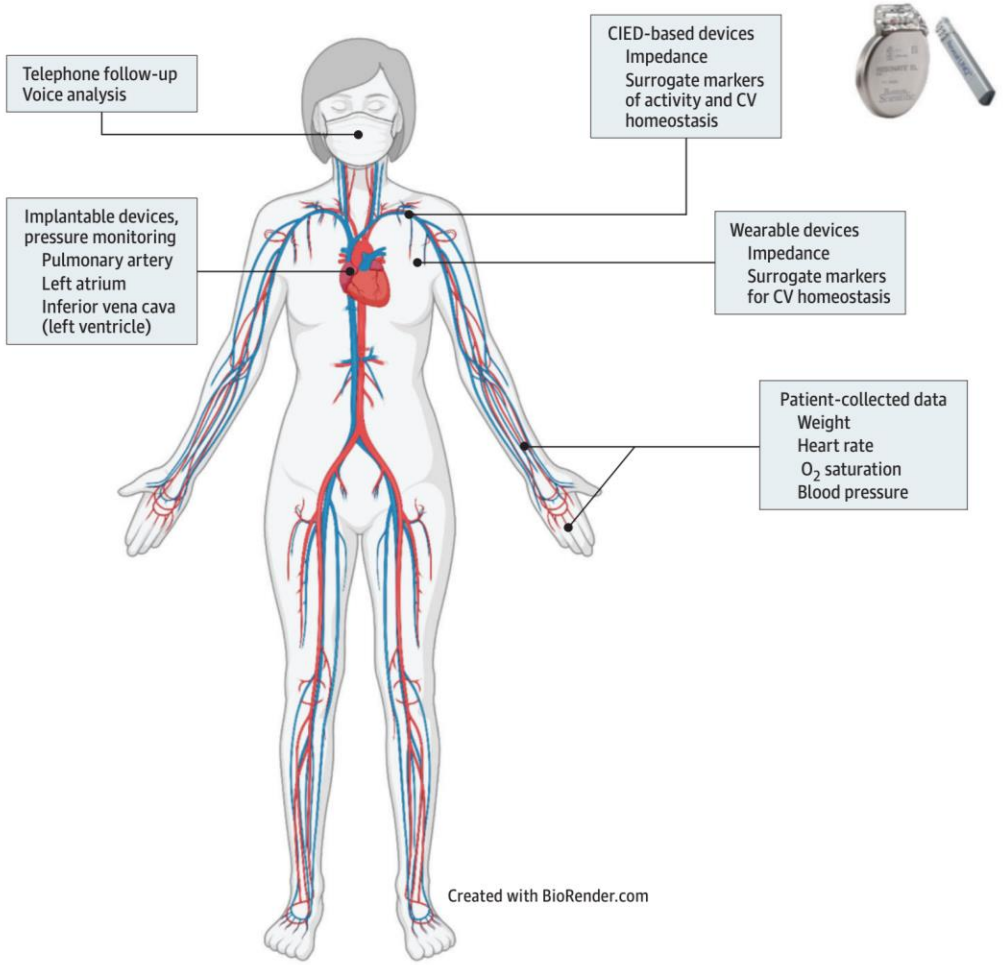
Remote monitoring in HF

Telephone

Implanted devices
(ICD, CRT)

Implantable devices
(invasive)

"Wearables"



Kennel PJ. JAMA Cardiol. 2022;7(5):556-564

Telephone and electronic consults

- Collects patient data via phone call or digital platforms.
- Adapted in most centers: easy, low cost, convenient for the patient.
- "Digital barrier"
- Conflicting evidence.
- Fundamental role of the HF nurse.
- Teleconsultation (e-consultation) has demonstrated:
  - Speed of care.
  - Ability to resolve a relevant number of consultations in a non-face-to-face manner.

Chaudry SI. N Engl J Med 2010; 363:2301-2309
Mazón-Ramos P. ESC Heart Fail. 2022;9(6):4150–9
Comín-Colet J. J Telemed Telecare. 2016;22(5):282-295

Telephone and electronic consults

TIM-HF2

- >2000 patients. Multicentric, randomized
- Better patient selection than TIM-HF
- Daily clinical data and questionaire
- Multidisciplinary approach

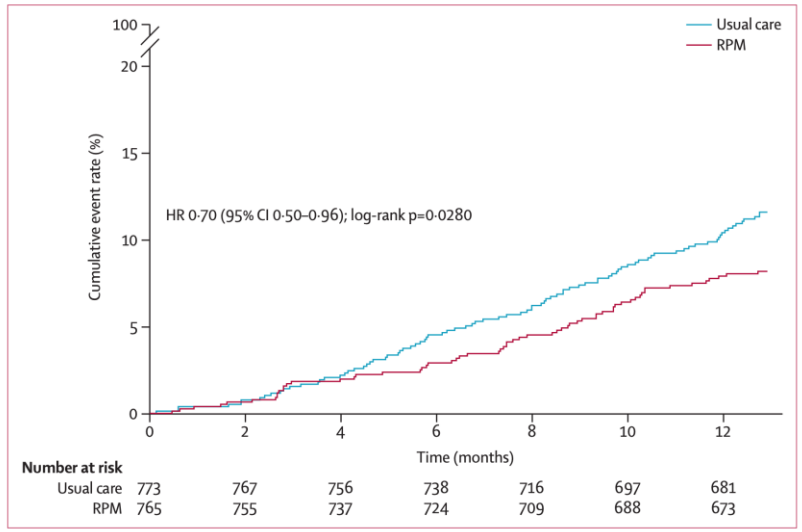
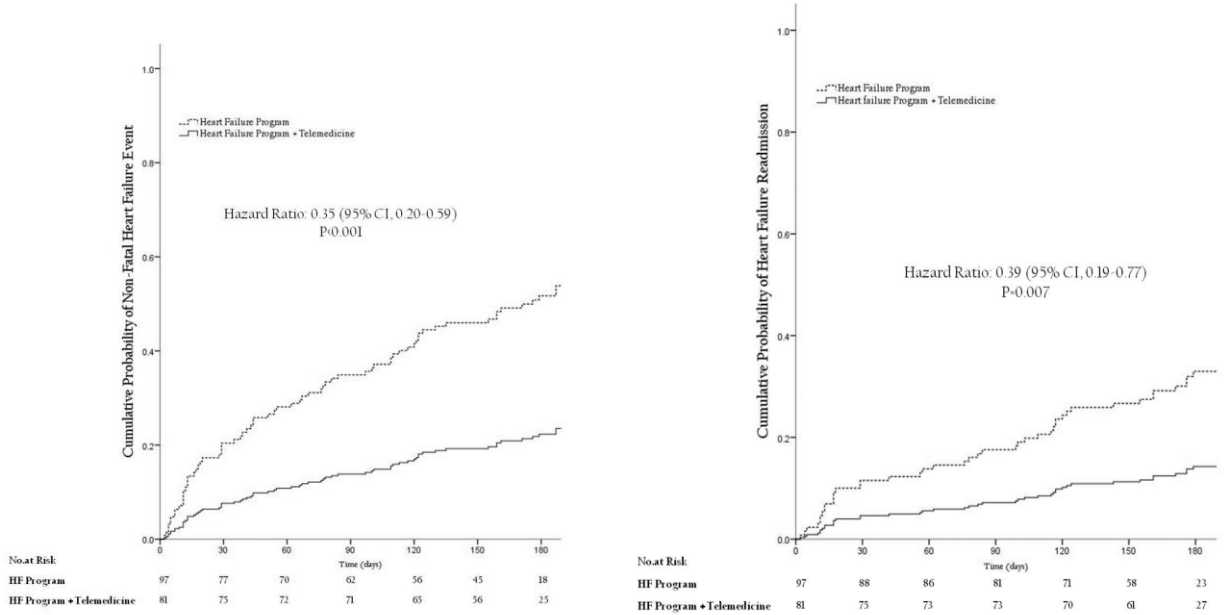


Figure 2: **Kaplan-Meier cumulative event curve for all-cause death**
HR=hazard ratio. RPM=remote patient management.

Reduction in admission days and all cause mortality

iCOR

- 188 patients. Unicentric and randomized
- High risk patients
- Nurse control, they could modify treatment
- Multidisciplinary approach



Koehler F. Lancet. 2018;392(10152):1047-1057
Comín-Colet J. J Telemed Telecare. 2016;22(5):282-295

Wearables

- Large number of devices under development
- Main methods used:
  - Pulmonary congestion measurements.
  - Integrate vital signs and activity measures
- Little scientific evidence.
- Major findings in reduction of heart failure hospitalization.
- No FDA approval.

Shochat MK. J Card Fail. 2016;22(9):713-722
Kennel PJ JAMA Cardiol 2022;7(5):556-564
Lala A. ESC Heart Fail. 2021;8(2):1047-1054

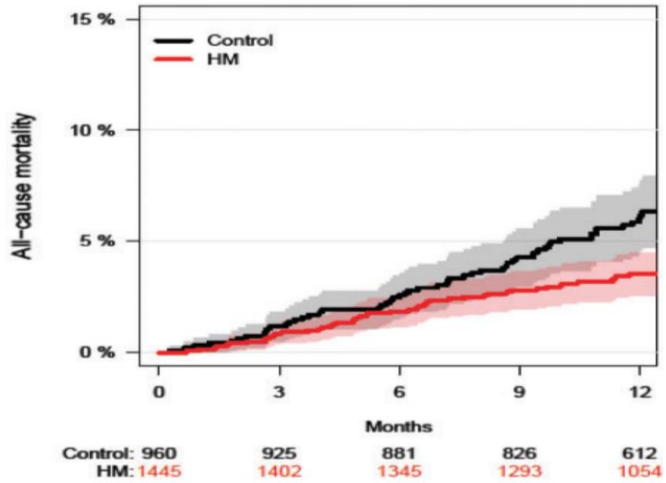
Cardiac implantable electronic devices (CIED) based monitoring

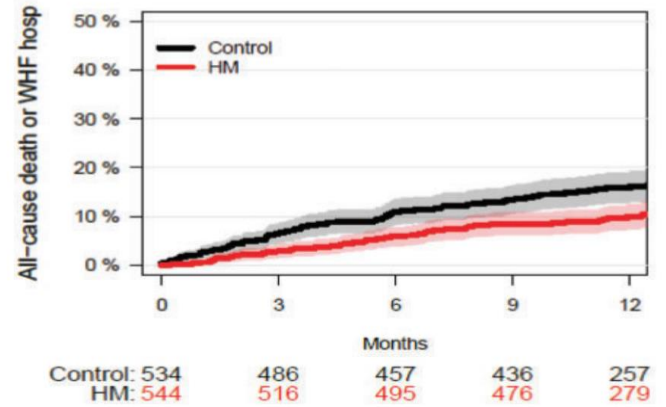
- Increasing number of intracavitary devices.
- Possibility of remote monitoring
- Modification of care and treatment based on findings.

Table I **Included trials**

	TRUST[3]	ECOST[5]	IN-TIME[12]
No. of centres	102 USA sites	43 French sites	26 German sites, 10 sites elsewhere[a]
Patient eligibility	Class1 indication for ICD, not pacemaker dependent	Indication for ICD, not NYHA class IV	Indication for ICD or CRT-D, heart failure (≥ 3 months), NYHA class II or III, LVEF ≤ 35%
Primary objective	To evaluate safety and efficacy of extended IO intervals	To compare major CVAEs including all-cause death	To compare heart failure outcomes using composite ("Packer") score[b]
Follow-up schedule			
HM group	IO at 3M and 15M. HM replaced IO at 6M, 9M, and 12M	IO at 1-3M, 15M, and 27M. HM replaced IO at 9M and 21M	IO at 12M, and in-between according to hospital routine
Control group	IO every 3M	IO at 1-3M, then every 6M	Same as in the HM group
Blinded endpoint committee	No	Yes	Yes

[a]Denmark (three sites), Czech Republic (two), Israel (two), Australia (one), Austria (one), Latvia (one).
[b]The score combines all-cause death, overnight hospitalization for heart failure, change in NYHA class, and change in patient global self-assessment.
CRT-D, cardiac resynchronization therapy defibrillator; CVAE, cardiovascular adverse event; ECOST, Effectiveness and cost of ICDs follow-up schedule with telecardiology; HM, Home Monitoring; ICD, implantable cardioverter-defibrillator; IN-TIME, Influence of HM on mortality and morbidity in heart failure patients with impaired left ventricular function; IO, in-office visit; LVEF, left ventricular ejection fraction; M, months; NYHA, New York Heart Association; TRUST, Lumos-T safely reduces routine office device follow-up.





Kennel PJ JAMA Cardiol 2022;7(5):556-564
Hindricks G. Lancet 2014;384:583–590
Hindricks G. Eur Heart J. 2017;38(22):1749-1755

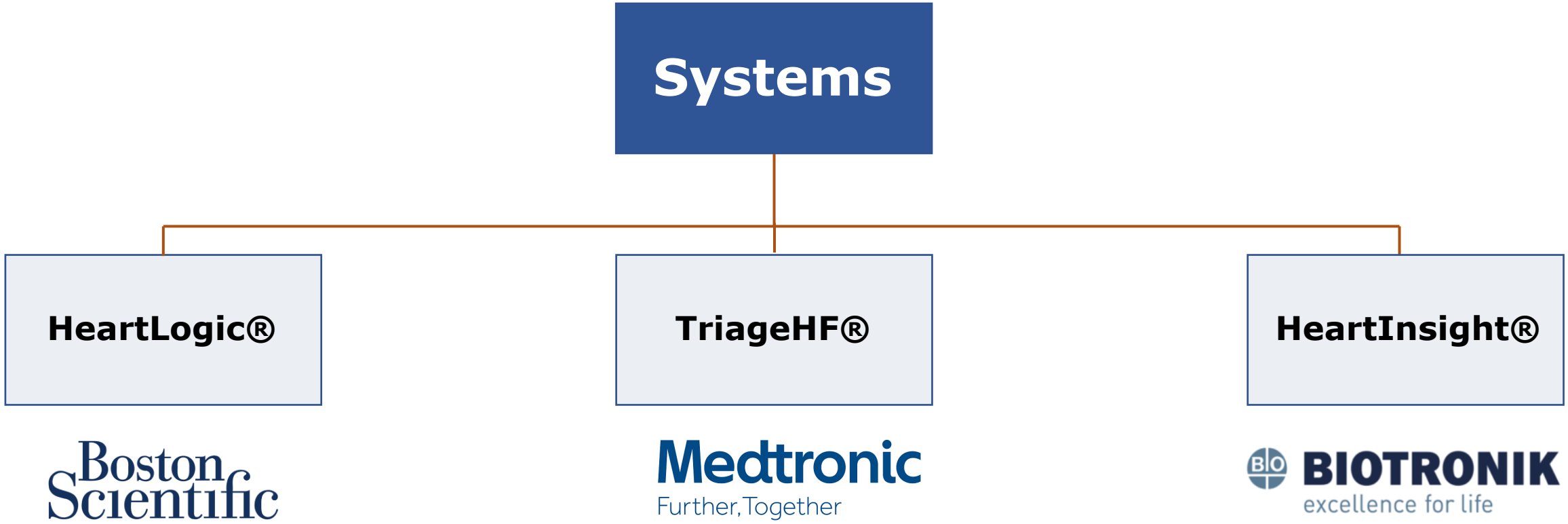
Cardiac implantable electronic devices (CIED) based monitoring

HF

- Development of algorithms for the detection of heart failure decompensation.
- Need for ICD and/or CRT
- Each commercial company develops its own algorithms
- Evidence in favor of improved patient prognosis

Kennel PJ JAMA Cardiol 2022;7(5):556-564
Hindricks G. Lancet 2014;384:583–590
Hindricks G. Eur Heart J. 2017;38(22):1749-1755

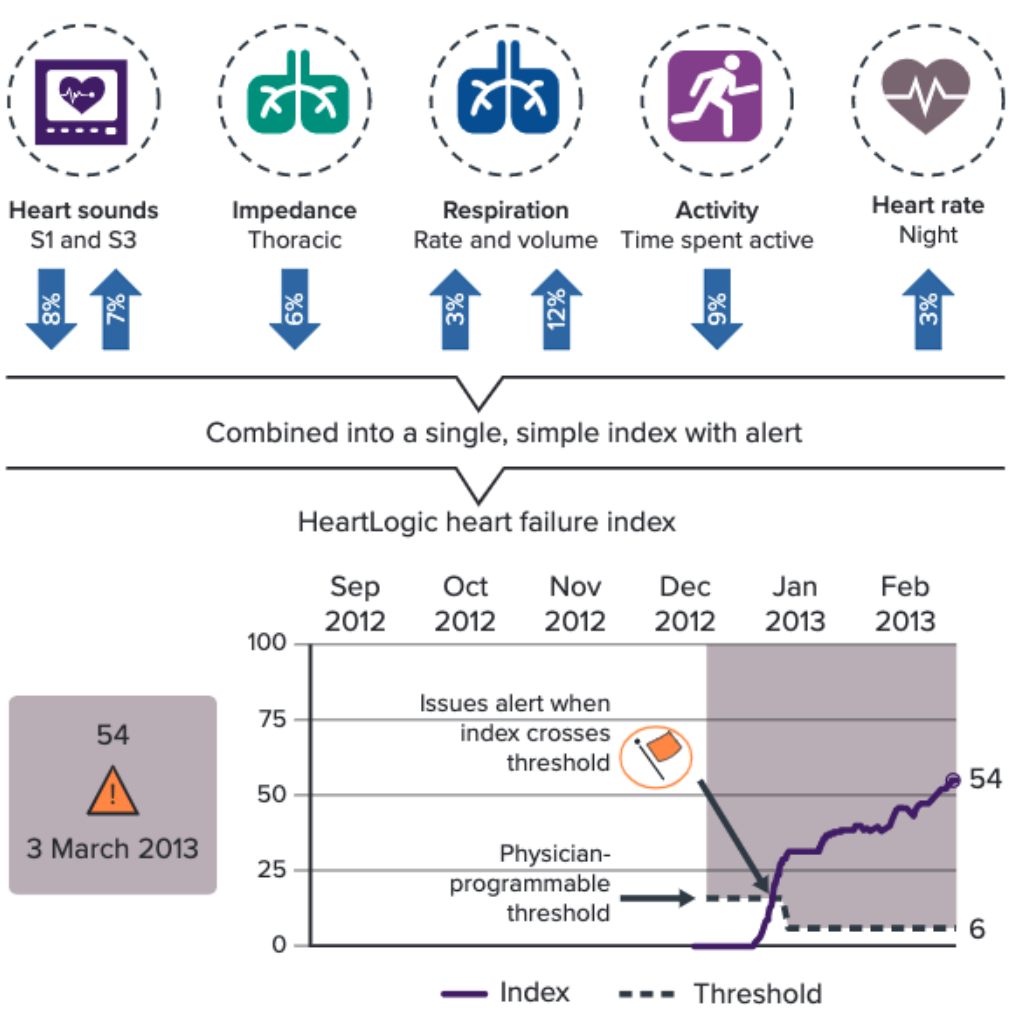
Cardiac implantable electronic devices (CIED) based monitoring



Kennel PJ JAMA Cardiol 2022;7(5):556-564

HeartLogic

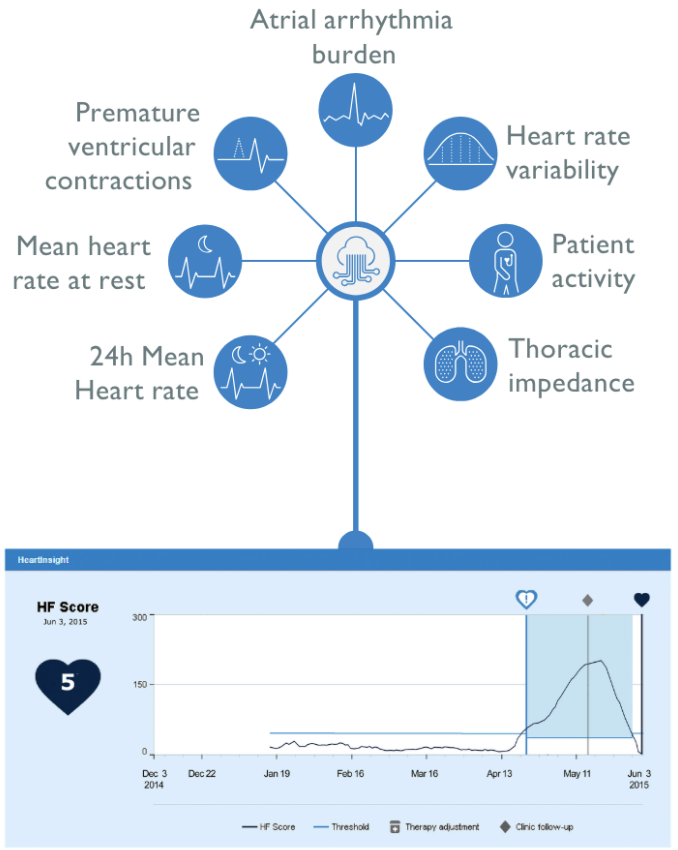
- Multiparametric algorithm that helps stratify the risk of heart failure decompensation.
- It is a patient-specific index. The baseline value is calculated over 3 months.
- An increase in this index indicates HF decompensation.
- The usual value is 16 (can be adjusted individually).



Boehmer JP. JACC Heart Fail 2017;5:216–25
López-Azor JC. Cardiac Failure Review 2022;8

HeartInsight

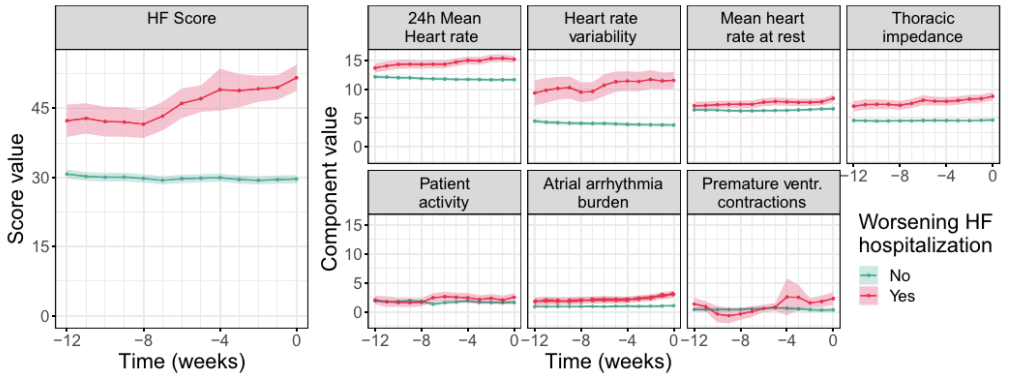
HeartInsight Heart Failure (HF) Score



Meta-analysis

- 9 trials
- 369 worsening HF hospitalizations
- 2,050 patients with ICD/CRT-D
- 3,939 cumulative follow up years

HF Score and components significantly increased before worsening HF hospitalizations:



The score components showed different behavior and contribution, reflecting different mechanisms or stages in the decompensation process. Trends of the HF Score may serve as a quantitative estimate of HF condition and evolution prior to worsening HF hospitalization.

Botto GL et al. Europace. 2024 Feb 1;26(2):euae032

TriageHF

Multiparametric algorithm

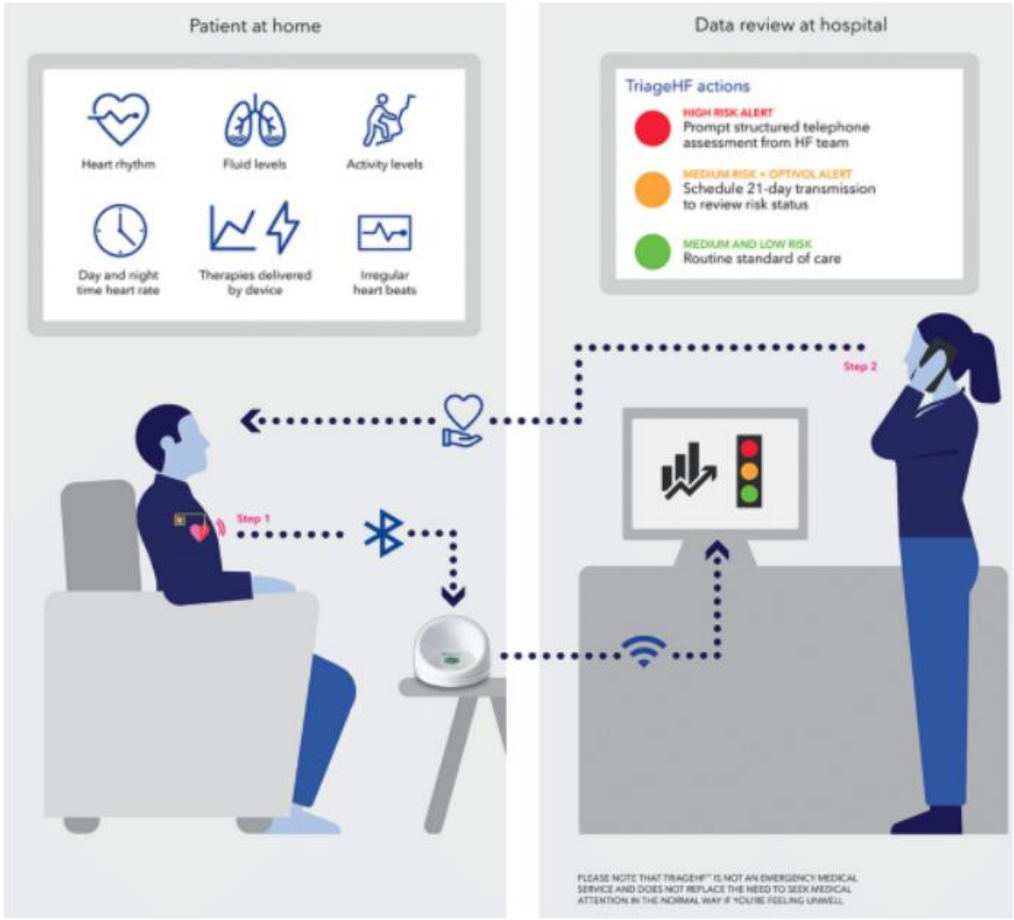
Rythm

Arrythmia

Device use

Congestion indexes

Patient activity



TriageHF

Fluid Index

Intra-thoracic Impedance

Heart Rate Variability

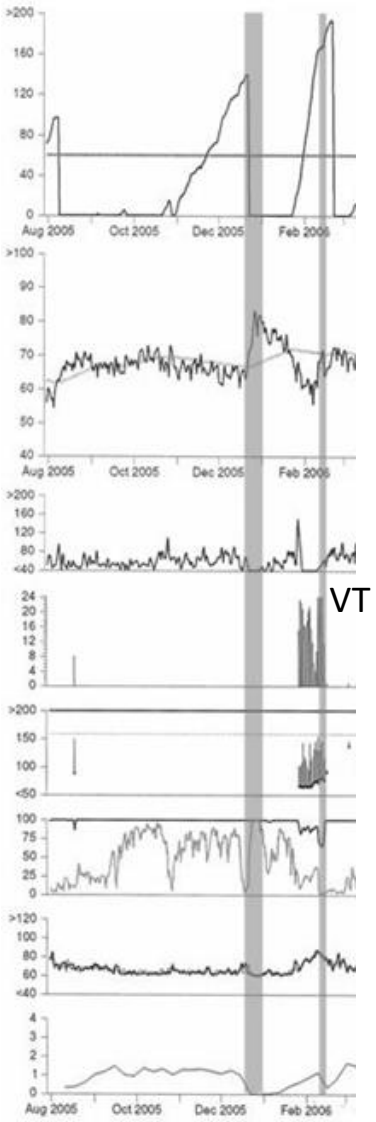
AF burden

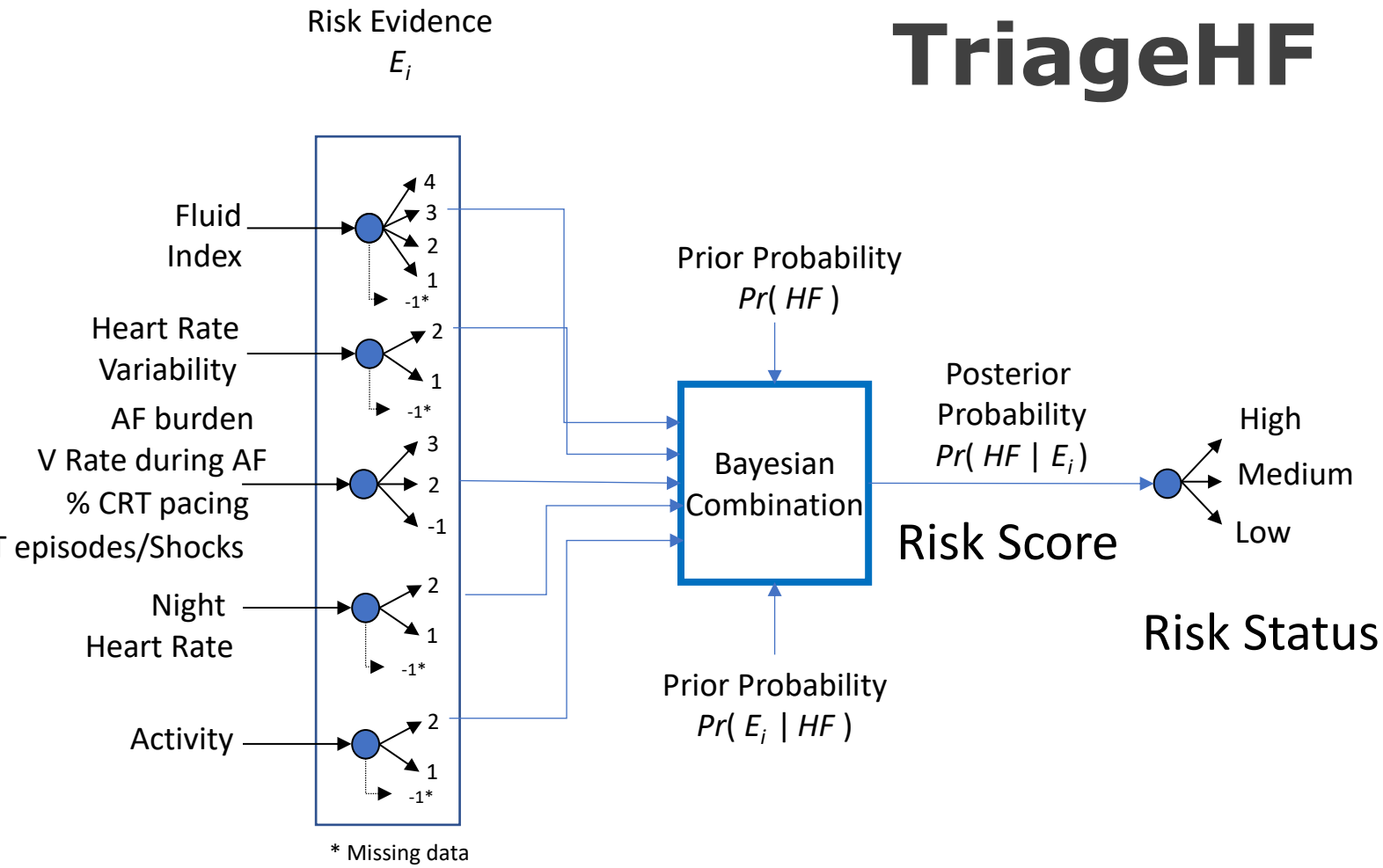
V Rate during AF

% CRT pacing

Night Heart Rate

Activity





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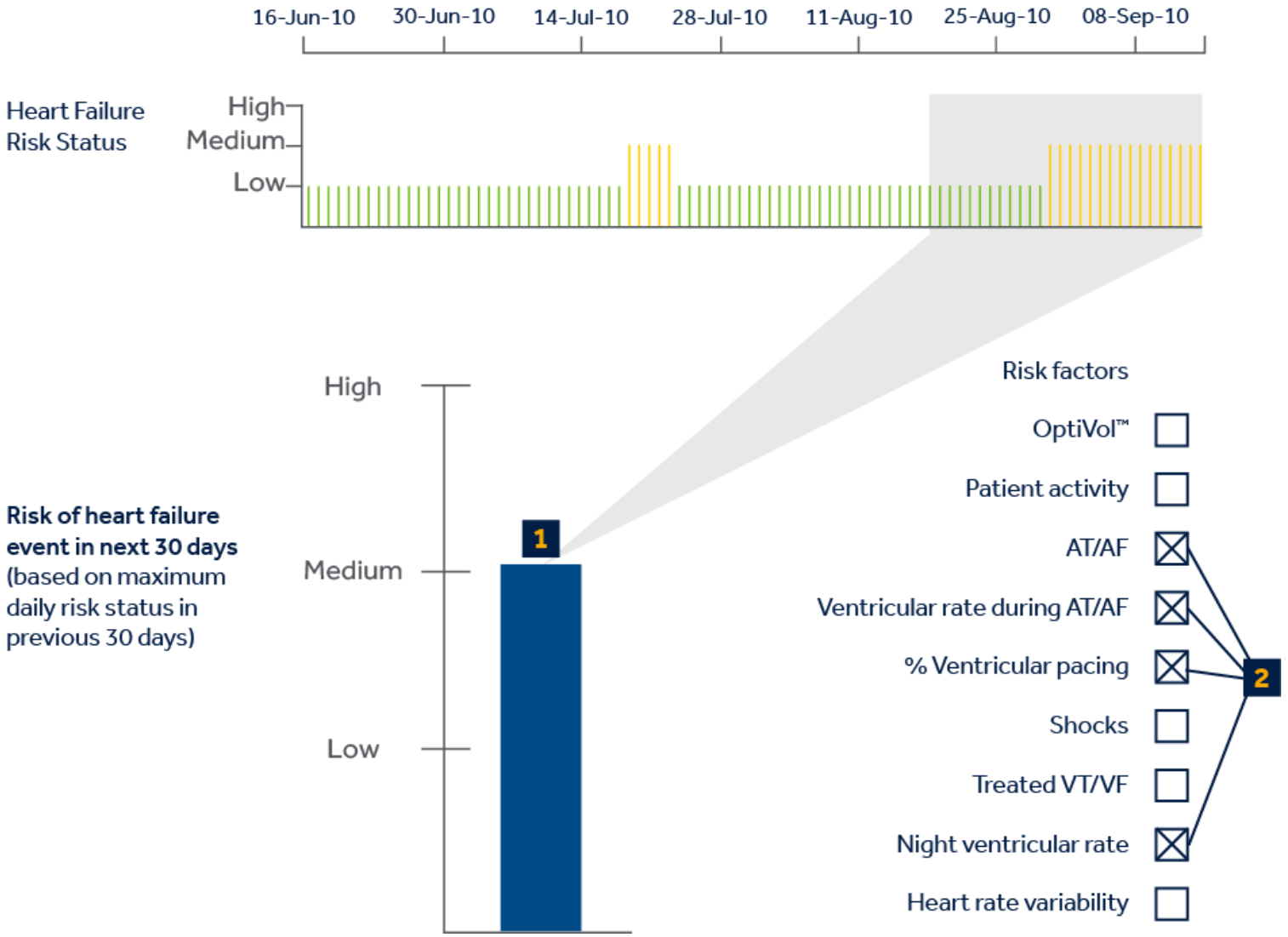
TriageHF

Calculates the risk or a HF event in the next 30 days

Based on data obtained in the previous 30 days



TriageHF

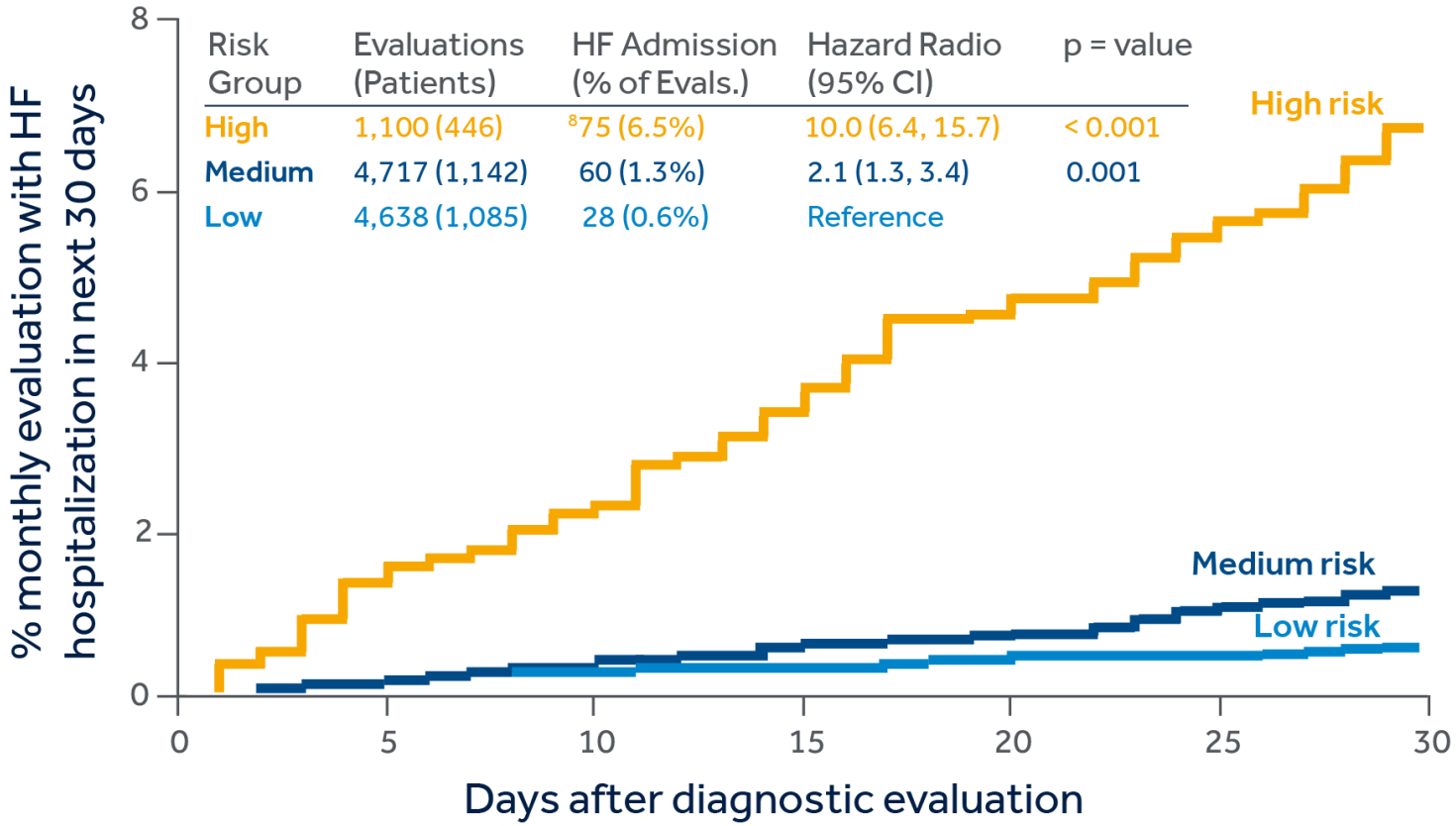
- Uses data from the previous 30 days to predict the risk of HF decompensation in the next 30 days.
- Calculated when data is received by the CareLink™ network (shared management required).
- Available from 65 days after implantation (OptiVol™ needs 34 days to start working and TriageHF 30 more days to stratify risk)

Factors	Threshold
Optivol	≥ 30 Ω; ≥ 60 Ω; ≥ 100 Ω
Activity	≤ 60 min/ día
AF/AT	≥ 1 hora/ día
Frec V durante AT/AF	≥ 90 lpm durante FA ≥ 6 horas/ día
% VP	≤ 90% (CRT)
Shocks	≥ 1
VF/VT and therapies	≥ 5
Night heart rate	≥ 85 lpm o ≤ 55 lpm
Heart rate variability	≤ 60 ms^2

TriageHF

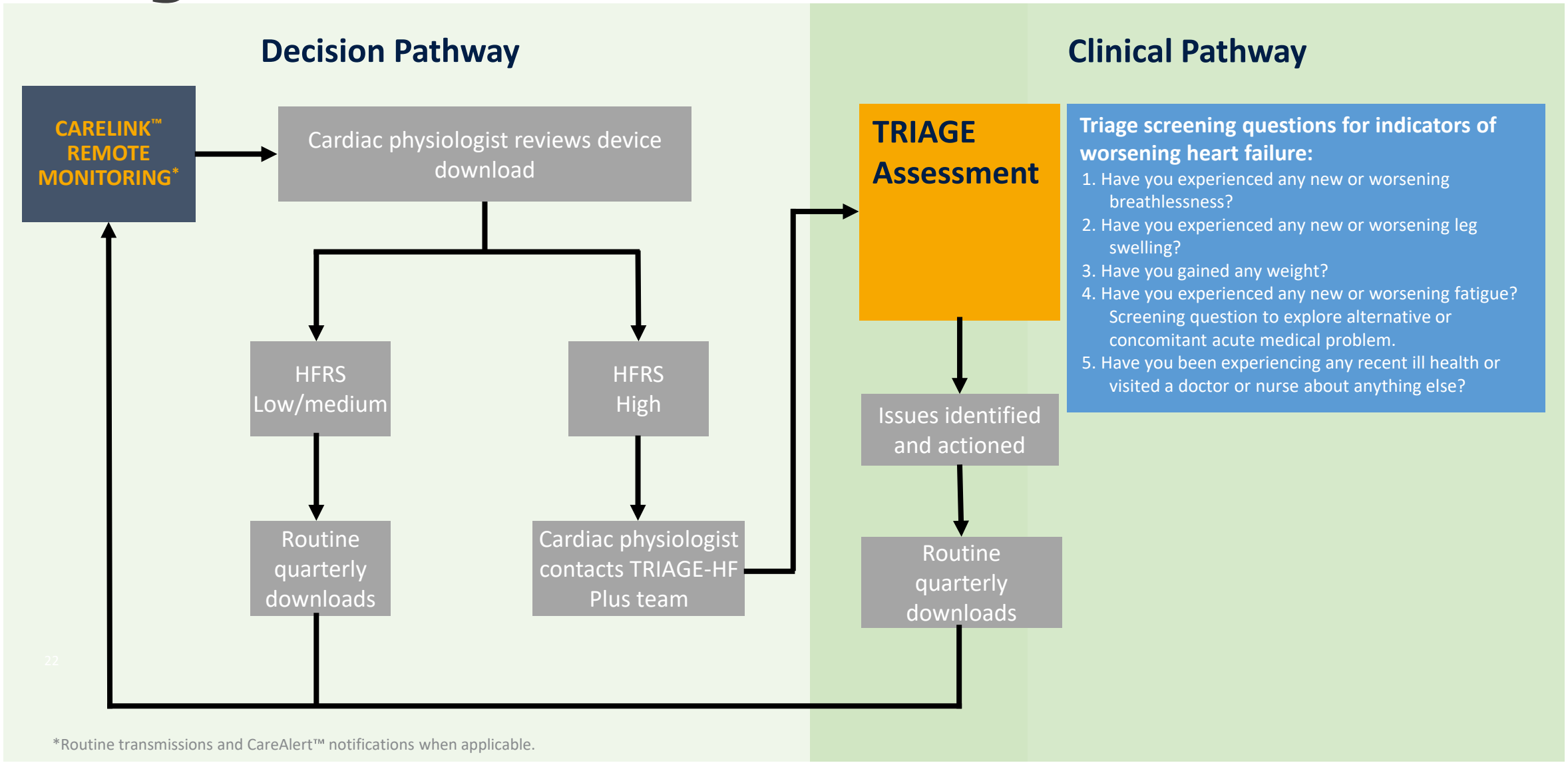
Development and validation of an integrated diagnostic algorithm based on device-monitored parameters to identify patients at risk of hospitalization for heart failure in an outpatient setting

High-risk patients are **10 times** more likely to be **hospitalized** in the next 30 days than low-risk patients.



Cowie MR, et al. Eur Heart J. 2013;34:2472-2480

TriageHF Plus



*Routine transmissions and CareAlert™ notifications when applicable.

TriageHF

TRIAGE HF PLUS

High Risk

Triage screening questions for indicators of worsening heart failure:

1. Have you experienced any new or worsening breathlessness?
2. Have you experienced any new or worsening leg swelling?
3. Have you gained any weight?
4. Have you experienced any new or worsening fatigue? Screening question to explore alternative or concomitant acute medical problem.
5. Have you been experiencing any recent ill health or visited a doctor or nurse about anything else?

+

Last consultation and next consultation data

Recent changes in treatment

Consultations in Primary Care and other Specialties

TriageHF Plus

Triage-HF Plus: a novel device-based remote monitoring pathway to identify worsening heart failure

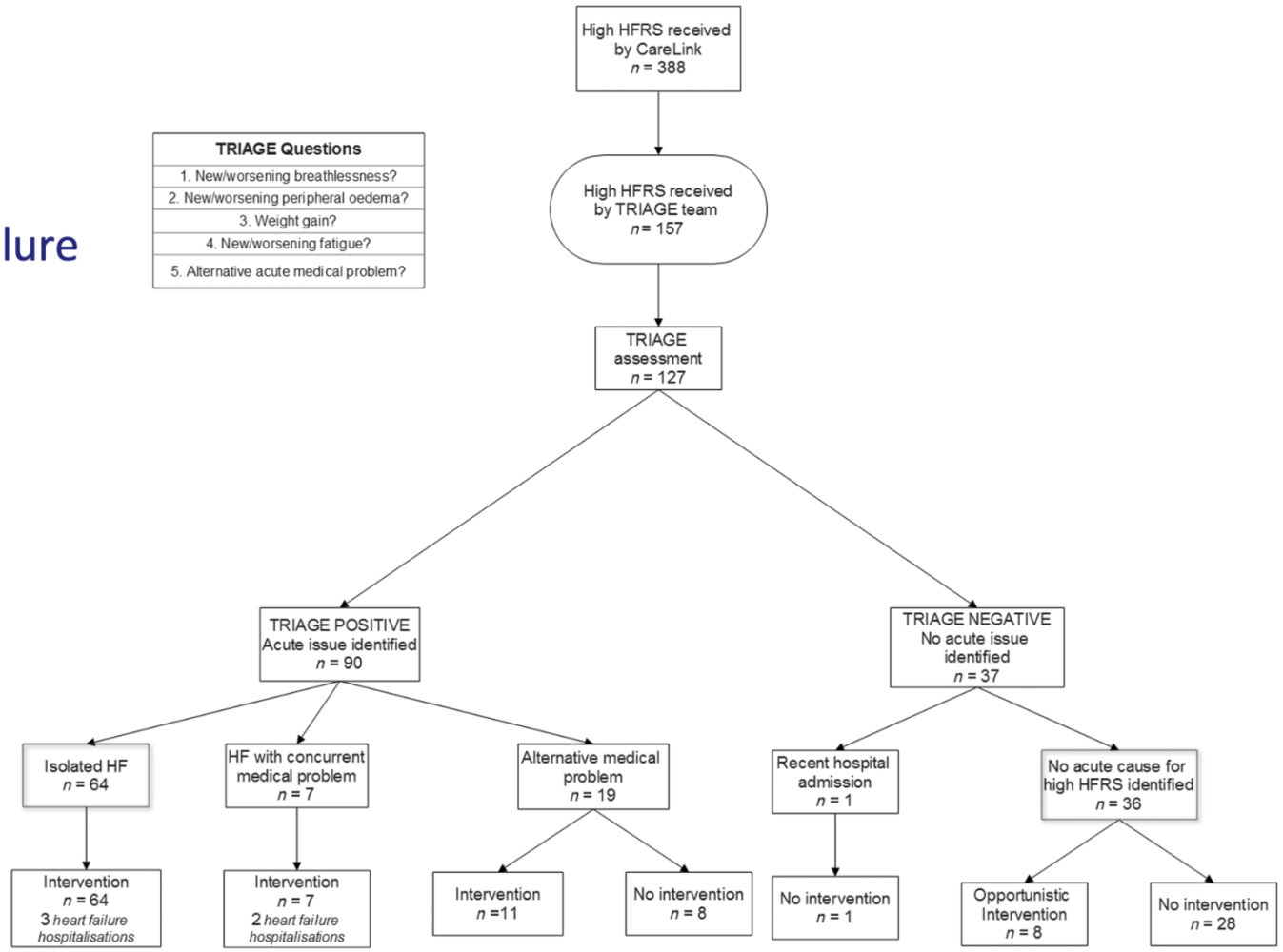
Analysis of > 2000 transmissions

388 high risk

Follow-up 27 months

55,9% had WHF

Sensitivity > 98%



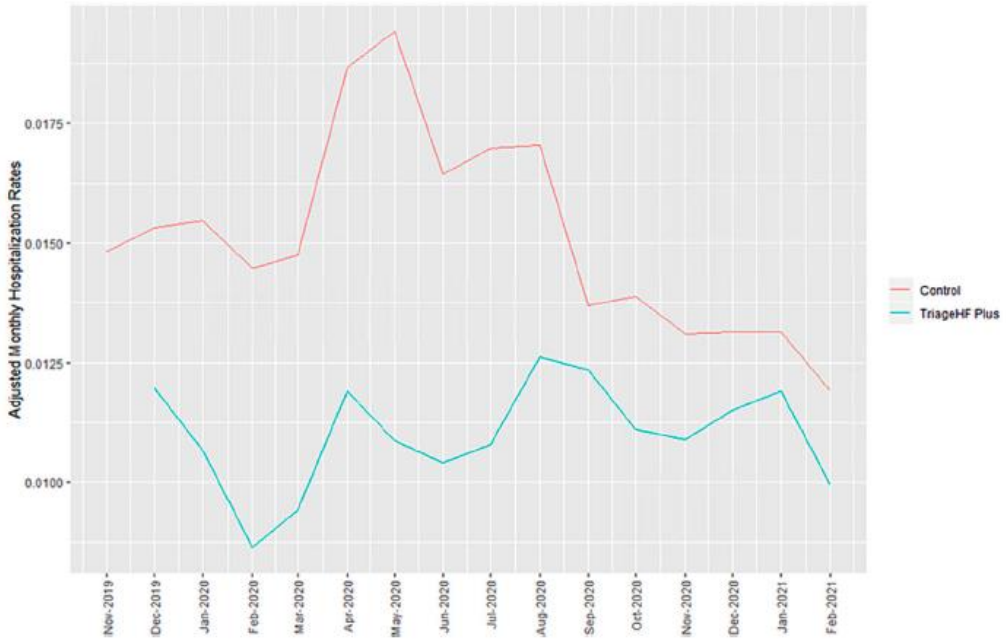
Ahmed FZ. ESC Heart Failure 2020;7(1):108–17

TriageHF Plus

Association of a device-based remote management heart failure pathway with outcomes: TriageHF Plus real-world evaluation

HF decompensation detection

Hospitalization reduction

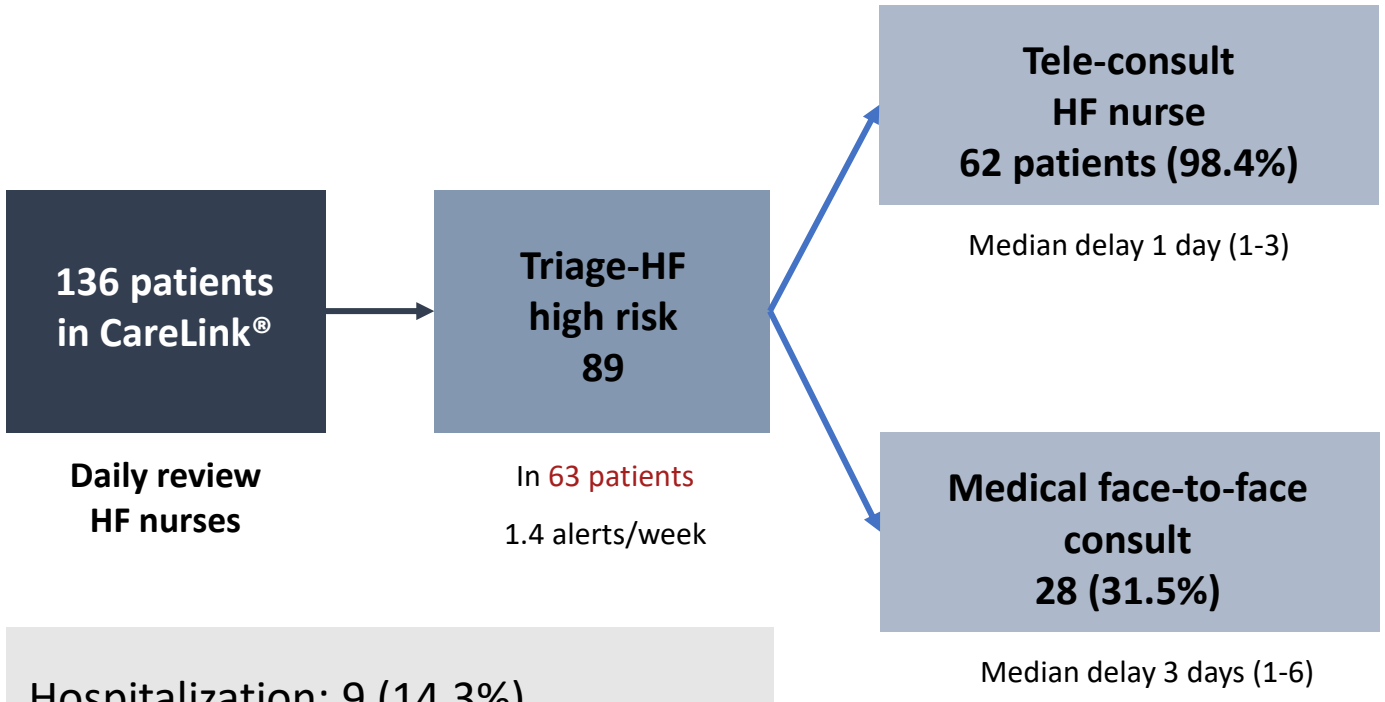


TriageHF Plus pathway	Total (N = 443) n (%) unless otherwise stated
High-risk status transmissions, *n*	196
Already hospitalized on date of transmission	9 (4.6%)
High-risk status transmission 'alerts' initial contacts	
Initial contact made	182/196 (93%)
Time to initial contact (days), median (IQR)	3 (1–4)
Acute medical issue identified	79/182 (43%)
Acute heart failure (HF)	50/79 (63%)
Clinical action taken[a]	44/79 (56%)
No acute issue identified	103/182 (57%)
Recent intervention/admission	5/103 (5%)
Actions taken at initial contact in those where acute HF was identified (n = 44)	
Change in cardiovascular medications[b]	33/44 (75%)
Investigations[c]	12/44 (27%)
Place of care	
Advised to attend ED/hospital attendance, *n*	<5
Existing OP follow-up escalated, *n*	<5
Treatment in day-care/in community[d], *n*	<5
New HF outpatient follow-up arranged	9/44 (20%)
Advice: long-term care management	7/44 (16%)
Advice: daily lifestyle	11/44 (25%)
Referral to other specialist, *n*	<5
Referral to primary care team, *n*	<5

Ahmed FZ. ESC Heart Fail. Published online May 7, 2024

TriageHF CHUAC

1-10-2022 to 31-12-2023



Hospitalization: 9 (14.3%)

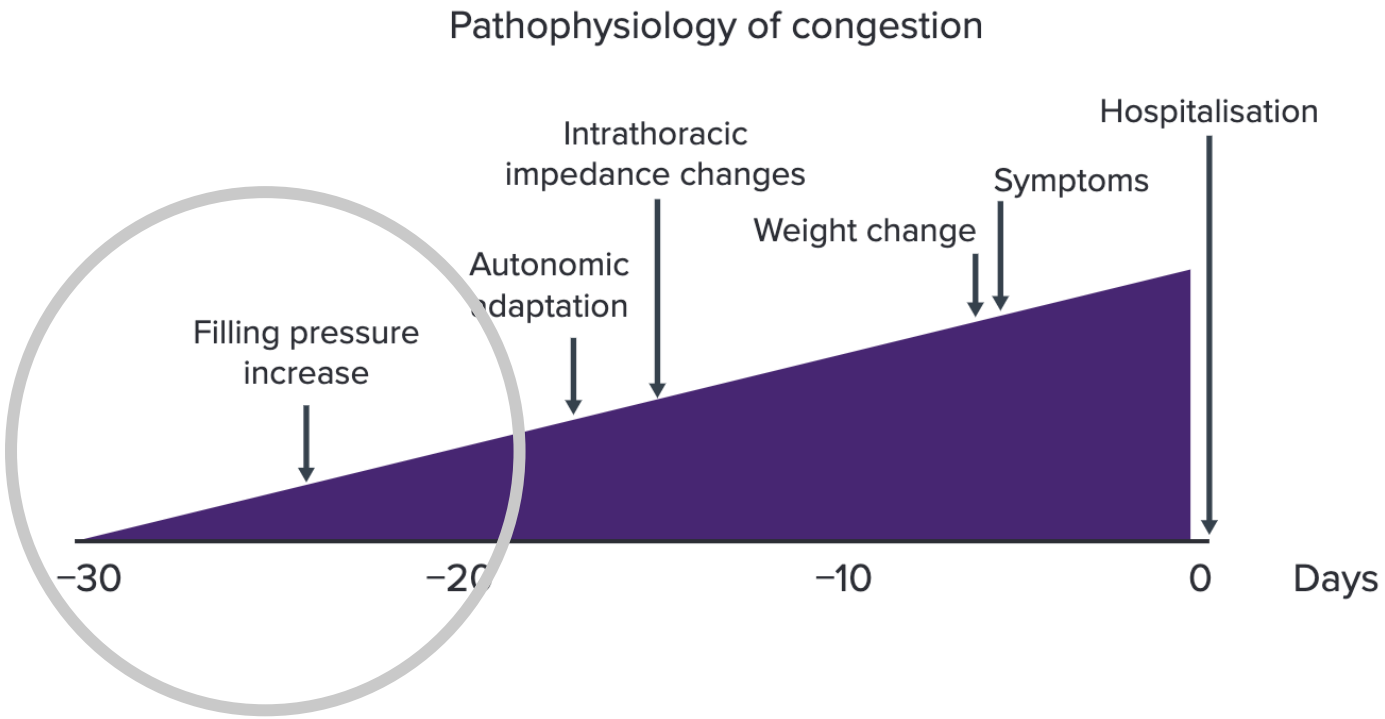
HFH after alert: 4 (6,3%)

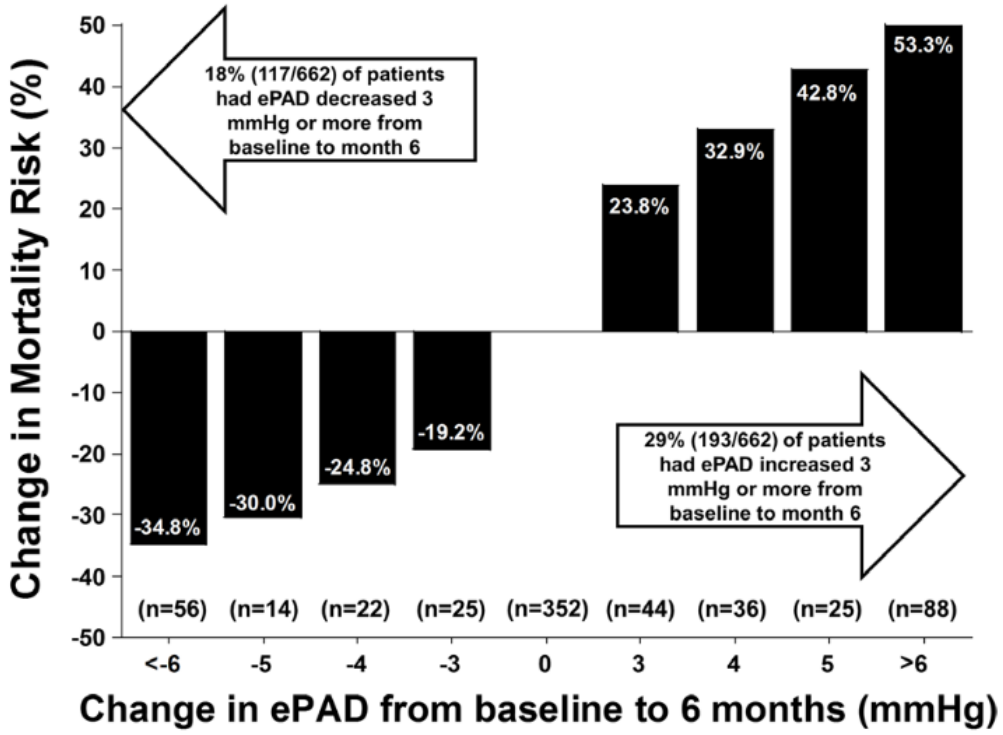
HF decompensation: 35 (39,3%)

Characteristics N=63	
Sex female n(%)	6 (9.5)
Age median (IQR)	68 (62-75)
Hypertension n(%)	30 (47.6)
Dyslipemia n(%)	38 (60.3)
Diabetes mellitus n(%)	26 (41.2)
Obesity n(%)	20 (31.7)
Chronic Kidney Disease n(%)	35 (55.6)
Chronic Obstrictive Pulmonary Disease n(%)	5 (7.9)
Ischemic cardiomyopathy n(%)	35 (55.6)
Left Ventricle Ejection Fraction median(IQR)	33 (27-38)
Atrial Fibrillation n(%)	30 (47.6)
ARNI /ACEi / ARB n(%)	47 (74.6)
Betablocker n(%)	57 (90.5)
MRA n(%)	46 (73.0)
SGLT2i n(%)	48 (76.2)
Vericiguat n(%)	6 (9.5)
Loop Diuretic n(%)	39 (61.9)
Thiazide n(%)	5 (7.9)

ESC HFA congress 2024

Invasive remote monitoring

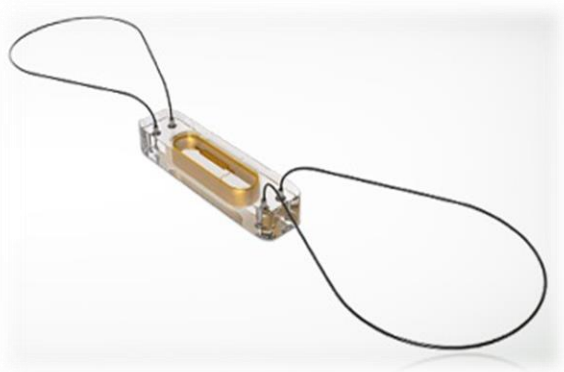




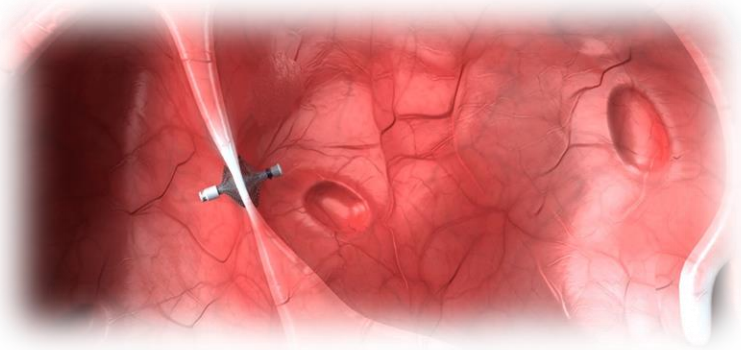
Zile MR et al. Circ Heart Fail. 2017;10:e003594

Invasive remote monitoring

CardioMEMS

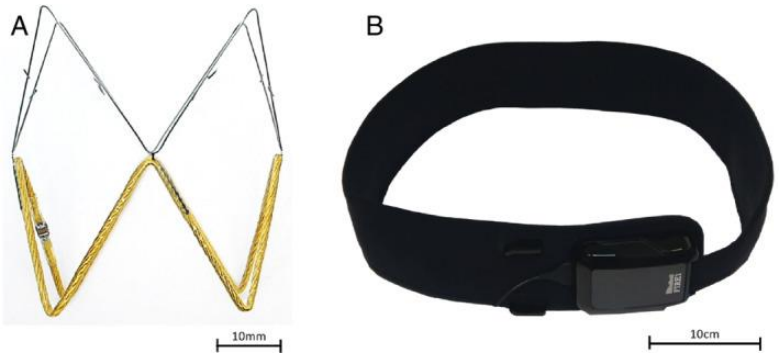


Vectorius V-LAP



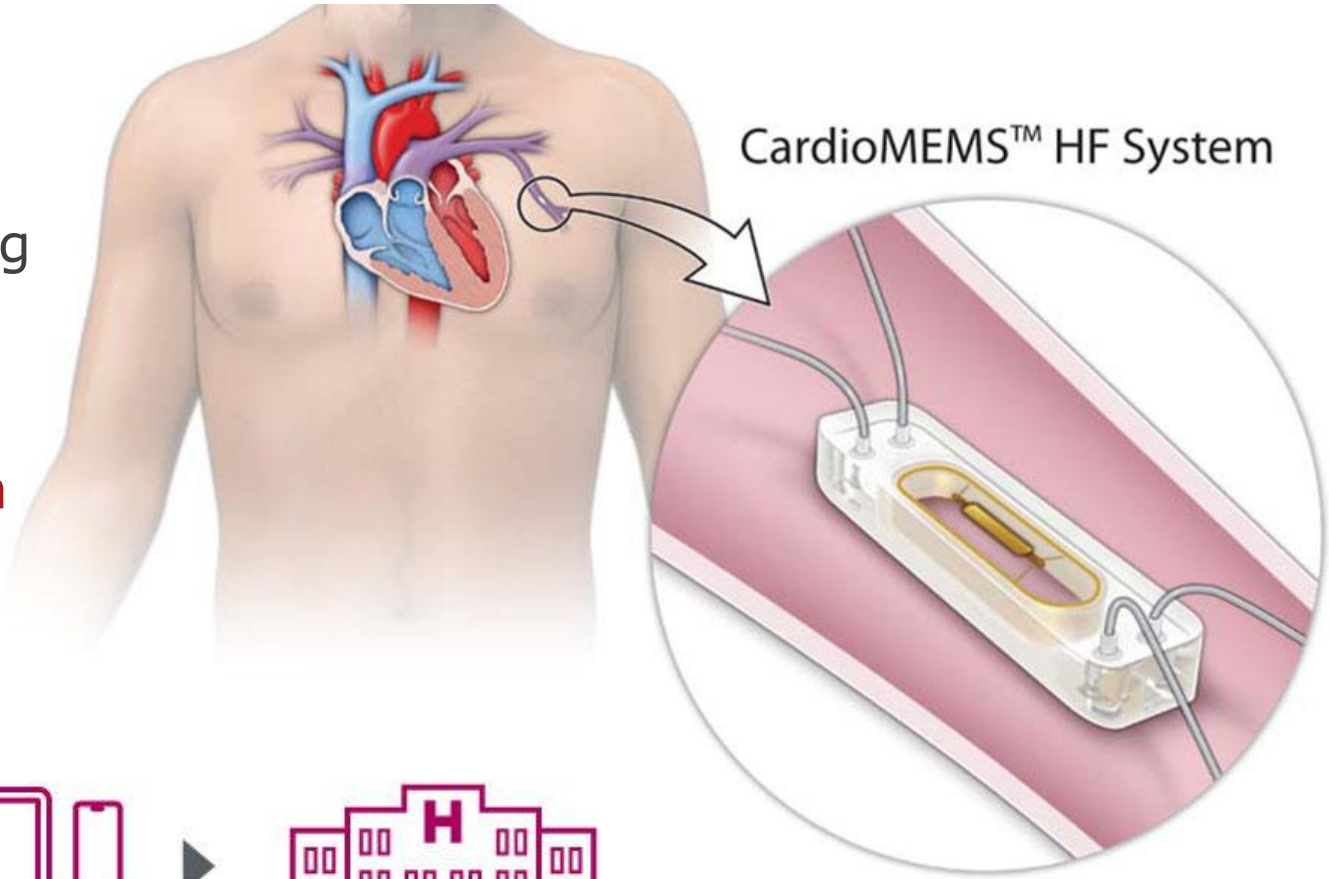
Cordella (Endotronix)

FIRE1



CardioMEMS

- Pulmonary artery pressure monitoring
- Allows daily wireless transmission
- Implantation via right catheterization
- Calibration with in-implant pressures



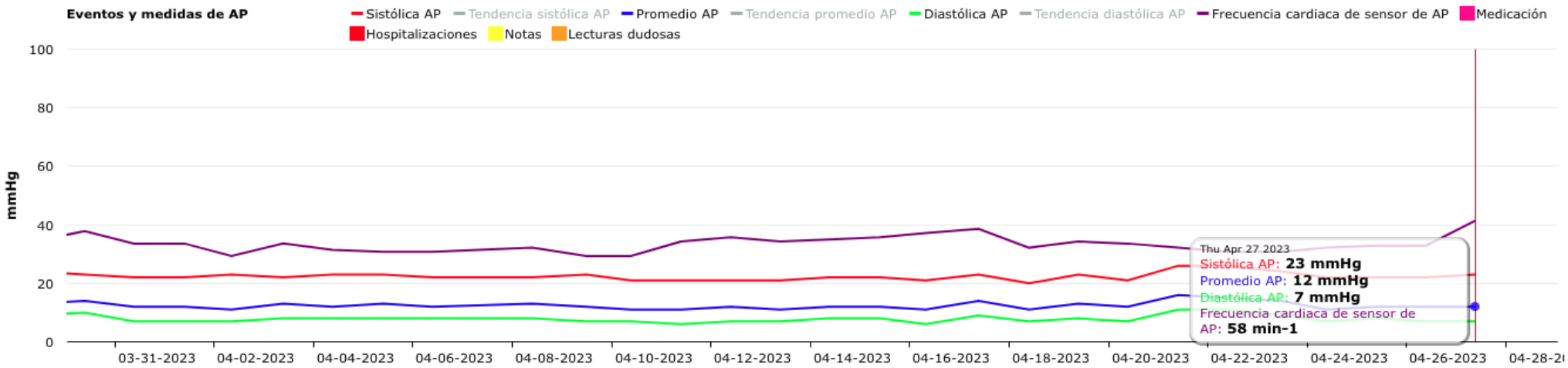
Sensor inserted via right heart catheterization

Patients take daily sensor reading from the comfort of their home

Data wirelessly transmitted to clinician's secure website

Clinician reviews data and contacts patient as necessary

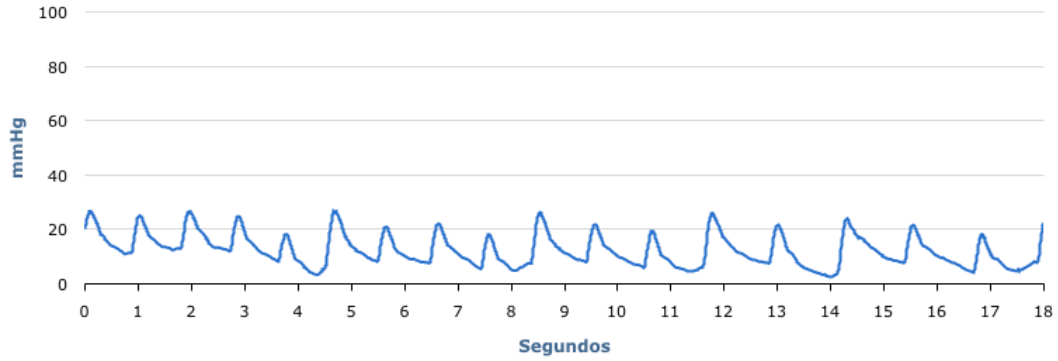
CardioMEMS



Tipo : Lectura del sensor del paciente

Realizada el : 04-27-2023, 09:33 AM

	Sistólica AP	Promedio AP	Diastólica AP	Frecuencia cardiaca
Sensor:	23 mmHg	12 mmHg	7 mmHg	58 min-1



Daily measurements

Allows to see the **trend**

Evaluate **pressure curve**

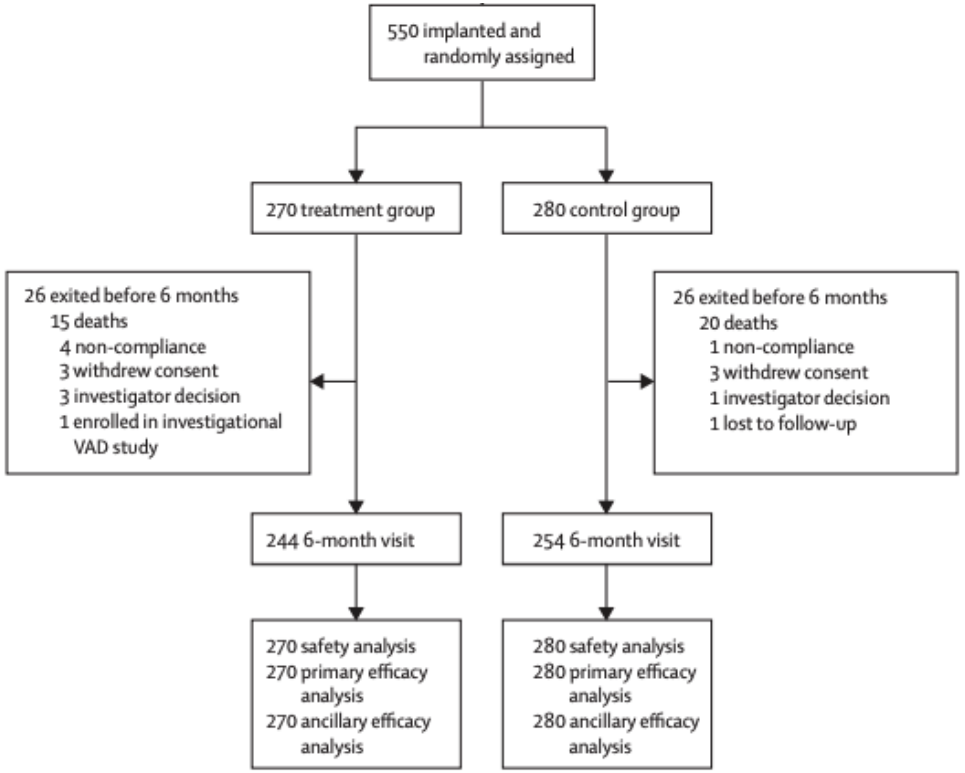
Clinical notes

A Coruña Heart Failure Academy

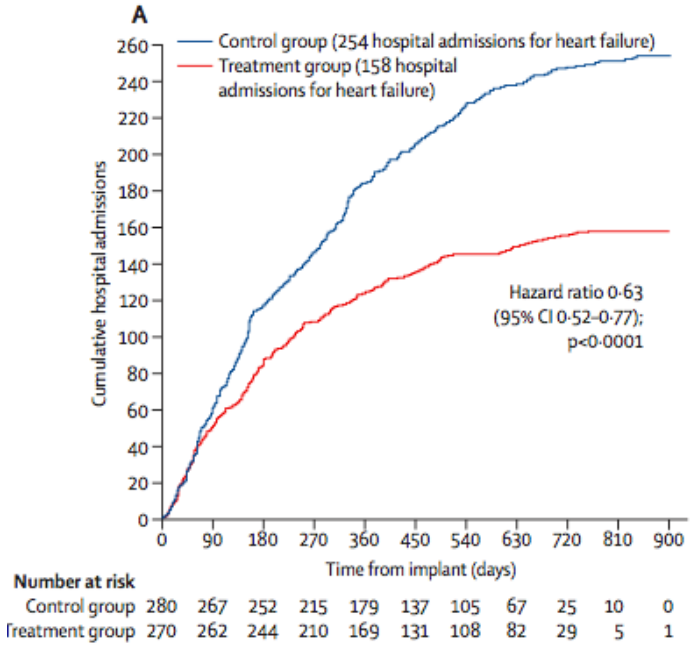
CardioMEMS: CHAMPION Trial

Wireless pulmonary artery haemodynamic monitoring in chronic heart failure: a randomised controlled trial

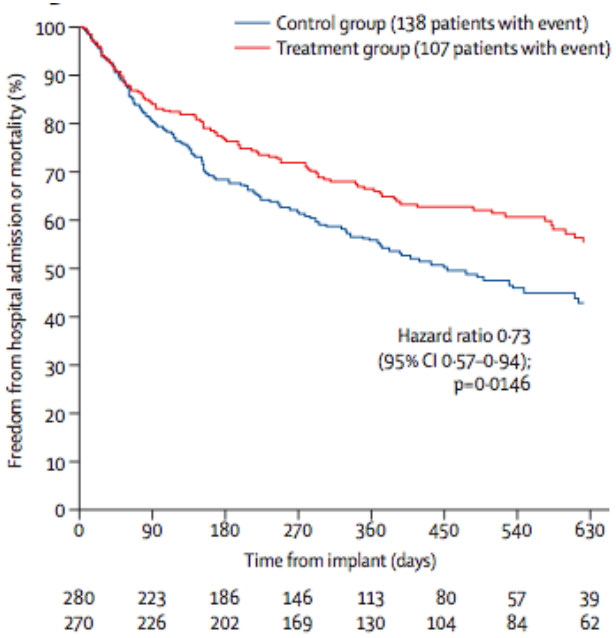
*William T Abraham, Philip B Adamson, Robert C Bourge, Mark F Aaron, Maria Rosa Costanzo, Lynne W Stevenson, Warren Strickland, Suresh Neelagaru, Nirav Raval, Steven Krueger, Stanislav Weiner, David Shavelle, Bradley Jeffries, Jay S Yadav, for the CHAMPION Trial Study Group**



HFH



HFH + mortality



Abraham WT et al. Lancet 2011; 377: 658–66

CardioMEMS: MONITOR HF Trial

N=348

Any Ejection Fraction

NYHA III with WHF episode (12 months)

Primary outcome: quality of life

Efficacy outcomes: HFH

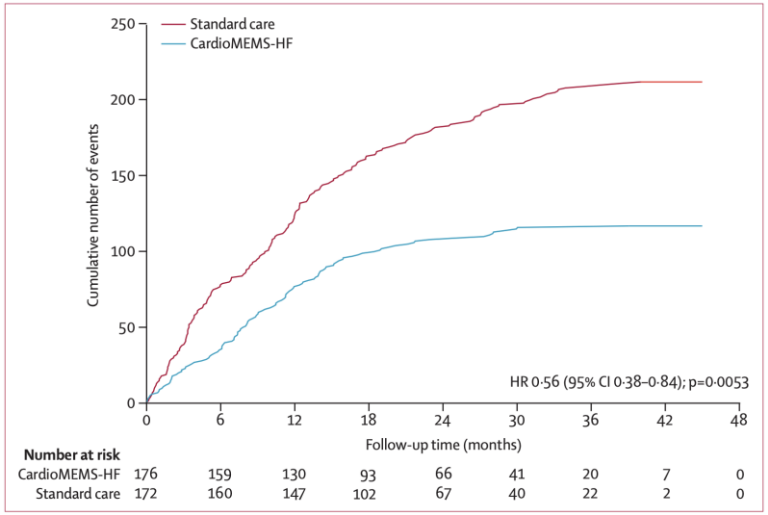
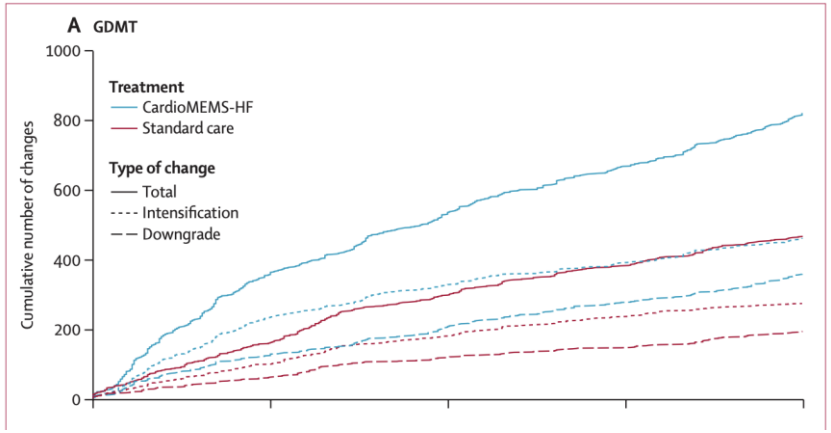
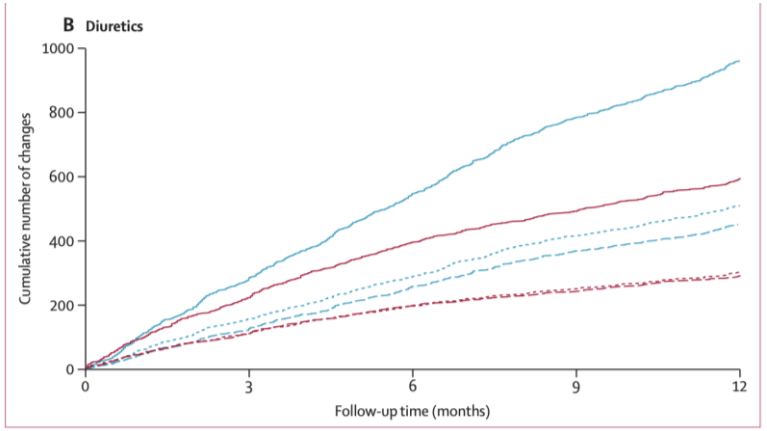


Figure 4: **Cumulative number of total heart failure hospitalisations (heart failure hospitalisations and urgent visits with necessity of iv diuretics) during entire follow-up**

Treatment changes





Brugts JJ. Lancet. 2023;401(10394):2113-2123

CardioMEMS

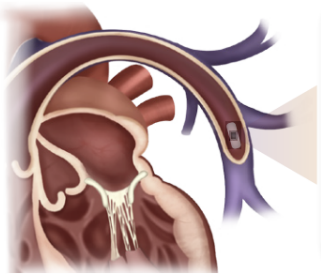
1898 patients in a pooled analysis of pulmonary pressure-guided therapy from CHAMPION, GUIDE-HF and MONITOR-HF trials

Characteristics

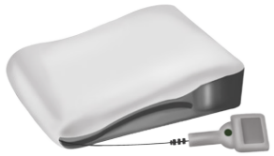
EF ≤40%	66%
Men	68%
Ischaemic aetiology	48%

Mean follow-up periods

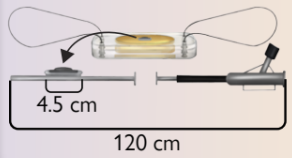
CHAMPION	17.6 M
GUIDE-HF	10.8 M
MONITOR-HF	21.4 M



Patient electronic system



PA sensor and delivery system



PA pressure database

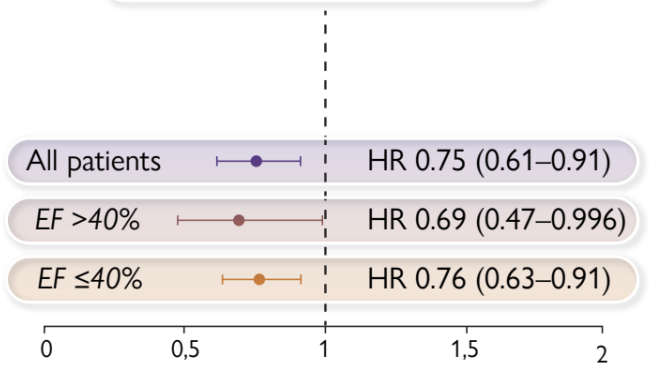
Physician access via secure website

Key inclusion criteria

CHAMPION	Chronic HF Independent of EF NYHA class III Previous HFH (12M)
GUIDE-HF	Chronic HF Independent of EF NYHA class II-IV Previous HFH and/or Elevated NT-proBNP
MONITOR-HF	Chronic HF Independent of EF NYHA class III Previous HFH (12M)

Clinical endpoints

Total HFH, urgent visits and death

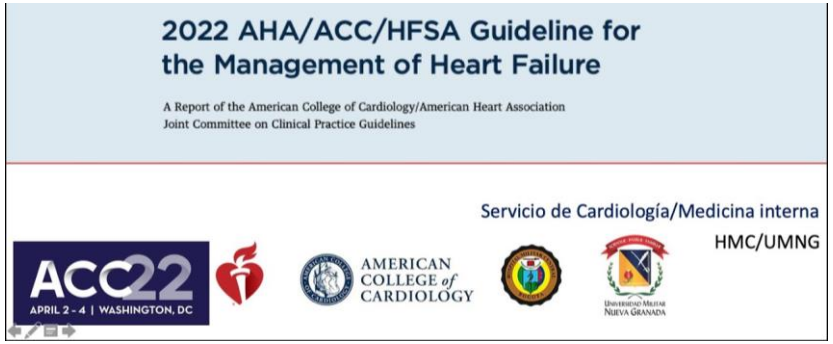


Clephas PRD. Eur Heart J. 2023;44(37):3658-3668

Invasive PAP monitoring

ESC
European Society of Cardiology

Monitoring of pulmonary artery pressure using a wireless haemodynamic monitoring system may be considered in symptomatic patients with HF in order to improve clinical outcomes.[372]	IIb	B



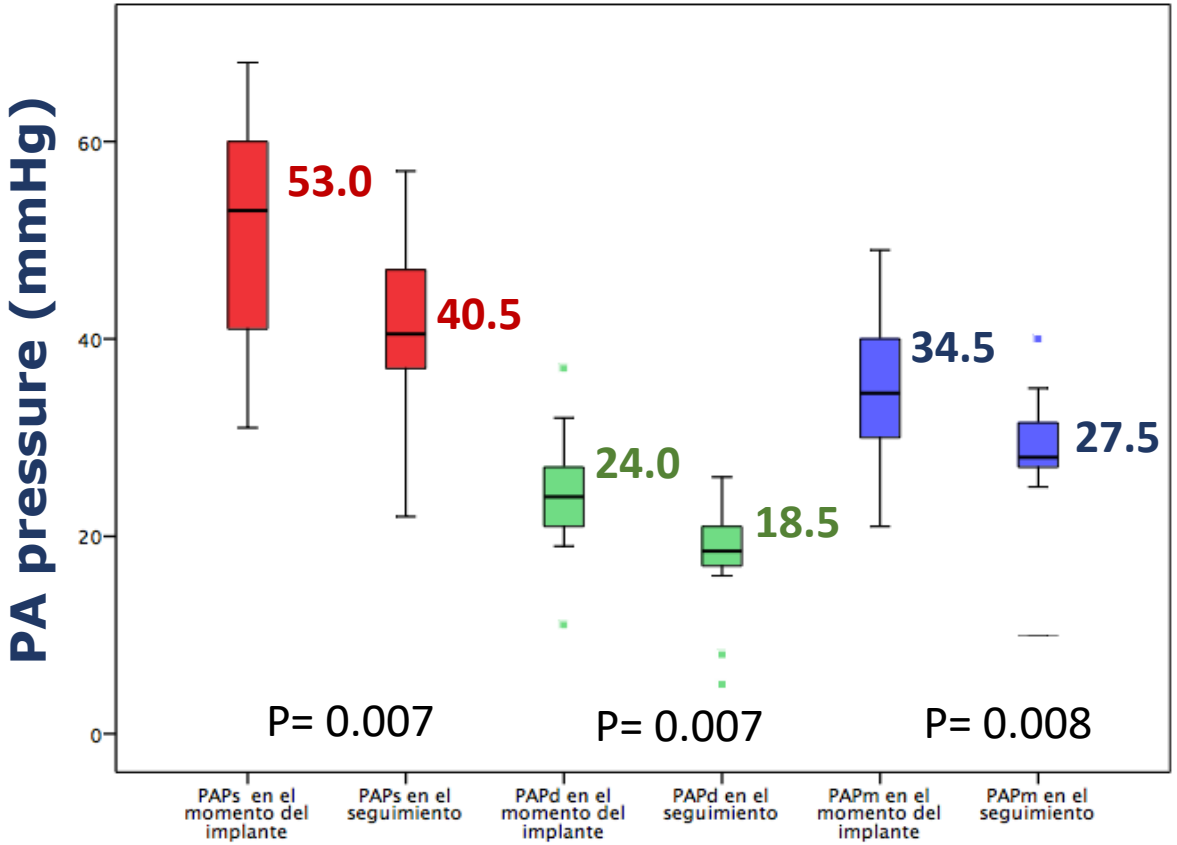
COR	LOE	Recommendation
2b	B-R	1. In selected adult patients with NYHA class III HF and history of a HF hospitalization in the past year or elevated natriuretic peptide levels, on maximally tolerated stable doses of GDMT with optimal device therapy, the usefulness of wireless monitoring of PA pressure by an implanted hemodynamic monitor to reduce the risk of subsequent HF hospitalizations is uncertain.[1–4]

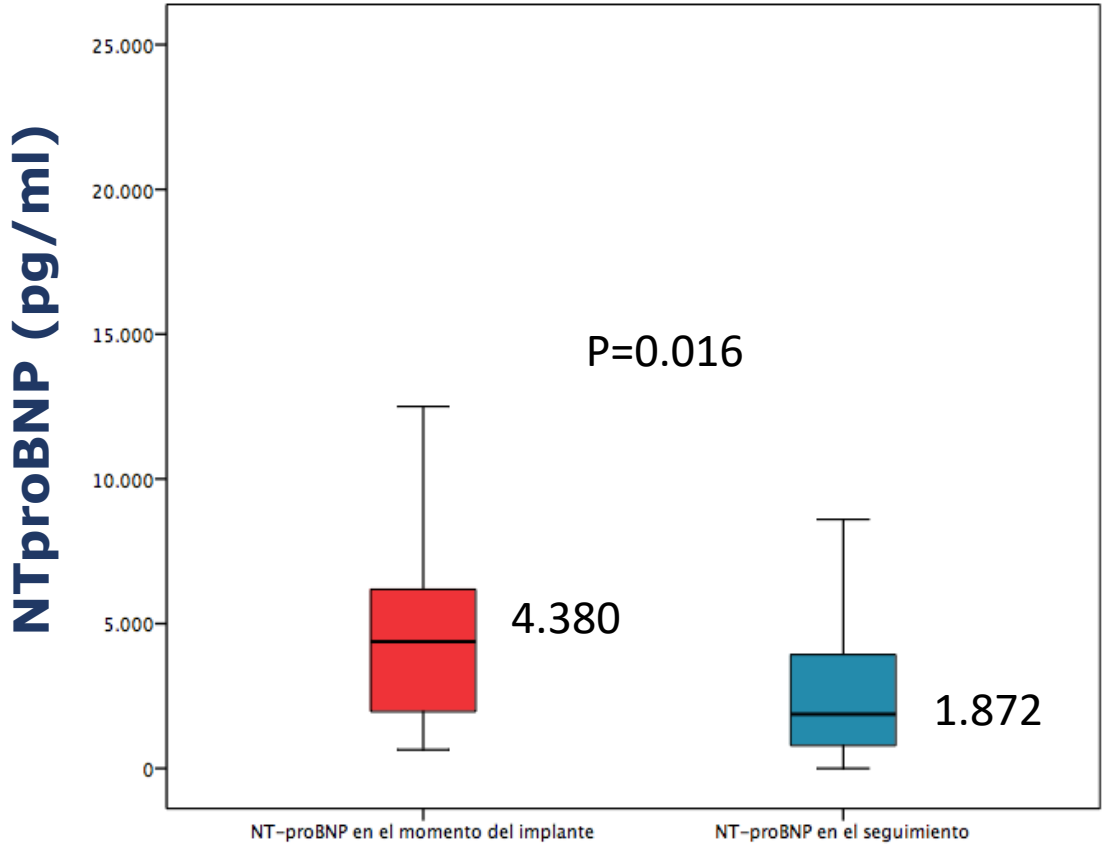
McDonagh TA et al. Eur Heart J 2021;42(36):3599-3726
Heidenreich PA et al Circulation. 2022;145:e895–e1032

CardioMEMS: CHUAC experience

HFH previous year (excluding HT list)
1.85 admissions/patient

HFH after implantation (excluding HT list)
0.23 admissions/patient/year



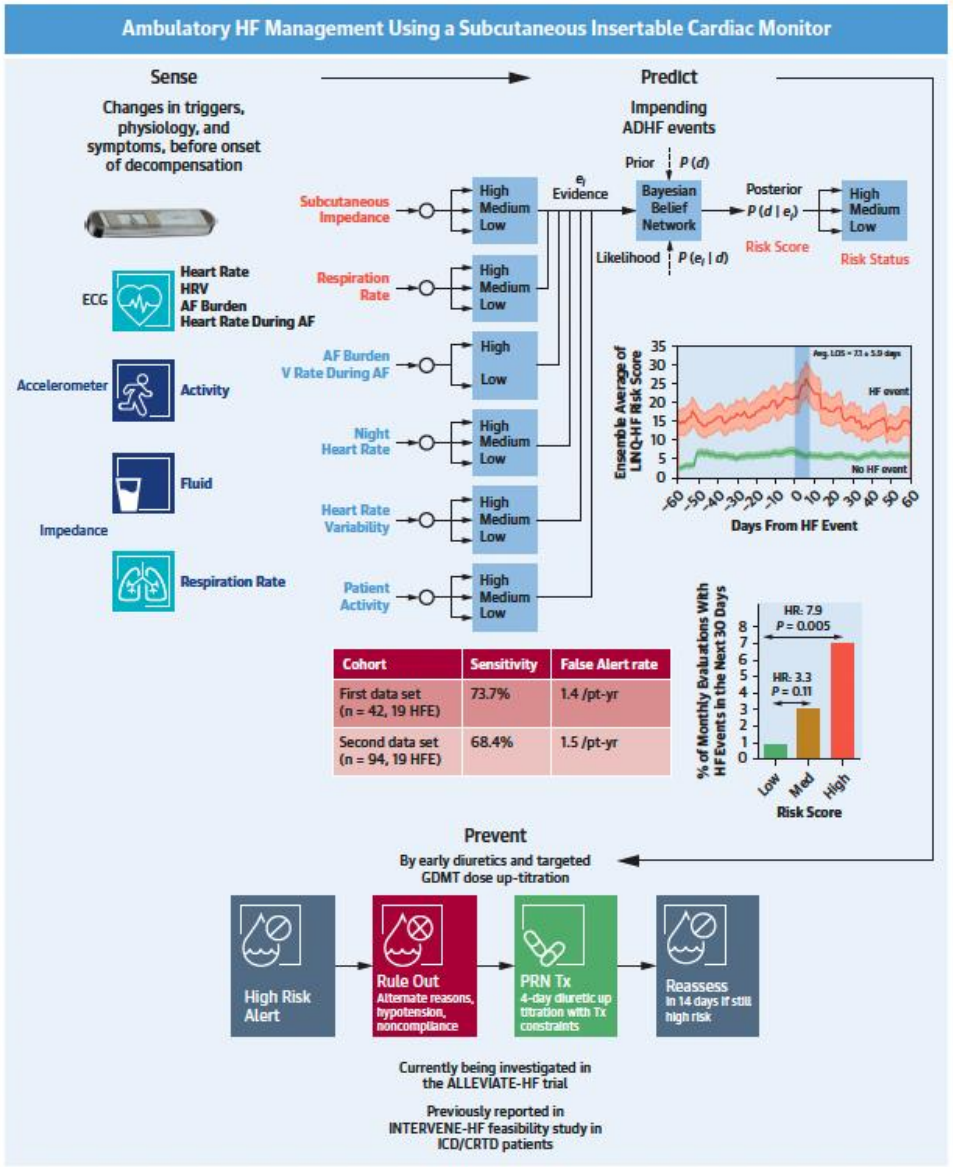


Future perspectives

A Novel Heart Failure Diagnostic Risk Score Using a Minimally Invasive Subcutaneous Insertable Cardiac Monitor

ALLEVIATE HF

Ongoing



Zile MR et al. JACC Heart Fail. 2024 Jan;12(1):182-196

Conclusions

- **HF decompensations**: very important prognostic impact on patients.
- **Remote monitoring** systems represent a technological advance to detect HF decompensations.
- **Patient selection** for each monitoring system is important.
- Systems using **implanted devices** (ICD / CRT) can **detect HF decompensation** and the possibility of early treatment.
- **PA Pressure** invasive monitoring can reduce HFH in selected patients.
- Importance of skilled **nursing**, and **trained professionals**.
- **Promising future** in the field of telemonitoring.


Thank you!