



**ABSTRACTS**  
**NVVC Najaarscongres 2025**  
**Donderdag 6 november**  
**09.00 – 10.30 uur**

**SESSIE 5: Heart failure (HTX & devices)**

	Zaal 14	Voorzitters: dr. Olivier Manintveld, cardioloog Erasmus MC, Mira van der Naald, AIOS UMC Utrecht
1	09.00 - 09.10	<b>Impact of Delayed Heparin Bridging on Bleeding and Stroke after Left Ventricular Assist Device Implantation</b> <i>P. Jahangiri (Erasmus MC, Rotterdam)</i>
2	09.11 - 09.21	<b>Diagnostic Accuracy and Clinical Efficacy of the CIED Multisensory Triage-HF™ Algorithm in an Integrated Heart Failure Care Path</b> <i>B. Kirchhof (LUMC, Leiden)</i>
3	09.22 - 09.32	<b>Fewer Heart Failure Hospitalizations Improved Survival with Cied Algorithm-Based Remote Monitoring on Top Standard of Care</b> <i>U. Aslan (LUMC, Leiden)</i>
4	09.33 - 09.43	<b>Contact Dermatitis and Risk of Driveline Infections in Patients with a Left Ventricular Assist Device</b> <i>V.C.E. Drost (Erasmus MC, Rotterdam)</i>
5	09.44 - 09.54	<b>Long-term Outcome and Treatment of Heart Failure Patients with Improved Ejection Fraction</b> <i>Y. Luo (Erasmus MC, Rotterdam)</i>
6	09.55 - 10.05	<b>Wearables and AI in Advanced Heart Failure: WAI-HF. Study Design and Initial Experience</b> <i>C.S. Pizarro (UMC Utrecht, Utrecht)</i>
7	10.06 - 10.16	<b>40 Years of Heart Transplantation in Rotterdam</b> <i>B.C.J. van Dijk (Erasmus MC, Rotterdam)</i>



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Abstract 1

**Impact of Delayed Heparin Bridging on Bleeding and Stroke after Left Ventricular Assist Device Implantation**

Presenting author: P. Jahangiri

Department: Cardiologie

*P. Jahangiri (Erasmus MC, Rotterdam); P. Jahangiri (Erasmus MC, Rotterdam); Y. Luo (Erasmus MC, Rotterdam); Y.Z. Sener (Erasmus MC, Rotterdam); J. Sjatskig (Erasmus MC, Rotterdam); J.J.H. Bunge (Erasmus MC, Rotterdam); E. Dubois (Erasmus MC, Rotterdam); C. Meuwese (Erasmus MC, Rotterdam); A. Constantinescu (Erasmus MC, Rotterdam); O.C. Manintveld (Erasmus MC, Rotterdam); F. Leebeek (Erasmus MC, Rotterdam); J. Kluin (Erasmus MC, Rotterdam); R. de Boer (Erasmus MC, Rotterdam); K. Caliskan (Erasmus MC, Rotterdam)*

**Purpose:**

Although the latest-generation left ventricular assist device (LVAD) HeartMate 3 carries a lower thromboembolic risk than earlier devices, reoperations for early postoperative bleeding remain common. After internal observations of high rate of early bleedings, we adjusted the guideline-based anticoagulation strategy by delaying early heparin bridging. This study evaluates the efficacy and safety of this approach.

**Methods:**

This single-centre retrospective study compared the postoperative outcomes of two anticoagulation protocols following HeartMate 3 LVAD implantation. In May 2022, a revised protocol was introduced delaying heparin bridging to beyond 48 hours, while the prior protocol initiated heparin after 24 hours according to the current guidelines. The primary efficacy endpoint was early (<30 days) postoperative bleeding events requiring reoperation. The primary safety endpoint was early ischemic stroke.

**Results:**

We analysed 180 patients (106 old protocol, 74 new). Median age was 54 years and 72% were male. The incidence of early bleeding events at 30-days postoperative requiring reoperation was significantly lower with the new protocol (42.4% vs 23.0%,  $p = 0.006$ ). Stroke incidence did not differ significantly (10.8% vs. 6.6%,  $p = 0.30$ ). Both total hospital stay ( $p = 0.04$ ) and ICU stay ( $p = 0.03$ ) were significantly shorter with the new protocol.

**Conclusion:**

In this retrospective study, delaying heparin initiation beyond 48 hours after HM3 implantation was associated with reduced early bleeding-related reoperations and shorter ICU and hospital stays, without a significant increase in stroke risk. Prospective studies are needed to confirm these findings and inform future recommendations for early postoperative anticoagulation.

**Keywords:**

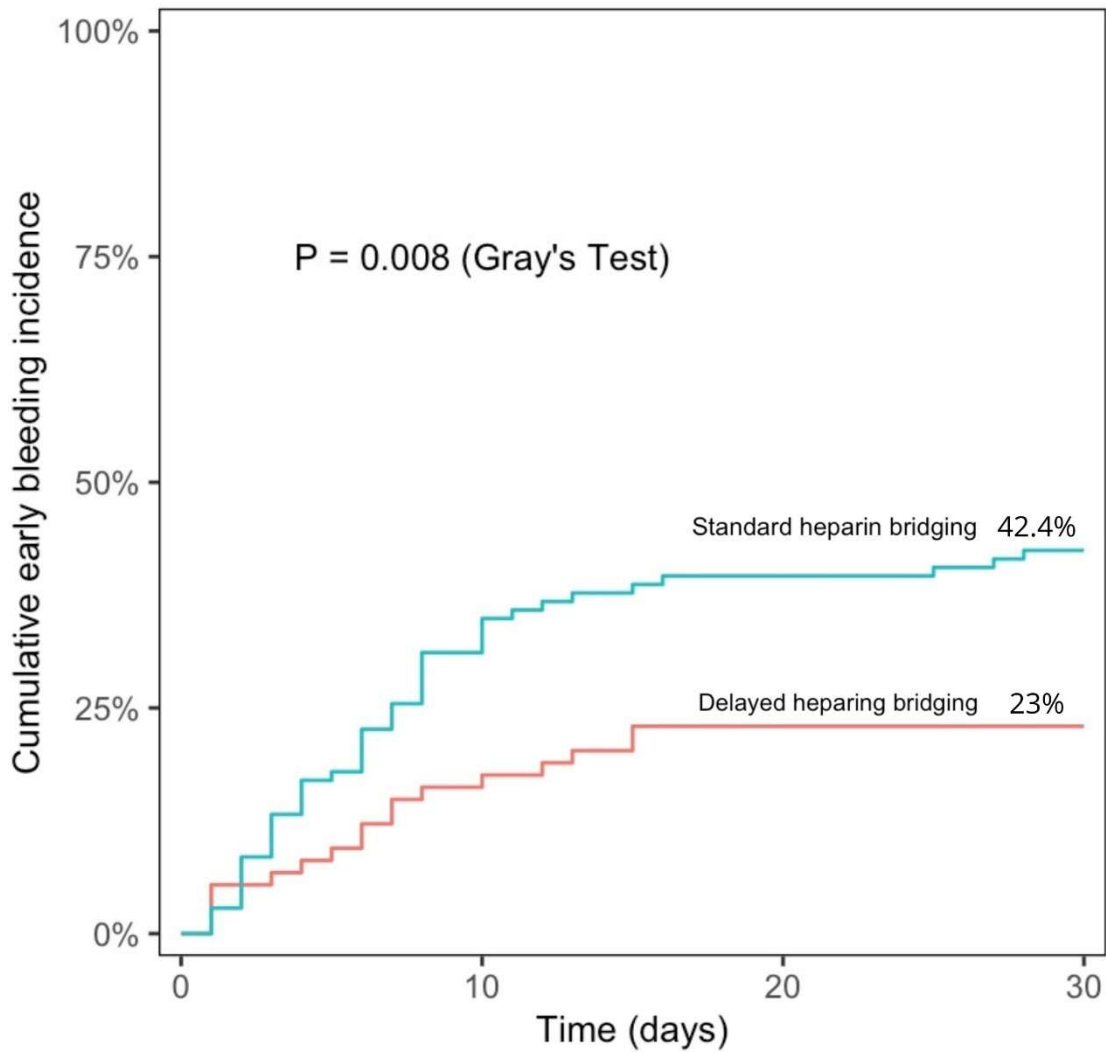
Left ventricular assist device, HeartMate 3, Anticoagulation



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**Figure:**

Cumulative incidence function for early (30-day) bleeding or tamponade events requiring reoperation following HeartMate 3 LVAD implantation. Comparison between standard heparin bridging (initiated within 24–48 hours postoperatively) and delayed heparin bridging (initiated after 48 hours).



**Patients at risk**

Standard heparin bridging	106	73	64	61
Delayed heparin bridging	74	60	55	55



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Abstract 2

**Diagnostic Accuracy and Clinical Efficacy of the CIED Multisensory Triage-HF™ Algorithm in an Integrated Heart Failure Care Path**

Presenting author: B. Kirchhof

Department: Hartziekten

*B. Kirchhof (LUMC, Leiden); B.A.C. Zwaenepoel (LUMC, Leiden; AZ Delta, Roeselare); U. Aslan (LUMC, Leiden); J.W. Jukema (LUMC, Leiden; NLHI, Utrecht); S.L.M.A. Beeres (LUMC, Leiden); A.D. Egorova (LUMC, Leiden)*

**Purpose:**

The Triage-HF™ algorithm (Medtronic™, Minnesota, USA) is a multi-sensor risk stratification tool embedded in cardiac implantable electronic devices (CIEDs) to detect patients at risk of worsening heart failure (HF). Evidence on its real-world diagnostic and clinical performance is limited. This study aimed to evaluate the diagnostic accuracy and clinical efficacy of Triage-HF™ when implemented in an integrated HF management setting.

**Methods:**

HF patients with an active Triage-HF™ algorithm on their CIED were followed within a standardized care path at a tertiary HF center between January 2023 and May 2025. High-risk alerts were classified as true/false based on clinical course. Diagnostic accuracy was evaluated using logistic regression with mixed-effects models.

**Results:**

In total, 145 patients (79% male, age 68.2±10.6 years) were included. Mean LV ejection fraction was 38±9% and 50% had an ischemic etiology of HF. During 188 patient-years, 70 high-risk alerts were analyzed. Sensitivity was 81% (95%CI: 66–90%), specificity 91% (87–94%), positive predictive value 68% (56–77%), and negative predictive value 93% (89–96%). Unexplained alert rate was 0.08 per patient-year, and false negative alert rate 0.08 per patient-year. Among true positive (TP) alerts, 66% led to clinical intervention at first contact. Management consisted of lifestyle reinforcement and/or HF-related medication escalation in 66% of the TP alerts. Emergency department visit was necessary in 11% and hospital admission in 23%.

**Conclusion:**

Integration of Triage-HF™ algorithm within a HF care path demonstrated robust diagnostic accuracy and guided timely clinical interventions, emphasizing its potential as a telemonitoring strategy for HF patients.

**Keywords:**

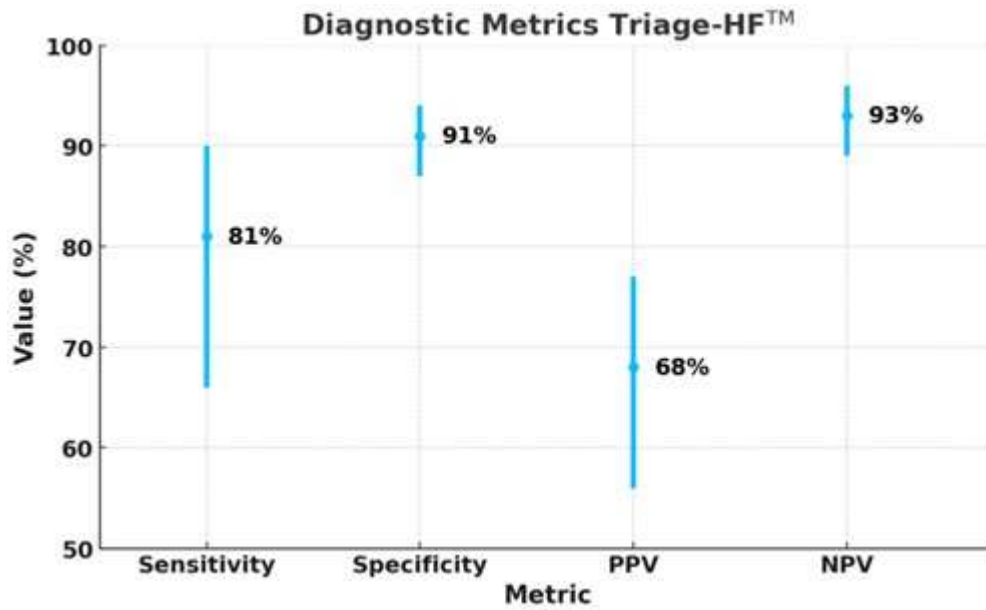
Telemedicine, CIED, Heart Failure



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**Figure:**

Diagnostic metrics of Triage-HF™ algorithm, applied in Triage-HF™ - HF care path. Metric % (95% confidence intervals): sensitivity, 81 % (66-90 %); specificity, 91 % (87-94 %); positive predictive value (PPV), 68 % (56-77 %); negative predictive value (NPV), 93 % (89-96 %).





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Abstract 3

**Fewer Heart Failure Hospitalizations Improved Survival with Cied Algorithm-Based Remote Monitoring on Top Standard of Care**

Presenting author: U. Aslan

Department: Cardiology

*U. Aslan (LUMC, Leiden); U. Aslan (LUMC, Leiden), B. Zwaenepoel (LUMC, Leiden), A.M. Kluff (LUMC, Leiden), M. Feijen (LUMC, Leiden), B.J.A. Mertens (LUMC, Leiden), J.W.J.M. Steegenga (LUMC, Leiden), S. Gelderblom (LUMC, Leiden), F.M. van Duijn (LUMC, Leiden), J.W. Jukema (LUMC, Leiden), A.D. Egorova (LUMC, Leiden), S.L.M.A. Beeres (LUMC, Leiden)*

**Purpose:**

Cardiac implantable electronic device (CIED)-based multisensory algorithms can detect early signs of fluid retention in heart failure (HF) patients, enabling timely intervention. Although previous have studies demonstrated safe integration into clinical practice, their effect on HF-related outcomes remains uncertain. This study evaluates the impact of CIED-based algorithm monitoring, in addition to standard care, on HF-related outcomes and mortality.

**Methods:**

This prospective cohort study included consecutive ambulatory HF patients with a CIED under follow-up between 01-05-2023 and 01-02-2025. Patients with an activated multisensory algorithm were remotely monitored per protocol; controls received standard care. The primary endpoint was HF hospitalization rate; secondary endpoints included HF-related emergency visits and all-cause death. Analyses were adjusted for baseline differences.

**Results:**

A total of 193 patients were included in the algorithm group and 374 in the control group. Baseline characteristics were generally comparable (76% male, median age 70 years). Only CRT use was higher in the algorithm group (67% vs 54%,  $p=0.002$ ). Over 945 patient-years, HF hospitalization rates were lower with algorithm-based monitoring (3.59 vs 7.79 per 100 patient-years; IRR: 0.46; 95%CI [0.23–0.84],  $P=0.017$ ), as were HF-related emergency visits (1.23 vs 3.83 per 100 patient-years; IRR: 0.32; 95%CI [0.09–0.83],  $P=0.036$ ). All-cause mortality was also lower (4.7% vs 10.7% deaths; HR: 0.43, 95%CI [0.21–0.88],  $P=0.02$ ).

**Conclusion:**

Integration of CIED-based multisensory algorithm monitoring into ambulatory HF care was associated with reduced HF hospitalizations, fewer emergency visits, and lower survival. These real-world findings support broader implementation and warrant validation in randomized trials.

**Keywords:**

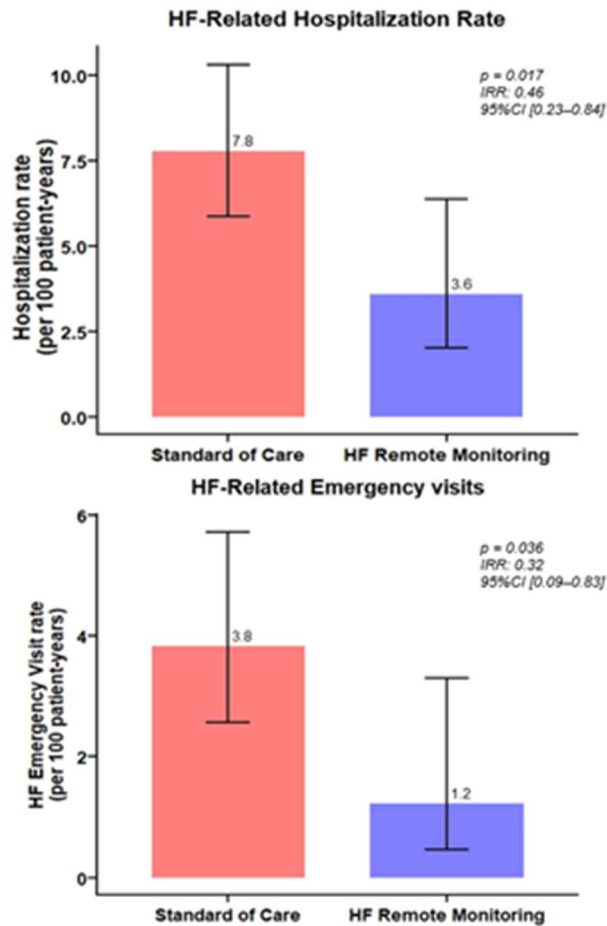
cardiac implantable electronic devices, telemonitoring, heart failure



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**Figure:**

HF-Related Hospitalization and Emergency visit Rate per 100 patient-years in the standard of care vs. Remote monitoring group.





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Abstract 4

**Contact Dermatitis and Risk of Driveline Infections in Patients with a Left Ventricular Assist Device**

Presenting author: V. Drost

Department: Cardiology

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**Purpose:**

Driveline exit-site care is essential for preventing driveline infections (DLIs) in patients implanted with a left ventricular assist device (LVAD). However, frequent driveline exit dressing changes can disrupt the skin barrier and cause contact dermatitis (CD). This study examined the prevalence of CD and whether it increases the risk of DLI in patients with an LVAD.

**Methods:**

In a single-center retrospective cohort, medical records of patients who received a HeartMate 3 LVAD between 2016 and 2025 were reviewed for CD and DLI. Cox regression analyses were performed to identify predictors of DLI.

**Results:**

A total of 169 patients were included (mean age  $54.3 \pm 12.4$  years, 128 [75.7%] male). A history of CD was present in 79 patients (46.7%), while DLI occurred in 59 (34.9%). The incidence of DLI was significantly higher in patients with CD compared with those without (46.8% vs 24.4%,  $p=0.002$ ). DLI tended to occur earlier in patients with CD (13.4 vs 14.3 months;  $p=0.06$ ). Kaplan–Meier analysis demonstrated a significantly higher cumulative incidence of DLI in patients with CD (log-rank  $p=0.007$ ). Multivariable Cox regression analysis revealed that a history of CD was an independent predictor of DLI (HR:2.34, 95%CI:1.39-3.94).

**Conclusion:**

Contact dermatitis is prevalent in patients implanted with an LVAD and independently increases the risk of driveline infections. These findings highlight the importance of proactive screening before LVAD implantation and early treatment of CD to reduce driveline-related complications.

**Keywords:**

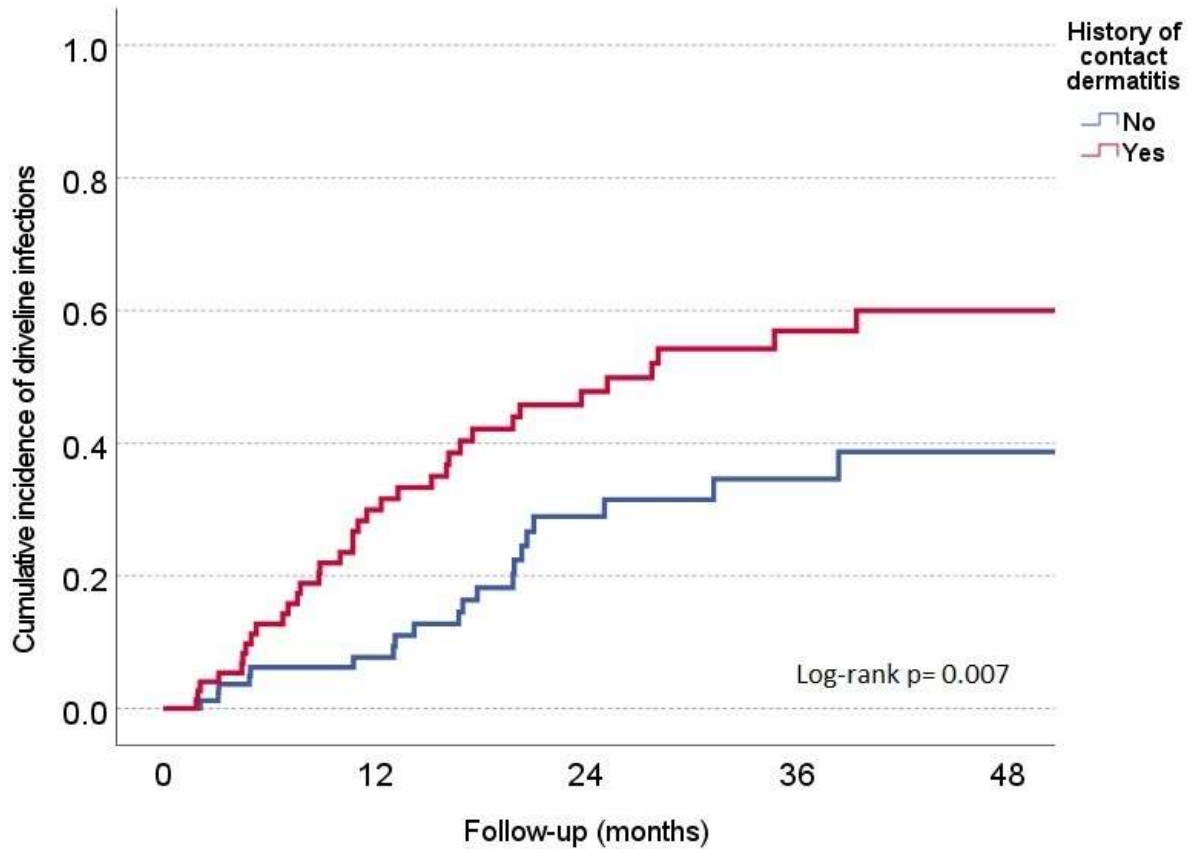
Left Ventricular Assist Device, Driveline Infection, Contact Dermatitis



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**Figure:**

Cumulative incidence function of driveline infection in patients with and without a history of contact dermatitis



Number at risk

—	79	43	25	15	11
—	90	43	29	18	9



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Abstract 5

**Long-term Outcome and Treatment of Heart Failure Patients with Improved Ejection Fraction**

Presenting author: Y. Luo

Department: Cardiology

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**Purpose:**

This real-world cohort study aims to characterize heart failure patients with improved ejection fraction (HFimpEF) with a focus on their long-term outcome and use of pharmacotherapy over a 10-year period.

**Methods:**

HF patients with reduced EF enrolled in the Rijnmond HF registry were included if their EF improved to >40% during follow-up. Primary outcome was defined as the first occurrence of HF-related hospitalization, left ventricular assist device implantation, heart transplantation, or all-cause death. Patients treated exclusively with renin-angiotensin system inhibitors (RASi) and  $\beta$ -blockers were further grouped separately and compared with those receiving additional drugs during follow-up, including mineralocorticoid receptor antagonists, loop diuretics, and/or digoxin.

**Results:**

Among 635 HF patients with reduced EF, 207 (32.6%) experienced EF improvement. The overall 10-year probability of primary outcome is 27.6%. Outcome events were mainly driven by non-cardiovascular deaths and HF-related hospitalizations. Forty-seven (22.7%) received RASi and  $\beta$ -blockers only, while the remaining 160 required additional drugs. These 47 patients had a significantly lower 10-year probability of primary outcome (5.4% vs. 36.9%; log-



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rank  $P < 0.001$ ) compared with the others. Higher age (hazard ratio[HR] 1.05;  $P = 0.004$ ), cancer history (HR 4.46;  $P = 0.001$ ), digoxin use (HR 3.26;  $P = 0.002$ ), and higher N-terminal pro-b-type natriuretic peptide (HR 1.06;  $P < 0.001$ ) at the time of EF improvement emerged as independent predictors of primary outcome.

**Conclusion:**

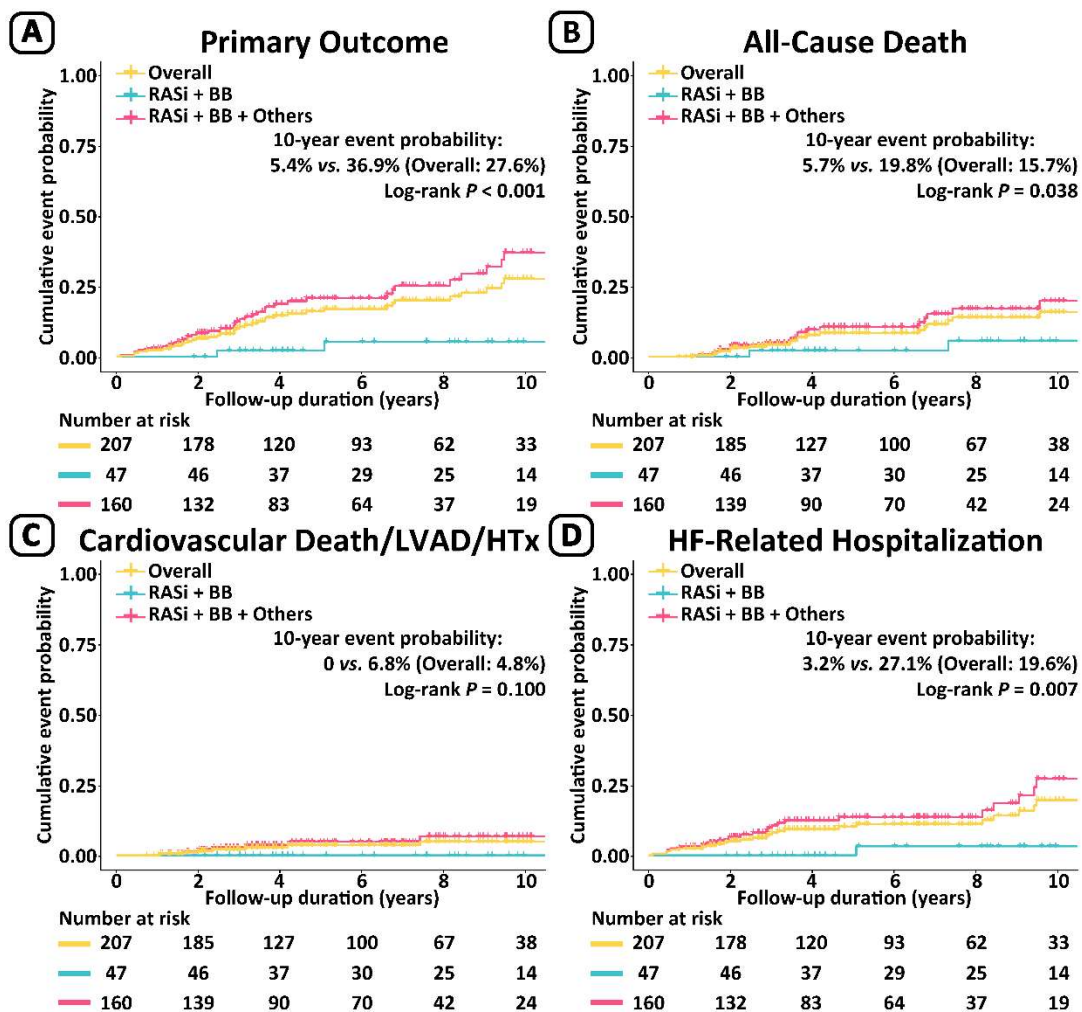
The long-term cardiovascular outcome of HFimpEF patients in this registry was generally favorable, with the majority of mortality in the overall cohort due to non-cardiovascular causes, potentially supporting the feasibility of drug minimization to only RASi and  $\beta$ -blockers in carefully selected patients.

**Keywords:**

Heart failure, Pharmacotherapy, Polypharmacy

**Figure:**

Survival analyses of the overall group, the RASi+BB group, and the RASi+BB+Others group. Abbreviations: HF, heart failure; HTx, heart transplantation; LVAD, left ventricular assist device.





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Abstract 6

**Wearables and AI in Advanced Heart Failure: WAI-HF. Study Design and Initial Experience**

Presenting author: C.S. Pizarro Perez

Department: Cardiologie

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**Purpose:**

Although mortality in advanced heart failure (AHF) has declined, recurrent hospitalizations remain a major driver of morbidity and reduced quality of life. This study aims to develop and validate a deep learning (DL) algorithm to predict imminent hospital admissions in AHF patients using wearable sensor data.

**Methods:**

WAI-HF is a prospective observational cohort study enrolling 200 patients with AHF ambulatory monitored for 12 months. Data are collected through a wrist-worn wearable device (Fitbit, USA), an electronic weight scale (Withings, France), and a mobile health application (Viduet Health, The Netherlands). The primary endpoint is a composite of all-cause hospitalizations and unplanned emergency department visits. A multimodal DL algorithm will be developed to detect dynamic changes in health parameters (resting heart rate, heart rate variability, respiratory rate, weight), physical activity (step count, energy expenditure), and clinical status (self-reported HF symptoms) associated with the endpoint. Model performance will be evaluated using AUROC, F1-score, sensitivity, specificity, and predictive values.

**Results:**

Recruitment is ongoing. To date, 11 patients have been monitored for a median of 40 days [IQR 27–43]. Preliminary physical activity data show a median of 1,324 steps/day [IQR 656–3,708] and a median daily distance of 1.2 km [IQR: 0.7 - 3.0]. The median value for resting heart rate is 69 bpm [IQR:60 - 87]. Moreover, a median 3-day weight variability of 0,13Kg [IQR: 0,025 – 0,2] has been observed.

**Conclusion:**

This study will provide novel insights into the use of wearable devices to monitor health status and predict outcomes in patients with AHF.

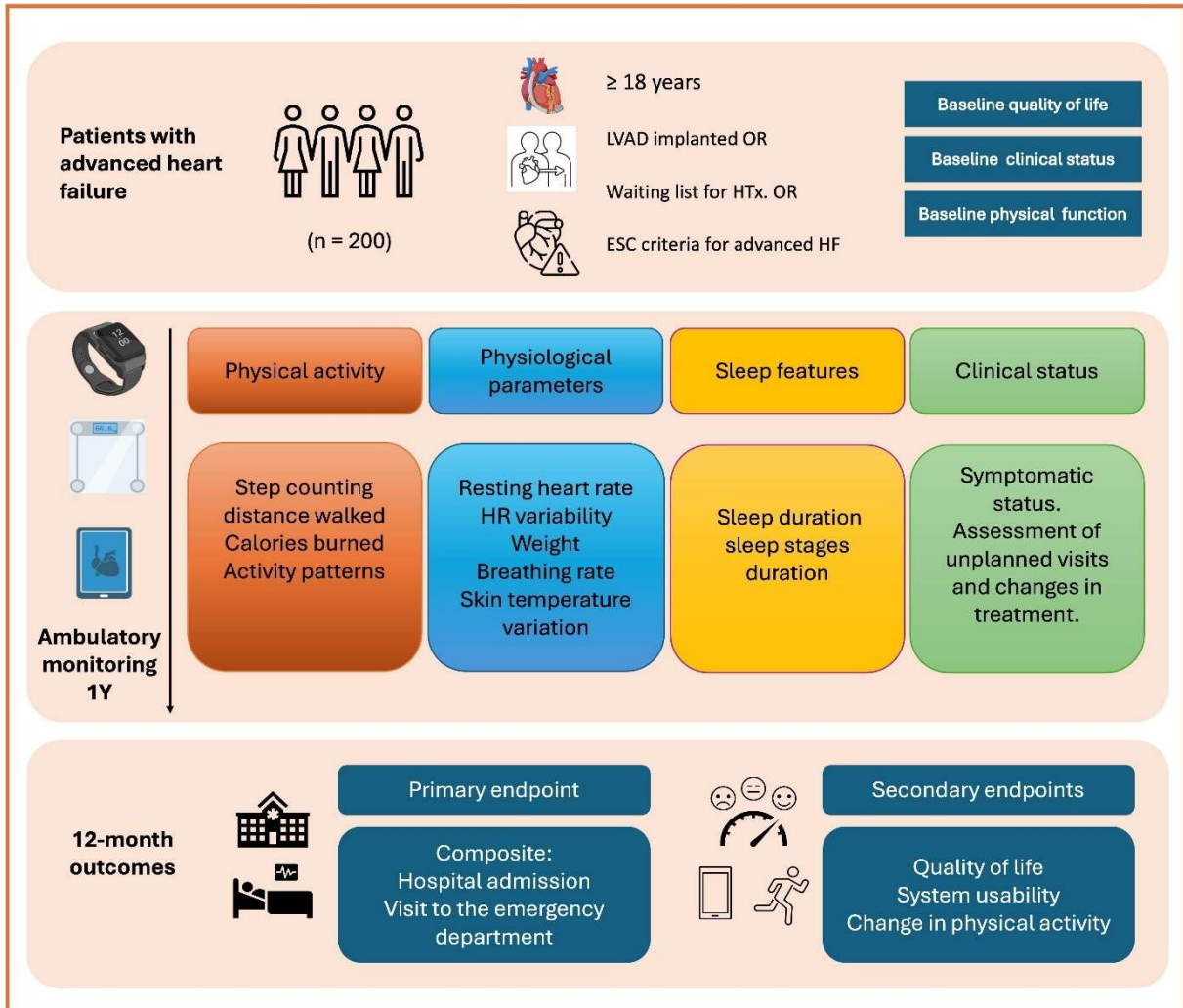
**Keywords:**

Advanced heart failure, Remote monitoring, Artificial intelligence



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**Figure:**





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Abstract 7

**40 Years of Heart Transplantation in Rotterdam**

Presenting author: B.C.J. van Dijk

Department: Cardiologie

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**Purpose:**

Over the past four decades, donor and recipient profiles and management after heart transplantation (HT) have changed markedly, driven by shifts in immunosuppressive therapy, donor legislation, the introduction of left ventricular assist devices (LVAD) and adoption of donation after circulatory death (DCD). We studied the impact of these changes on patient characteristics, post-HT malignancies and survival.

**Methods:**

We prospectively collected data from all consecutive adult HT recipients at our center, categorized into two cohorts: A (1984-1999, n=353) and B (2000-2024, n=402). Cohort definition was based on changes around 2000, including availability of donor hearts, early post-HT statin use and newer immunosuppressants.

**Results:**

Compared with cohort A, more women were transplanted in cohort B (17% vs. 33%,  $p<0.001$ ); while pre-transplant BMI and diabetes prevalence increased over time (3% vs. 13%,  $p<0.001$ ), as did renal dysfunction ( $p=0.002$ ). Furthermore, bridge-to-transplant LVAD use and DCD transplantation were introduced, affecting waiting list duration between cohorts (all  $p<0.001$ ).

Donor age increased (27 vs. 45 years,  $p<0.001$ ) with a shift in donor cause of death and percentage of female donors (42% vs. 57%,  $p<0.001$ ).

With the change in immunosuppression there was also a change in post-HT solid organ malignancies (both  $p<0.001$ ).

One- (90% vs. 87%) and five-year (80% vs. 82%) survival remained stable between cohorts, while ten-year survival improved significantly (56% vs. 72%,  $p<0.001$ ; Table 1).

**Conclusion:**

Over the past four decades, HT recipients have experienced longer waiting times with more co-morbidities, while receiving hearts from older donors. Despite these changes, short-term survival remained stable, while long-term survival improved.

**Keywords:**

Heart Transplantation



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**Figure:**

Table 1: recipient and donor characteristics, post-transplant malignancies and patient survival.

Continuous data are presented as median [IQR].

a Waiting list duration was available for 130 of the 353 patients in Cohort A.

b Maintenance immunosuppression data were available for 334 patients in Cohort A and 389 in Cohort B.

c Including malignancies of the lung, stomach, kidney, prostate, pancreas and breast.

d Among the 402 patients in Cohort B, 310 patients were eligible for evaluation of 5-year survival, with 254 patients (85%) reaching this milestone.

e Among the 402 patients in Cohort B, 244 patients were eligible for evaluation of 10-year survival, with 176 patients (72%) reaching this milestone.

	Cohort A 1984-1999 <i>n</i> = 353	Cohort B 2000-2024 <i>n</i> = 402	<i>P</i> -value
<b>Recipient</b>			
Age (years)	50 [43-55]	52 [44-59]	0.02
Female gender, <i>n</i> (%)	61 (17)	134 (33)	<0.001
<b>Pre-heart transplant diagnosis, <i>n</i> (%)</b>			
Cardiomyopathy	143 (41)	230 (57)	<0.001
Coronary artery disease	192 (54)	126 (31)	<0.001
Valvular	11 (3)	10 (3)	0.60
Congenital	5 (1)	19 (5)	0.01
Retransplant	2 (1)	7 (2)	0.14
Myocarditis	0 (0)	9 (2)	0.005
Dissection	0 (0)	1 (1)	0.35
BMI pre-HT (kg/m <sup>2</sup> )	23 [21-25]	24 [22-27]	<0.001
Diabetes pre-HT, <i>n</i> (%)	11 (3)	53 (13)	<0.001
Serum creatinine pre-HT (μmol/L)	111 [95-133]	119 [99-145]	0.002
LVAD, <i>n</i> (%)	0 (0)	38 (9)	<0.001
DCD, <i>n</i> (%)	0 (0)	48 (27)	<0.001
Waiting list duration (days)	184 [49-292] <sup>a</sup>	483 [191-907]	<0.001
<b>Donor</b>			
Age (years)	27 [20-36]	45 [34-54]	<0.001
Female, <i>n</i> (%)	147 (42)	231 (57)	<0.001
<b>Cause of death, <i>n</i> (%)</b>			
Head trauma	161 (55)	108 (27)	<0.001
Stroke	118 (40)	228 (57)	<0.001
Euthanasia	0 (0)	11 (6)	0.002
Other	14 (5)	54 (13)	<0.001
<b>Immunosuppressive therapy, <i>n</i> (%)</b>			
Induction therapy	242 (69)	379 (94)	<0.001
<b>Maintenance immunosuppression<sup>b</sup></b>			
Cyclosporine	259 (78)	43 (11)	<0.001
+ Mycophenolate Mofetil	17 (6)	23 (54)	<0.001
+ Prednisone	250 (97%)	39 (91)	0.08
+ Everolimus or Sirolimus	12 (5)	4 (9)	0.21
+ Azathioprine	76 (29)	0 (0)	<0.001
Tacrolimus	74 (22)	346 (89)	<0.001
+ Mycophenolate Mofetil	8 (11)	193 (56)	<0.001
+ Prednisone	66 (89)	249 (72)	0.002
+ Everolimus or Sirolimus	9 (12)	46 (13)	0.79
+ Azathioprine	8 (11)	1 (1)	<0.001
<b>Post-heart transplant malignancy, <i>n</i> (%)</b>			
Skin	55 (16)	49 (12)	0.18
Solid organs <sup>c</sup>	73 (21)	42 (10)	<0.001
Other	15 (4)	21 (5)	0.53
<b>Post-heart transplant survival, <i>n</i> (%)</b>			
One year	318 (90)	351 (87)	0.23
Five year	283 (80)	254 (82) <sup>d</sup>	0.56
Ten year	199 (56)	176 (72) <sup>e</sup>	<0.001