Combining Home Monitoring Temporal Trends from Implanted Defibrillators and Baseline Patient Risk Profile to Predict Heart Failure Hospitalizations (SELENE HF)

Study Design

- International, multi-center, prospective, observational, event-driven cohort study

- 34 centers in Italy and Spain

- 918 ICD (dual-chamber, DX and CRT-D) patients with NYHA Class II-III, LVEF ≤ 35%

- To develop and validate an algorithm to predict heart failure (HF) hospitalization based on 7 Home Monitoring parameters and a baseline risk stratifier (based on the Seattle Heart Failure Model)

- Home Monitoring parameters: Mean heart rate, mean heart rate at rest, premature ventricular contractions (PVC), atrial burden, heart rate variability (HRV), patient activity, and thoracic impedance (TI)

- Primary endpoint: First HF-related hospitalization

- Collection of ≥ 50 primary endpoint events

- Post-hoc randomization into 2 cohorts for algorithm development and validation

Main Results

The algorithm predicted HF hospitalizations early, with high sensitivity and with a low false alert rate.

Endpoint	Sensitivity (%)	Alerting time (days)	False alert rate (ppy)
First post-implant HF hospitalization	65.5 (45.7-82.1)	42 (21-89)	0.69 (0.64-0.74)

Table 1: Main performance parameters of the predicting algorithm
(Numbers in brackets: confidence intervals, except for alerting time (IQR))

66% sensitivity
2 out of 3 hospitalizations were predicted

42 days alerting time
may allow proactive care to possibly prevent hospitalizations

**Only 0.7 false alerts per patient year**
may keep workload low

Clinical Relevance

- HF is associated with poor prognosis and high hospitalization rates. Recurrent hospital admission due to HF result in a gradual worsening of the health status of patients and constitutes a considerable healthcare burden.

- Early prevention of HF decompensation is a key strategy to improve patient outcomes. A CIED-based algorithm that predicts impending HF hospitalization could help reduce hospitalization among high-risk HF patients.

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The Newly Designed Algorithm is Early and Highly Effective in Predicting HF Hospitalizations

Patient case: Prediction of a HF Hospitalization Event
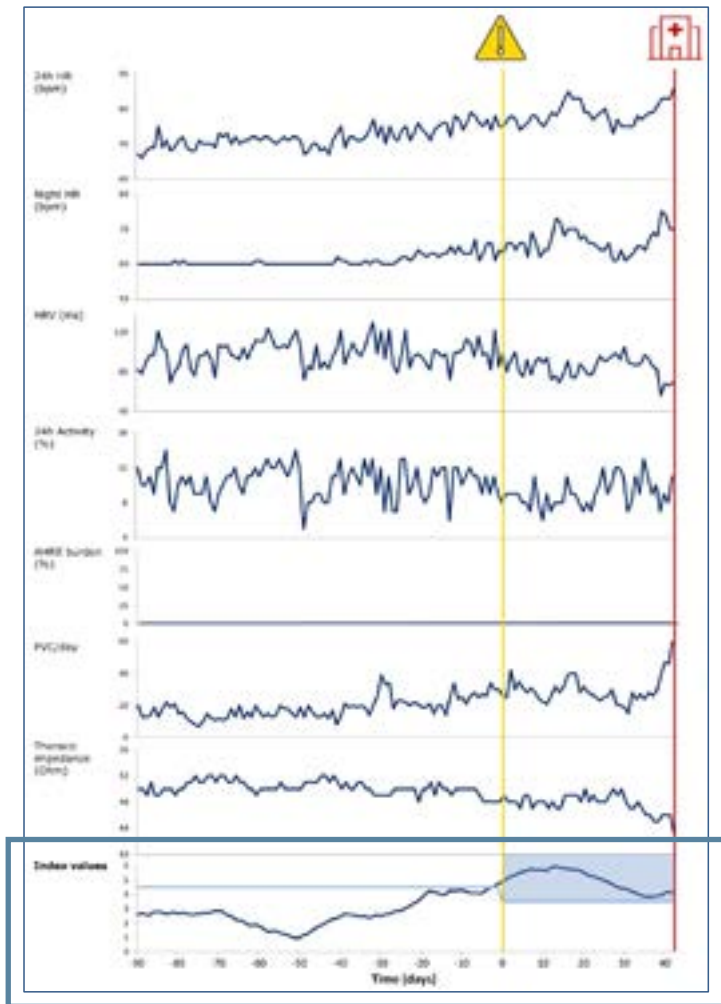
Trends of Home Monitoring variables and the predicting index in an 82-year-old man preceding a hospitalization event.

Relevant changes in trends of **multiple Home Monitoring parameters** contribute to a **single predicting index**.
The index increases over time, ultimately leading to an alert.

The alerting time of 42 days prior to hospitalization would have allowed proactive care and possibly would have prevented the hospitalization.

Main drivers of the index increase:
Mean heart rate (24h HR)
Mean heart rate at rest (Night HR)
Patient activity (24h Activity)
Premature ventricular contractions (PVC /day)
Thoracic impedance (TI)

The predicting index appears in the box:

— Day of alert
— Day of HF hospitalization
— Threshold of predicting index

In-alert state (period of increased risk of HF hospitalization)

What the Authors Say:

" Our algorithm generated alerts at a median of 42 to 61 days before events, allowing sufficient time for patient contact, investigations, and preventive measures to reduce hospitalizations. "

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