Symptom-Rhythm Correlation Patterns in Patients Undergoing Ambulatory ECG Monitoring: Analysis of over 1 Million Patients

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Background

- Symptoms are the most common indication for ambulatory cardiac monitoring.
- However, symptom-rhythm correlation (SRC) has not been well described, particularly across the spectrum of different rhythms.

Objective

- We assessed SRC in patients undergoing patch-based long-term continuous ambulatory ECG monitoring (LTCM) up to 14 days.

Methods

- Retrospective cohort study of Zio® monitor or XT LTCM (iRhythm Technologies, San Francisco, CA) devices prescribed in the US between June 2023 and July 2024 **(Figure 1)**.
- Devices included a patient-activated button to document symptoms during the continuous recording.
- Inclusions: Patients ≥18 years; Devices worn for >7 to 14 days.
- Exclusions: 100% AF.
- Symptoms documented within a ±45 second window of an arrhythmia were considered rhythm-correlated.
- For each rhythm type, a patient was classified as having SRC if there was ≥1 rhythm-correlated button press during the wear period, regardless of the number of button presses that were not temporally associated with an arrhythmia.
- Data were further stratified by observed symptom frequency, defined as the number of button presses/day:
  - Daily Symptoms (≥ 1/day), or
  - Non-Daily Symptoms (< 1/day)
- ECG data was analyzed via a deep-learned AI algorithm and confirmed by certified cardiographic technicians.

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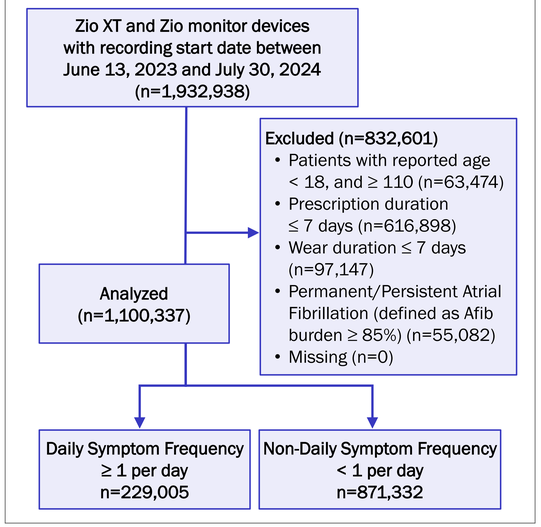
CEM0014.01

The Zio monitor is a prescription-only, single-use ECG monitor that continuously records data for up to 14 days. It is indicated for use on patients who may be asymptomatic or who may suffer from transient symptoms such as palpitations, shortness of breath, dizziness, lightheadedness, pre-syncope, syncope, fatigue, or anxiety.

Results

Figure 1. Study Diagram



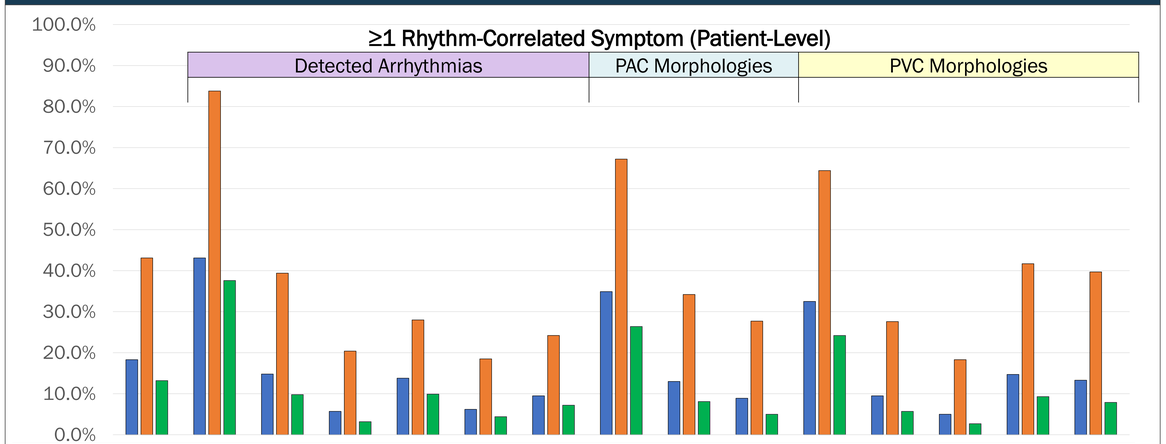
Cohort Description

- Cohort size: 1,100,337; age 61.4 ± 17.6 years; 55.6% female.
- 20.8% (229,005) had Daily Symptoms.
- 79.2% (871,332) had Non-Daily Symptoms, including 284,784 patients with no documented symptoms.
- 78.5% had one or more arrhythmias (AF, SVT, VT, VF, Pause or 2nd Degree or Complete Heart Block):
  - AF (7.2%), SVT (71.3%), VT (25.5%), VF (0.01%), Pause (3.2%) and 2nd Degree or Complete Heart Block (1.5%).
- Most patients had atrial (99.6%) or ventricular (98.8%) ectopic beats.

SRC Findings

- There was wide variation in SRC by arrhythmia type and symptom frequency **(Figure 2)**.
- SRC was highest for AF, and isolated ectopic beats (SVE and VE).
- Among patients with AF, SRC was 43.1%, including:
  - 83.8% SRC for patients with Daily Symptoms, and
  - 37.6% SRC for patients with Non-Daily Symptoms
- SRC was 34.9% for isolated SVE, including:
  - 67.2% SRC for patients with Daily Symptoms, and
  - 26.4% SRC for patients with Non-Daily Symptoms
- SRC was 32.5% for isolated VE, including:
  - 64.4% SRC for patients with Daily Symptoms, and
  - 24.2% SRC for patients with Non-Daily Symptoms
- SRC varied, but was low (<15%) for patients with other arrhythmias or PAC/PVC morphologies.
- SRC was higher for the Daily Symptom group vs. the Non-Daily Symptom group across all rhythms.
- Among patients with any arrhythmia detected, SRC was low (18.3%), including:
  - 43.1% SRC for patients with Daily Symptoms, and
  - 13.2% SRC for patients with Non-Daily Symptoms

Figure 2. Symptom-Rhythm Correlation: Arrhythmias and Ectopic Beats



Rhythm Type	Any Arrhythmia†	AF	SVT	VT	VF	Pause	AV Block	Isolated SVE	SVE Couplet	SVE Triplet	Isolated VE	VE Couplet	VE Triplet	Bigeminy	Trigeminy
Detections††															
Total	863,393	79,329	784,824	280,287	116	35,032	16,715	1,096,264	951,732	813,767	1,087,341	667,524	306,084	351,467	352,788
Daily	148,061	9,450	133,549	41,251	25	4,335	2,208	228,134	178,117	138,680	224,954	116,725	45,222	58,709	59,674
Non-Daily	715,332	69,879	651,275	239,036	91	30,697	14,507	868,130	773,615	675,087	862,387	550,799	260,862	292,758	293,114
SRC†††															
Total	18.3%	43.1%	14.8%	5.7%	13.8%	6.2%	9.5%	34.9%	13.0%	8.9%	32.5%	9.5%	5.0%	14.7%	13.3%
Daily	43.1%	83.8%	39.4%	20.4%	28.0%	18.5%	24.2%	67.2%	34.2%	27.7%	64.4%	27.6%	18.3%	41.7%	39.7%
Non-Daily	13.2%	37.6%	9.8%	3.2%	9.9%	4.4%	7.2%	26.4%	8.1%	5.0%	24.2%	5.7%	2.7%	9.3%	7.9%

† 'Any Arrhythmia' includes episodes of AF ≥30 sec, SVT ≥90 bpm & ≥4 beats, VT ≥100 bpm & ≥4 beats, any VF, Pause ≥3 sec, and/or AVB (any 2nd Deg or CHB).
†† 'Detections' denotes number of patients with detected rhythm out of the total study population (N = 1,100,337), Daily Symptoms group (N = 229,005), or Non-Daily Symptoms group (N = 871,332).
††† 'SRC' reflects % patients with ≥1 rhythm-correlated button press during the wear period from among patients with detection of each rhythm. Reported for total population, Daily and Non-Daily groups.

Limitations

- SRC was defined as requiring only one temporally associated arrhythmia. This could have been coincidental in patients who had a high volume of non-correlated button presses.
- Symptoms may have been present but not reported by button press in some cases.

Conclusions

- This is the largest study characterizing symptom-rhythm correlation by rhythm type in ambulatory monitoring.
- The results demonstrate that **AF and ectopy** were the rhythms most correlated with patient symptoms.
- **Overall symptom-rhythm correlation was low**, but higher for patients with Daily Symptoms than Non-Daily Symptoms.

Disclosures

- AJ Battisti, R Pinkerton, V Fokin, and B Wright are employees of and have received equity from iRhythm Technologies, Inc.
- Dr. Turakhia has received equity from iRhythm, Connect America, Evidently, PocketRN, AliveCor, and Hippocratic.ai. Dr Turakhia is an employee and corporate officer of iRhythm Technologies Inc.