

Continuous Remote Patient Monitoring In Patients With Heart Failure (CASCADE Study): Mixed Methods Feasibility Study

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PURPOSE / OBJECTIVES

Heart failure (HF) is a prevalent chronic disease associated with increased mortality and morbidity. HF is a leading cause of hospitalizations and readmissions in the United States. We hypothesize that the use of a continuous noninvasive remote monitoring solution with machine learning analytics will lead to an earlier and more accurate prediction of decompensation and help to prevent HF readmissions. The primary aim of this study is to determine the feasibility and preliminary efficacy of a continuous remote monitoring solution in post discharge HF patients at NorthShore University HealthSystem (NSUHS).

Primary Outcomes

- Feasibility will be determined by evaluating provider and patient acceptability and satisfaction through qualitative measures using the affective adaption of the technology model [1] and by determining the study attrition and completion rate.
- Preliminary efficacy will be determined by comparing the study group readmission rate with a retrospective cohort readmission rate.

MATERIAL & METHODS

This is a prospective, mixed-methods, nonrandomized, open-label feasibility study with 3 phases.

- Phase 1 (n=5) soft launch (completed) [2]
- Phase 2 (n=15) calibration and testing period to evaluate and optimize the workflow, monitoring protocol, and notification mechanisms (completed)
- Phase 3 (n=45) pilot period of the optimized study protocol

Participants

- Eligible participants are recruited from patients hospitalized at NSUHS with an HF exacerbation.

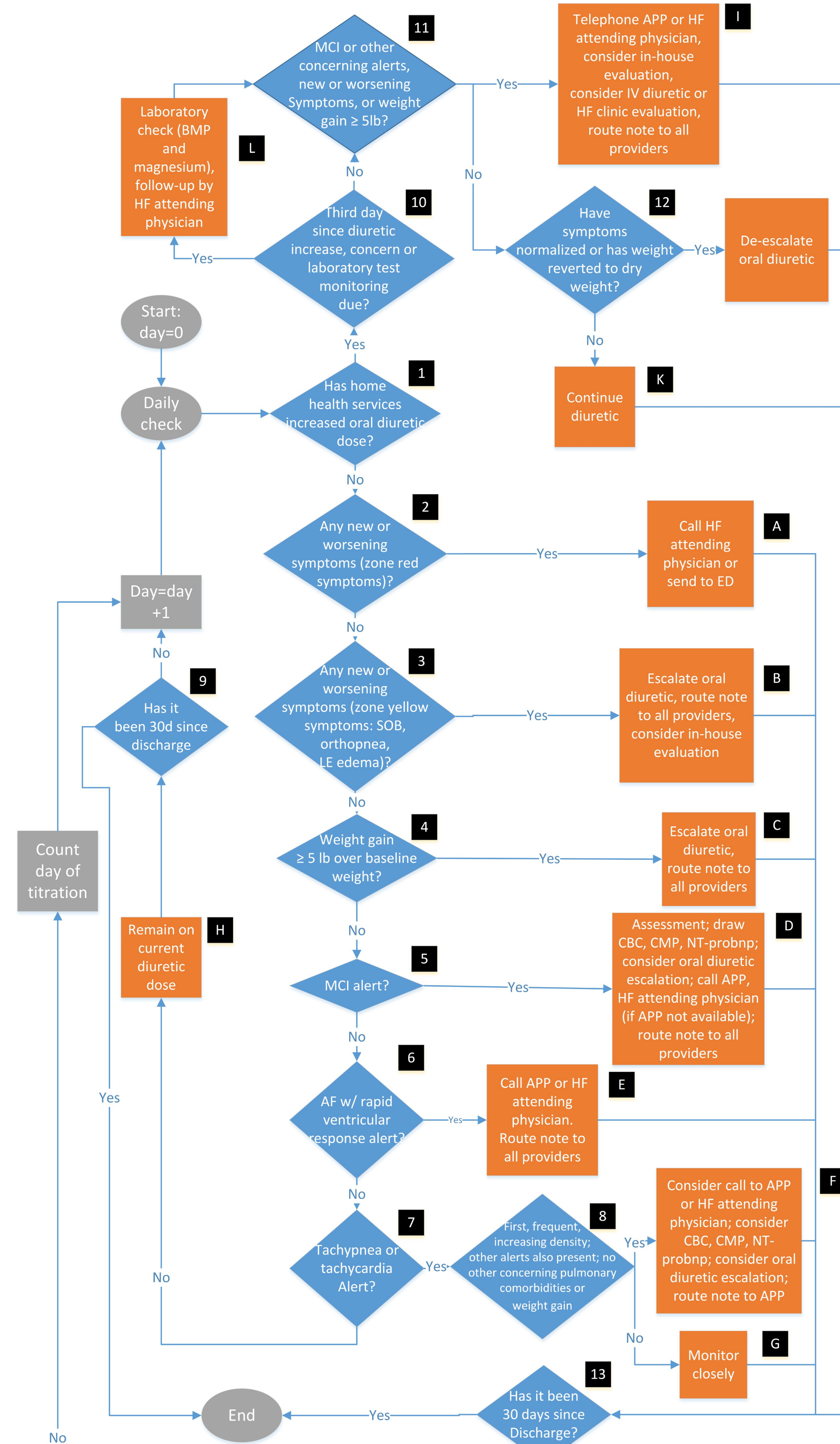
Workflow

- physIQ's pinpointIQ™ solution is a continuous remote monitoring solution using wearable a biosensor that streams physiologic data to the cloud where artificial analytics are applied and notifications are generated to the clinical team through a web-based portal.
- Eligible, enrolled patients participate in the program for 30 days. Participants also complete a daily symptom and daily weight survey.
- MCI is a machine-learning based analytic that trains on patient data and identifies the difference between expected and observed physiological data.
- The physiological data is analyzed, and notifications are triggered when tachypnea, tachycardia, bradycardia, atrial fibrillation, atrial fibrillation with rapid ventricular response, or MCI events occur
- If pre-specified alerting criteria are met, a notification is triggered and a predetermined management pathway is completed by the monitoring nurse and clinical team.

RESULTS

The results of Phase 1 are summarized here [2]. The study team evaluated phase 1 results and workflow process and modified the monitoring protocol. Phase 2 is completed. Phase 3 is ongoing [3]. In Phase 1, 2/5 (40%) of patients were readmitted. There were 128 clinical notifications during Phase 1, and staff responded to 127/128 (99.2%) of alerts. Patient adherence for sensor-wear and quality data were high.

WORKFLOW PATHWAY



APP: Advanced Provider Practitioner; HF: Heart Failure; MCI: Multivariate Change Index; CBC: Complete blood count; BMP: Basic metabolic panel; CMP: Complete metabolic panel; Mag: Magnesium; NT-proBNP: N-terminal pro beta natriuretic peptide; Afib: Atrial fibrillation; SOB: Shortness of breath; LE: Lower extremity; ED: emergency department

FIGURES

Figure 1

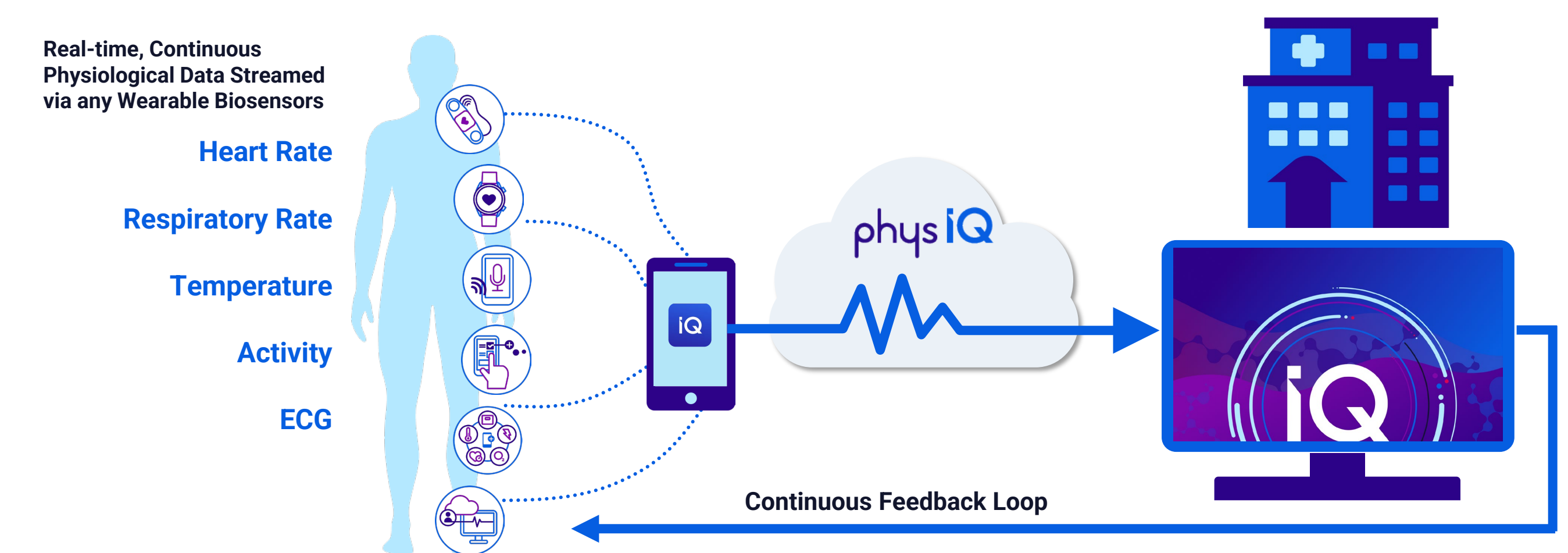
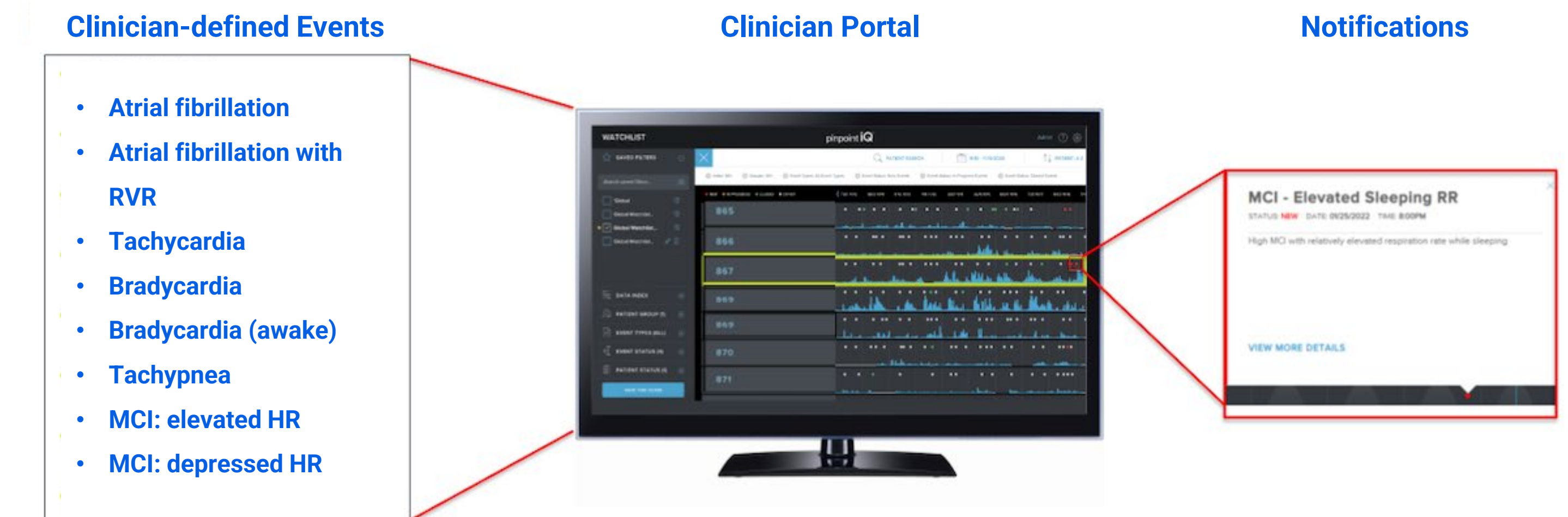


Figure 2



SUMMARY / CONCLUSION

The CASCADE study is a feasibility study using a continuous remote monitoring solution with machine learning analytics and an escalating, cascading notification system with structured care pathways to monitor and manage post-discharge HF patients. As far as we know, this is the first study that uses cRPM with machine learning algorithms, a cascading notification system, and a defined intervention pathway. A cRPM solution may help decrease HF readmissions and may also help lay the groundwork for the use of a cRPM system in other high-risk patient populations.

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