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Upstream Detection of Arrhythmias

A Population Health Framework for Proactive Monitoring

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iRHYTHM® PAS Predictive Arrhythmia Solutions™

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EXECUTIVE SUMMARY

Cardiac arrhythmias are clinically consequential and systematically under-detected in modern healthcare. Atrial fibrillation alone affects millions of US adults,[1,2] yet, across most health systems, a meaningful share of clinically actionable arrhythmias remain undiagnosed until patients present with an acute clinical event that may have been preventable with earlier diagnosis.[3–5] **The signal is in the data; the system has not been built to listen for it.**

Predictive Arrhythmia Solutions™ (PAS)* is designed to close that gap, integrating capabilities into a single operational framework:

- Candidate prioritization based on patient data (e.g., clinical history, healthcare use)
- Targeted ambulatory cardiac monitoring in addition to symptom-driven evaluation
- Confirmed arrhythmias enable care teams to pursue guideline-directed management

The framework does not replace clinical judgment — it adds an upstream layer that helps prioritize patients for monitoring before the disease declares itself acutely.

This paper examines the operationalization of PAS at Desert Oasis Healthcare (DOHC), an integrated delivery network managing patients with substantial cardiometabolic burden under value-based contracts.

For health systems operating in risk-bearing environments, the relevant question is no longer whether such patients exist within their attributed populations — it is whether the system will identify them proactively, or only after a stroke, a heart failure admission, or a sudden cardiac event leads to a diagnosis.

The Challenge: A Reactive System Under Strain

Health systems face mounting pressure to improve cardiovascular outcomes while managing rising utilization,[6,7] constrained specialty capacity,[8] and accelerating exposure to risk-bearing contracts.[9]

Cardiac arrhythmias — including atrial fibrillation, ventricular tachycardia, and high-grade conduction system disorders — remain major contributors to acute care utilization and downstream cardiovascular morbidity and mortality.[10]

Yet many clinically significant arrhythmias remain undetected for years, often without symptoms, before they are diagnosed.[11,12] When detection finally occurs, it often happens in acute care setting designed to treat the end-results of an arrhythmia: an emergency department admission for stroke,[3] a heart failure decompensation,[13,14] a syncopal fall,[15] or a sudden cardiac event.[16] By that point, the opportunity for prevention has passed.

Patients with chronic cardiovascular and cardiometabolic diseases — diabetes,[17,18] chronic kidney disease,[19,20] coronary artery disease,[21] COPD,[22,23] and heart failure — face substantially elevated arrhythmia risk.[24,25] Long before diagnosis, these patients exhibit recognizable patterns within routine clinical and utilization data: comorbidity trajectories, medication signatures, vital sign anomalies, and changes in healthcare utilization.[26–28]

Patient data contains meaningful patterns that most health systems are not fully leveraging. Arrhythmia detection pathways remain predominantly symptom-driven.[29] Monitoring is initiated after a patient complaint, an incidental finding, or an acute event — not as a result of proactive and systematic candidate identification.

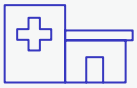
PREDICTABLE DOWNSTREAM CONSEQUENCES OF THE REACTIVE APPROACH



Patients remain undiagnosed until complications occur



Monitoring resources are inconsistently and inefficiently deployed



Specialty clinic capacity is consumed by low-yield referrals

This is **not a problem of demand.** It is a **problem of imprecise decision-making of when to utilize cardiac monitoring.** Legacy fee-for-service models historically rewarded testing volume over deployment of diagnostic resources based on a proactive clinical identification strategy. As health systems transition into value-based and risk-bearing contracts, that model is no longer financially or operationally sustainable.

The opportunity is not to detect more arrhythmias.
It is to detect clinically actionable arrhythmias earlier — before preventable events occur.

How Arrhythmia Detection Became Reactive

Modern arrhythmia detection workflows were built in an earlier era of medicine. When diagnostic tools were limited and longitudinal data fragmented, symptom-driven evaluation was the only practical strategy. Patients entered diagnostic pathways after presenting with palpitations, syncope, stroke, or heart failure exacerbation; the health system responded.

TWO STRUCTURAL CHANGES HAVE SINCE RESHAPED THE LANDSCAPE

1. Electronic health records and claims systems now capture rich longitudinal data on most patients in most health systems. This information has historically been used for documentation, billing, and retrospective reporting — not for prospective identification of disease risk.

2. The burden of cardiometabolic disease has grown substantially. Populations with diabetes, chronic kidney disease, and atherosclerotic cardiovascular disease — each carrying elevated arrhythmia risk — now represent a larger and more medically complex share of attributed lives.[7]

Ambulatory cardiac monitoring technology has advanced in parallel. Extended-duration ambulatory monitors and continuous rhythm recording have meaningfully improved the ability to capture intermittent arrhythmias.[30,31] But the upstream decision to initiate monitoring has remained tethered to symptom-driven clinical judgment. Better tools have not, by themselves, produced better population-level detection.

The result is a paradox: Health systems possess more relevant data than at any point in their history, yet arrhythmia detection still occurs, in most cases, only after an adverse event — reflecting a longstanding pattern of reactive care delivery.

Predictive Arrhythmia Solutions (PAS)

A Proactive Monitoring Framework

Advances in data analytics now make it possible to shift arrhythmia identification upstream.[27,28,32] Rather than waiting for symptoms or events, health systems can analyze longitudinal patient data to understand which candidates may be appropriate for further evaluation of a clinically actionable arrhythmia.

PAS is a population health framework built around this principle. PAS is not a single technology; it is the integration of three coordinated capabilities, each addressing a distinct gap in the existing detection pathway.

THE FRAMEWORK'S VALUE IS IN INTEGRATING THREE CAPABILITIES

1	2	3
Predictive Candidate Identification	**Targeted Proactive Ambulatory Cardiac Monitoring**	**Structured Care Pathways**
Analyze longitudinal clinical and utilization data to support prioritization of patients who may be appropriate candidates for evaluation of a clinically actionable arrhythmia.	Long-term continuous ambulatory cardiac monitoring is proactively deployed using a Zio® monitor to aid a physician in determining whether a patient has an arrhythmia.	Patients with confirmed arrhythmias are routed into care pathways — anticoagulation, rate or rhythm control, EP consultation, device evaluation — so detection translates into action.

Predictive candidate prioritization without monitoring infrastructure produces a list. Monitoring without targeting produces noise. Targeting without bringing the information to the appropriate pathways produces diagnoses without follow-through. Together, the three capabilities allow health systems to align diagnostic intensity with patient risk — and clinical action with diagnostic finding.

Note: Predictive models do not diagnose arrhythmias. They identify candidates for evaluation. Confirmatory testing, clinical interpretation, and treatment decisions remain with the care team.

Potential Benefits of Proactive Monitoring

When integrated into population health programs, PAS is designed to deliver measurable improvements across three coordinated dimensions.



Clinical

- Earlier identification of clinically actionable arrhythmias before acute events[4,32]
- Reduced time to confirmed diagnosis[33,34]
- Earlier initiation of guide-line-concordant therapy, including anticoagulation, rate or rhythm control, and advanced therapies where indicated[10,33,34,35]



Operational

- Greater likelihood of clinically actionable findings per ambulatory cardiac monitor placed[30,36]
- Better alignment of specialty capacity with patient risk[8]
- Fewer low-yield in-person cardiology consultations, with more cases resolved upstream[36,37]



Financial

- Reduction in preventable acute care utilization — emergency visits and inpatient admissions tied to arrhythmia presentations[31,38]
- Improved total cost of care performance within targeted populations[31,38,40]
- Alignment with value-based care objectives, including quality, resource utilization, and total cost of care[9,41]

These benefits compound. The clinical case for proactive detection is well-established. The operational and financial cases follow when detection is targeted, monitoring infrastructure is integrated, and care pathways are evidence-based.

Implementation in Practice: Desert Oasis Healthcare

Desert Oasis Healthcare (DOHC) is an integrated healthcare delivery network managing cardiovascular risk across an attributed patient population with substantial cardiometabolic burden. Operating in a mixed-payer environment with significant value-based and risk-bearing exposure, DOHC has been an early operational site for the PAS framework, integrating predictive arrhythmia identification into clinical workflow.

What follows draws on the perspective of DOHC service line leadership and reflects the early operational reality of running a predictive arrhythmia detection program.

Why Proactive Detection Became a Population Health Priority

Within DOHC's attributed population, leadership identified a pattern familiar to most integrated systems carrying substantial cardiometabolic risk: Arrhythmia diagnoses were clustering around acute presentations rather than emerging through systematic outpatient identification. Patients arrived in the emergency department and the workup that followed often revealed an arrhythmia that had been clinically present for months or years.

From the population health perspective, this represented a recurring set of avoidable failures — clinical, operational, and financial.

Tom Brazeal, PharmD, APh, BCACP, associate director technology and process, population health and prescription management at Desert Oasis Healthcare, explains, "We noticed that first diagnoses of arrhythmias were happening at the hospital. Hospitalizations, whether they be staying for several nights in an acute setting or in the ER, cost more and lead to poorer patient outcomes." For DOHC, the goal was to identify patients earlier, rather than waiting for the hospital to become the point of diagnosis.

The approach also aligned with DOHC's broader population health priorities. Keeping patients out of the hospital was not only a financial imperative; it was central to patient experience and quality of care. "Patients want to be home. They don't want to be in the hospital," Dr. Brazeal says. "If we can avoid cost in those areas too, it's a win-win on both sides."

Why a Predictive Model — Rather Than Symptom Driven

The conventional alternatives to a predictive approach are familiar: expand symptom-driven referral, broaden criteria, or deploy ambulatory monitoring more liberally across the population. Each has limitations. Symptom-driven approaches miss silent disease by definition. Broader approaches dilute diagnostic yield and strain specialty capacity. Liberal monitoring deployment increases costs without proportional clinical benefit.

DOHC leadership concluded that patient identification needed to operate upstream of the symptom — where the data already exists, but the system has historically not looked.

The decision also reflected DOHC's operating culture. The organization has a history of using internal data to identify trends, evaluate patient demographics, and look for opportunities to improve care delivery. It also had prior experience with the Zio® cardiac monitoring service, which made adopting a proactive model a logical step.

> We have a long history of being early adopters of technology and being very willing to work with early projects that are innovative and potentially showing a benefit to our organization and to our population. — Dr. Brazeal

How the Model Identifies Candidates

Patient prioritization draws on a combination of clinical and utilization features routinely captured in the electronic health record — including comorbidity trajectories, laboratory values, medication patterns, vital signs, and healthcare utilization signatures.

At DOHC, the initial focus was shaped by both internal observations and medical literature. The organization examined which patients were being diagnosed with arrhythmia in the hospital and then looked for the populations most likely to benefit from proactive monitoring.

"Of the patients initially diagnosed with arrhythmias at the hospital, we set out to determine: Who are those that are at highest risk?" Dr. Brazeal says.

That analysis pointed to patients with cardiometabolic and chronic disease burden, including COPD, chronic kidney disease, diabetes, and chronic coronary artery disease. These were patients who could plausibly benefit from a more proactive clinical identification strategy, even when they were not presenting with arrhythmia-related symptoms.

Workflow Integration

The success of proactive population health intervention depends on both model performance and workflow integration. DOHC implemented Lucem Health's Reveal Arrhythmias solution,† an AI-enabled candidate prioritization program that integrates predictive output into existing cardiac monitoring workflows to identify candidates for evaluation. Candidate prioritization feeds directly into infrastructure that supports efficient clinician-initiated cardiac monitor ordering.

Just as important, DOHC designed the program to minimize disruption for clinicians, centralizing much of the work within a smaller team. Providers, medical assistants, and nurses received education and handouts to share with patients and help answer basic questions. More complex questions were escalated to clinically trained experts who could speak to the clinical need for monitoring and the possible implications of a diagnosis.

DOHC also streamlined the ordering process. For patients in the program, ordering was intentionally made faster and easier than the standard process, with information automatically prepopulated for clinician review and order placement.

> "It's actually quicker for me to order this on a patient versus one that would be ordered through our cardiology clinic because of the way it was set up in terms of reducing the impact to workflows." — Dr. Brazeal

The deliberately contained operating model: Start with a centralized team, work through the process, evaluate impact, and determine whether permanent workflow changes are warranted.

Defining Success: Establishing Evaluation Goals

An evaluation framework typically spans clinical, operational, and financial dimensions.

Clinical	Operational	Financial
• Yield of clinically actionable findings • Time from candidate prioritization to confirmed diagnosis • Downstream initiation of guideline-concordant therapy	• Alignment of monitoring utilization with patient risk • Specialty referral efficiency • Provider experience	• Total cost of care impact within the targeted cohort • Avoided downstream acute utilization • Performance under risk-bearing contracts

Because the program remains in an early phase, DOHC is still evaluating final metrics. Even so, the organization has identified several measures that matter most: diagnostic yield, clinically meaningful diagnoses that influence healthcare costs, hospitalization trends, and prescribing patterns.

DOHC is also evaluating whether proactive detection changes the setting of first diagnosis. The question is not only whether the program finds arrhythmias, but also whether it reduces the number of patients whose first arrhythmia diagnosis occurs during a hospital encounter.

> Our aim is to decrease the hospitalizations. — Dr. Brazeal

"We're not just looking at this population, but our population as a whole and how frequently we're having patients being first diagnosed with an arrhythmia in the hospital versus our benchmark."

Early Implementation Lessons

1 Start with Metrics

- Define the goal
- Determine key metrics

2 Build Team Buy-In

- Ensure cross-functional alignment
- Consider workflow impact on teams

3 Develop a Communication Strategy

- Ensure messaging is clear, credible, and reassuring
- Account for the patient communication environment

4 Stay Flexible

- Monitor program performance
- Gather feedback and adjust quickly

Early Implementation Lessons Cont.

The most important implementation lesson so far is that proactive detection requires a comprehensive communication strategy.

For DOHC, patient outreach quickly emerged one of the most complex aspects of the program. Patients needed sufficient information to understand why they were being contacted and why monitoring was recommended, while communication also needed to be clear, reassuring, and credible.

That challenge is heightened by today's patient communication environment. Health systems are contacting patients in a world of constant spam, robocalls, phishing attempts, and health-related scams. As a result, even legitimate outreach may be ignored or mistrusted if it does not feel familiar or credible.

"We always have to keep the context in mind whenever we're doing any kind of outreach," Dr. Brazeal says. "What's the caller ID that we're calling on? What's the caller ID that we're sending SMSs from? When we're introducing ourselves, how are we identifying ourselves?"

Those details affected how DOHC structured phone calls, text messages, emails, and personalized outreach.

The organization adjusted as it learned which messages patients opened, which calls they answered, and what language helped patients feel informed without feeling alarmed. "You also have to consider the level of information you're going to give to these patients. How much do you tell them without scaring them?" Dr. Brazeal explains. "We had to be careful with our wording."

For other organizations considering a similar model, Dr. Brazeal's advice is to begin with the metrics and the team. A proactive program needs a clear definition of what it is trying to improve, how improvement will be measured, and how the workflow will affect the people expected to support it. Team buy-in is equally important. If the program creates burden or if the operational team does not see the same value leadership sees, implementation will be difficult to sustain.

Finally, DOHC's experience underscores the need for flexibility. Proactive detection programs require active monitoring, fast adjustments, and regular feedback from the people doing the work. "You have to remain flexible," Dr. Brazeal explains. "You have to be willing to make changes quickly and on the fly."

Looking Ahead

For DOHC leadership, proactive identification provides an opportunity to identify patients earlier, before avoidable utilization or disease progression occurs. "It's really about trying to identify patients before they end up in the hospital," Dr. Brazeal says.

For health systems operating under value-based contracts, this is the broader potential of proactive identification: using the data already present in the system to surface candidates earlier, focus intervention where it is most likely to matter, and reduce the likelihood that the hospital becomes the first place an arrhythmia is diagnosed.

Call to Action

Three conditions have converged for the first time in cardiovascular care: the clinical evidence base supporting earlier arrhythmia intervention is expanding,[10,33,34,35] longitudinal patient data sufficient to prioritize candidates already lives within health system infrastructure,[26,27,42] and ambulatory cardiac monitoring has reached the price-performance threshold for population-scale deployment.[31,38,40]

What has been missing is an integrated framework to connect them.

PAS Provides That Framework

The capability is not theoretical. It is being operationalized today, in real population health programs, at organizations like DOHC — built on infrastructure most health systems already own, and aligned with the value-based and risk-bearing contracts most health systems are already accountable to.

The strategic implication for health system leadership is straightforward: The patients most likely to benefit from earlier detection are already present within your attributed population. The data required to identify them already lives within your systems. The remaining decision is not whether to act, but how quickly the operational capability gets built.

Next Steps

Health systems interested in exploring proactive arrhythmia detection* can engage with the iRhythm Technologies team through two initial evaluation options:

1

POPULATION FEASIBILITY ASSESSMENT

For population health, analytics, and service line leadership

An exploratory analysis designed to estimate predictive yield, target cohort size, and operational considerations within the attributed population

2

EXECUTIVE BRIEFING

For clinical, operational, and finance leadership

A strategic discussion focused on the potential role of proactive arrhythmia detection within value-based care initiatives

Following the initial evaluation, organizations may choose to further assess pilot implementation and operational planning.

For additional information, contact:

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* Patient identification models and algorithms are not part of the Zio service.

† Lucem Health utilizes EHR data to prioritize potential candidates for evaluation for arrhythmia, it does not represent functionalities of any Zio branded medical device.

Safety Info: https://app.myzio.com/zio-at-safety and https://app.myzio.com/zio-mon-safety

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