XANDAR KARDIAN

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Continuous Health Monitoring in End-of-Life Care: A Case Study

How the Xandar Kardian XK300-H offered clarity during the final stage of life.

White Paper • 2025

Disclaimer: This image is for illustrative purposes only and does not depict actual patients or events.

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Executive Summary

After being diagnosed with advanced pancreatic cancer, Rod M. chose to return home to spend his last moments surrounded by family. For two weeks, he was monitored continuously with the XK300-H radar sensor, which ambiently recorded his breathing, heart rate, movement, and sleep without ever disturbing his rest. Honoring his wish, this case study shares these observations so that his experience may inform future care and bring clarity to others at the same stage of life.

Six days before his passing, marked changes became visible: sleep extended to nearly 20 hours a day, respiratory rate dropped below 12 breaths per minute, and heart rate rose well above his usual range. Other measures, such as variability in breathing and airflow, or breathing waveform, also shifted in measurable ways.

Findings from this case reflects what has been seen in 300+ other journeys captured by the same device in long-term care. Clear signs of decline were present in 79% of patients, with notable changes in breathing or heart rate appearing an average of more than five days before death. These observations highlight a consistent pattern that can give families and caregivers meaningful time to prepare.

Xandar Kardian XK300-H:
Vital sign monitoring sensor

“Rod’s story stands as a testament to the integrity of his vision and to the real impact of the technology he believed in; not just professionally, but personally. In his final days, the Xandar Kardian sensor provided the very information and support he had long advocated for, transforming the way care is delivered.”

-Brittany Jefferson, Chief Commercial Officer at Rosie Connectivity Solutions

Monitoring Life's Final Stage

Redefining Monitoring To Respect What Matters Most

At the end of life, the focus of care shifts from intervention to comfort. Because vital sign monitoring has traditionally been linked to medical procedures, its use in hospice may be perceived as prolonging discomfort rather than easing it.

When applied thoughtfully, however, continuous, contact-free monitoring can provide a different kind of value. Instead of signaling when to intervene, it offers a quiet awareness of change, capturing subtle shifts and unspoken needs that help caregivers know when comfort measures are needed most.

This approach is unobtrusive: no wires, wearables, or physical contact are required. By observing gently and continuously, monitoring can bring clarity to families, guide caregivers in preparing for what is to come, and help ensure that the final days remain peaceful.

Supporting Patients, Families, and Clinicians

End-of-life care is as much about the family as it is about the patient. It is a time of uncertainty and heartache, not only for loved ones but also for the caregivers who stand alongside them.

- **Patients** want comfort and dignity. Radar removes the need for wires, wearables, or repeated checks, allowing them to rest without disturbance.
- **Families** want time and clarity. Subtle changes are detected early enough to gather loved ones, share last moments, and ensure final wishes are respected.
- **Clinicians** want reliable insight. Radar highlights changes that can guide care plans and conversations with families and support adjustments that maximize comfort.

Helping Hospice Care

Hospice organizations walk a delicate line: honoring dignity and comfort for patients through responsive care planning while also managing limited staff and resources. Radar offers support that strengthens both sides of this mission, by:

- **Recognizing decline earlier:** Subtle changes in breathing or heart rate often appear days before visible signs, creating time to manage symptoms, adjust care, and ensure families can gather.
- **Guiding care:** Trend data helps clinicians see whether symptoms relate to medication effects, agitation, or accelerating decline; while directing care to where it is most needed.
- **Strengthening operations:** Objective data supports quality reporting and may also enable access to programs like the Medicare Service Intensity Add-On Funding, which provides additional daily funding for enhanced nursing care in the final week of life.

Technology & Features

ABOUT THE XK300

The XK300 is a health monitoring device that passively measures vital signs by detecting subtle chest and body micro-movements. It captures thousands of data points daily using safe, ultra-low-power radar signals. No wires, wearables, or maintenance required; just set it up and let it run continuously in the background.

The XK300 is ideal for professional care settings, but also available in the XK300-H form factor, better suited for residential use.

Both use the same radar technology and measurements capabilities, with the XK300-H designed for an even simpler DIY setup, supporting both wall-mount and tabletop installation. Portable and flexible, just move it wherever it's needed.

XK300

XK300-H

HOW IT WORKS

Reliable monitoring made simple: Mount, plug in, connect and track what matters most:

1. **Mount** the sensor on the wall or place it on the bedside table.
2. **Connect** to power and Wi-Fi/LTE
3. **Monitor** in real time and set custom alerts in the Kardian Dashboard or XKare app.

ACCURACY

HR ± 1.8 beats/min (vs EKG)

RR ± 1.18 breaths/min (vs $ETCO_2$ mask)

U.S. FOOD & DRUG ADMINISTRATION

XK300 is FDA 510(K) approved Class-II Medical Device

WHAT DO XK SENSORS MONITOR?

- **Resting Heart Rate**
- **Resting Respiratory Rate**
- **Movement Index**
- **Bed Presence**
- **Sleep Quality**
- **Changes in Baseline Vitals (PoBC)**

KEY BENEFITS

Compliance-Free
No interaction needed

Privacy Protected
No cameras. No microphones.

Continuous Monitoring
Avg **6,000+** Resting HR & RR measurements captured each day.

Case Review: In Memory of Rod M.

A Life of Service to Others

Rod M. dedicated his career at Rosie Connectivity Solutions to developing technologies that supported caregivers, reduced the burden on families, and improved patient care. His work reflected a belief that healthcare should be safer, more compassionate, and centered on the people it serves. He set a standard that continues to shape the future of care.

In January 2025, Rod was diagnosed with stage IV pancreatic cancer. Four months later, he chose to spend his last days at home, surrounded by family and comfort. As the end approached, Rod expressed his wish that he be monitored by the Xandar Kardian sensor, such that both XK and Rosie could learn from his experience to ultimately ease the path for those who would follow. For two weeks, the XK300-H quietly captured his vital signs, bearing witness to his final journey.

Rosie Connectivity Solutions

> "Rod's legacy at Rosie lives on through Xandar Kardian. Together, we carry forward his mission: technology that dignifies care, eases burdens, and honors every patient's final moments."

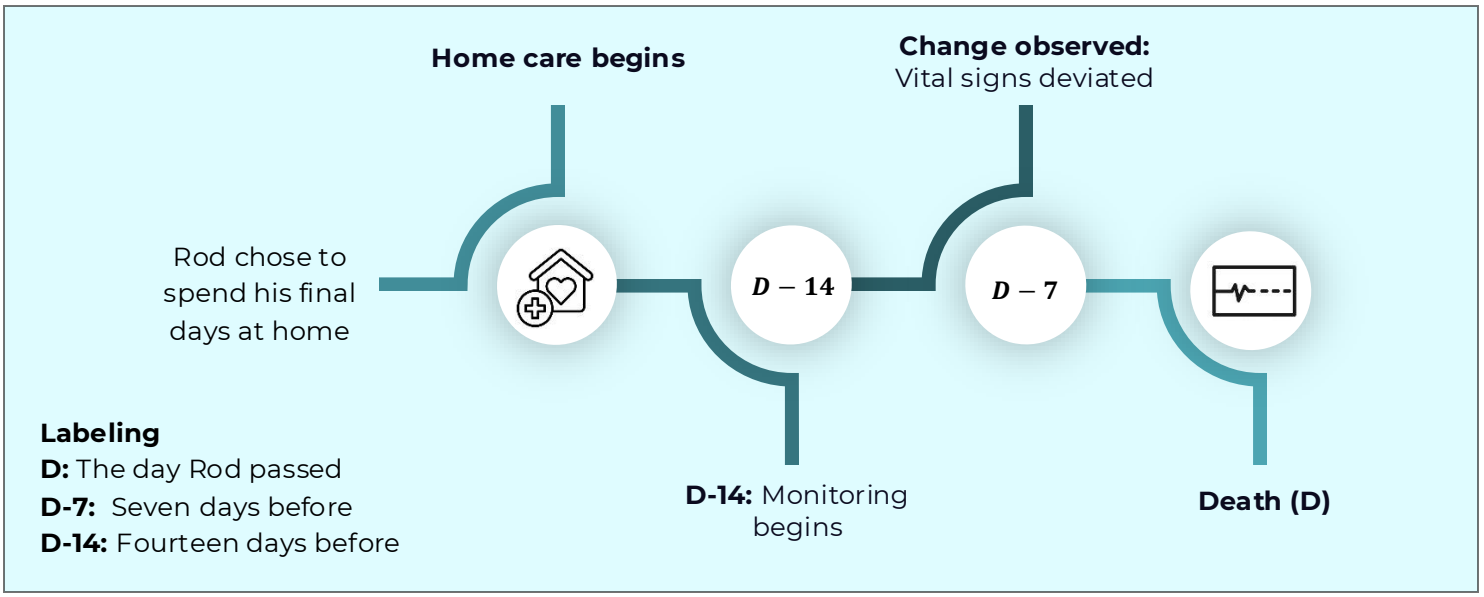
-Brittany Jefferson, Chief Commercial Officer at Rosie Connectivity Solutions

PATIENT PROFILE

Demographics	Primary Diagnosis	Comorbidities	Medications
64-year-old male	Stage IV pancreatic cancer	Type 1 diabetes	Pain medication

TIMELINE

The XK300-H radar continuously monitored the final 14 days of Rod's passing. Below is the overall timeline:



Movement & Sleep

Summary of Collected Data

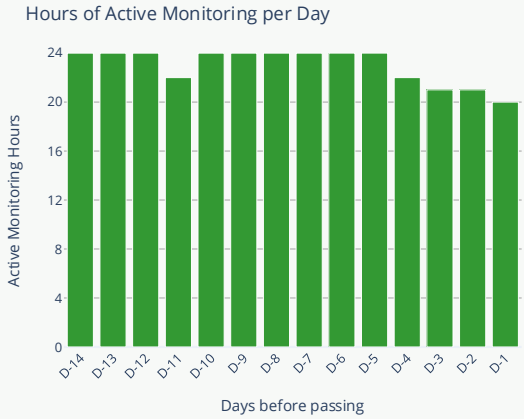
The XK300 sensor, installed in the Rod's home, continuously monitored vital signs and movements, passively, without requiring any wearables or active compliance from the patient or caregiver. Over two weeks, that amounts to a 95% monitoring time, the remaining 5% explained by unplugging or absence.

15 Days
Monitoring Period

95%
Active Monitoring

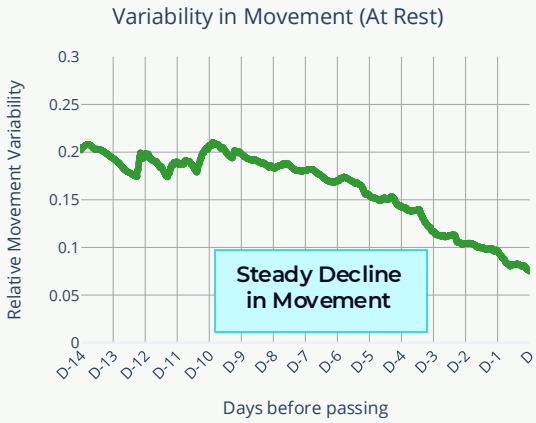
8,000 / Day
Avg. Resting Heart Rates Captured

10,000 / Day
Avg. Resting Respiratory Rate Captured



Body Movement Analysis

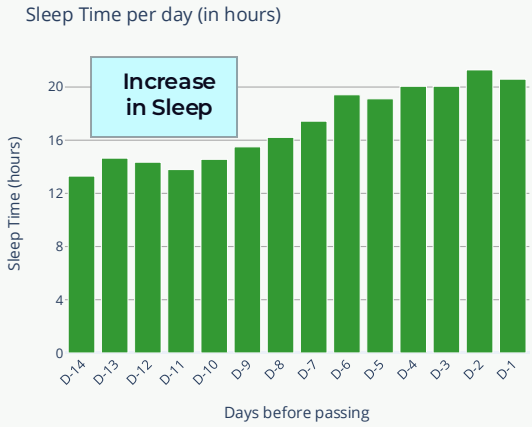
The XK300 analyzes subtle body motion to capture overall stillness. It showed a steady decline in movement variability over the two-week observation period. In the final days, the patient was nearly motionless, a pattern associated with decreased consciousness near the end of life [1].



Sleep Analysis

The XK300 detects sleep by analyzing patterns in respiration and movement. As shown in the chart, sleep steadily increased over two weeks, reaching more than 20 hours per day on D-4.

This rise, along with reduced movement, is another hint at reduced consciousness. As death approaches, patients often appear asleep or only half-awake, though they may still hear others [2].



SUMMARY

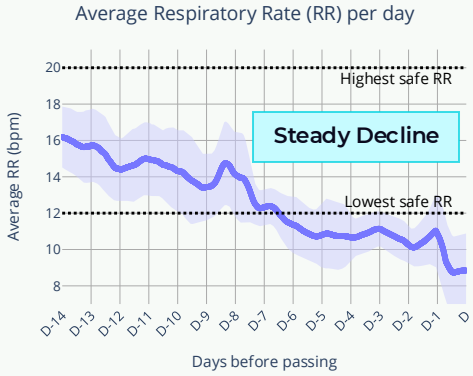
The XK300 monitored continuously for 15 days, averaging 8,000 resting heart rates and 10,000 resting respiratory rates daily. Over this period, movement steadily declined, and sleep increased to more than 20 hours per day, signs associated with reduced consciousness in the final days of life.

Resting Respiratory Rate

Respiration Rate Measurement

The radar measures respiratory rate (RR) by tracking chest movements. RR is a key indicator of health and an early marker of decline [3]; abnormal values are strongly linked to higher risk of ICU admission and in-hospital mortality [4].

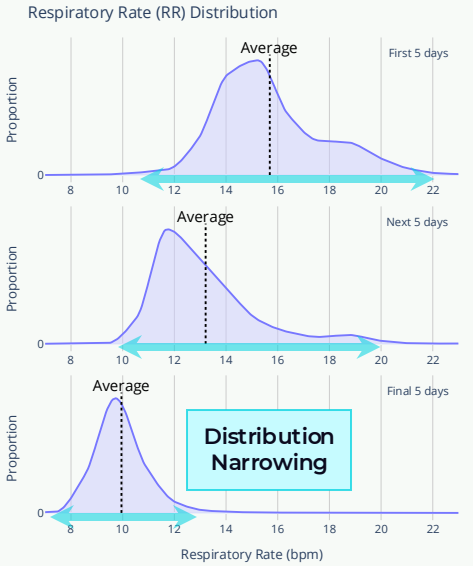
The chart shows a steady decrease in daily RR over the 14-day observation period, dropping from about 16 to 9 breaths per minute. Around D-7, RR dropped below the normal range of 12–20 bpm and remained low until passing, reflecting a clear deterioration in respiration.



Distribution of Respiration Rate

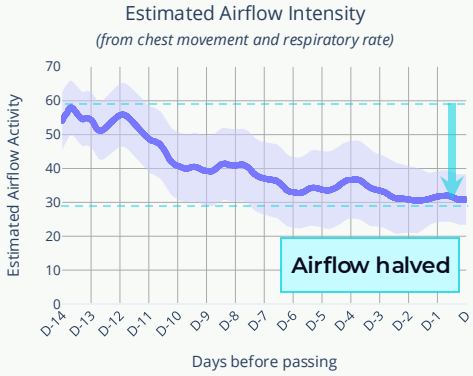
Unlike wearables or subjective methods that provide only an average, the XK300 captures respiration thousands of times each day. This high level of detail allows radar to look at the full picture of respiratory patterns instead of just an average or a spot check.

The charts show RR distributions over three timeframes: first 5 days, next 5, and final 5 days. At the start, the average RR was ~16 breaths per minute with a wide spread of values, reflecting healthy variability (lower during rest, higher with activity). Over the following days, the distribution narrowed, suggesting reduced adaptability, while average consistently decreased. In the final days, respiration became uniform and inflexible, showing the body's declining ability to adjust to internal demands. [5, 6]



Estimated Airflow*

Airflow is estimated using chest movement and respiratory rate (RR), adding depth of details beyond just RR. While slower but deeper breaths can sometimes maintain oxygen intake, this chart shows an overall reduction of nearly 50% over two weeks. This indicates that both breathing rate and air volume declined, reflecting a marked loss of respiratory capacity.



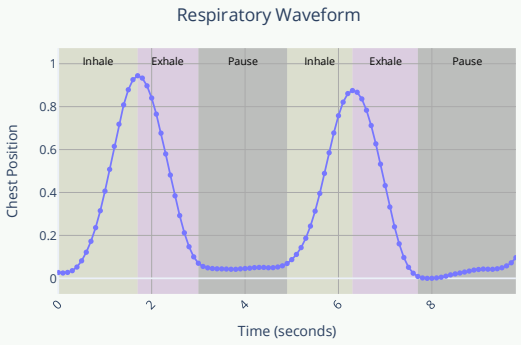
SUMMARY

Respiratory rate fell from 16 to 9 breaths per minute, dropping below the normal range a week before death. Variability disappeared and airflow halved, showing a marked loss of respiratory capacity and adaptability.

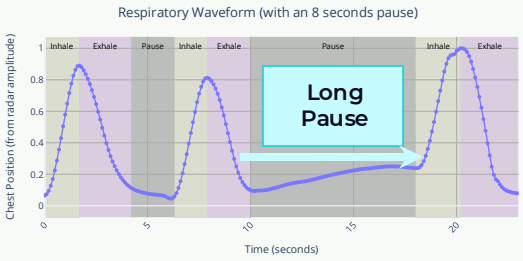
Respiratory Waveform

Respiration Rate Measurement

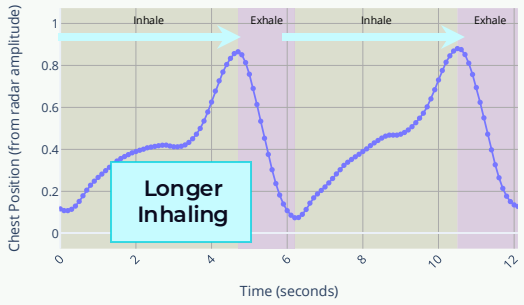
Beyond just tracking average RR, the XK300 radar captures full respiratory waveforms, which can detect inhalation, exhalation, and pauses between breaths. The first chart shows a normal example, highlighting these phases. This cycle-by-cycle view reveals abnormalities such as pauses or phase imbalances that averages cannot show [7].



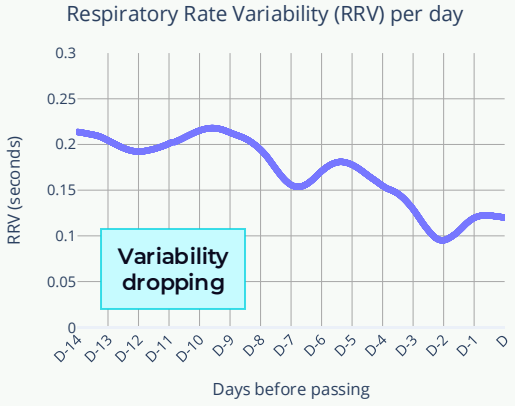
The second chart shows a prolonged pause between breaths lasting 8 seconds. These abnormal events are only visible with waveform-level analysis and when occurring frequently, can be early signs of respiratory failure, even if the overall rate remains within normal limits. [7, 8]



The third chart shows the balance between inhaling and exhaling shifting in Rod's final week. Normally, inhaling takes a little longer than exhaling [9], but in the example inhaling became much longer, almost 5 seconds, an early sign of respiratory obstruction or airway narrowing [10].



The Respiratory Rate Variability (RRV) is the natural variation in how long each breath lasts, from one breath to the next. Early in Rod's case, RRV was higher, showing his breathing could still adapt, but over time, it fell significantly, suggesting the body was losing its ability to respond to changing needs [6].



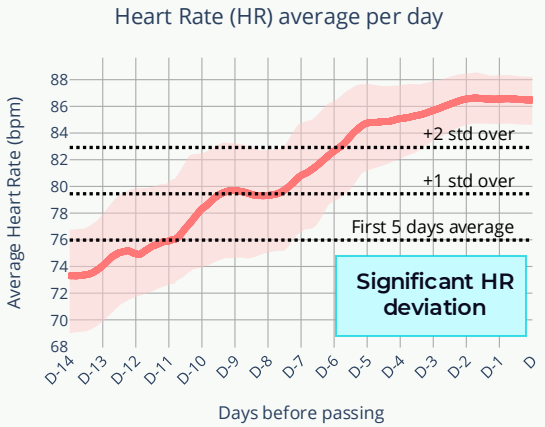
SUMMARY

The respiratory waveform, a core functionality of the XK300, revealed breathing patterns far beyond what RR alone can show: prolonged pauses, extended inhalations, and loss of variability. These hidden shifts in breathing exposed a clear decline in adaptability during the final days.

Resting Heart Rate

Heart Rate Measurements

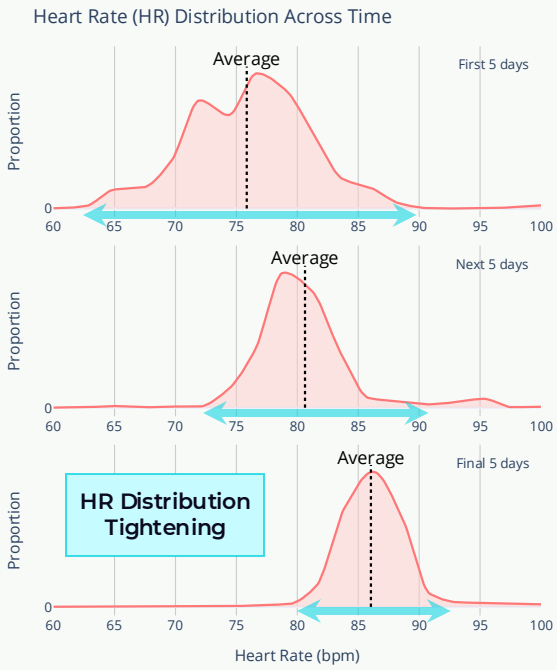
The radar revealed a steady rise in heart rate, increasing from an average of 73 BPM on D-14 to 87 BPM by D-2. While values remained within the traditional "normal" range, the change was clinically significant, exceeding two standard deviations above the initial five-day average. Unlike spot checks or threshold-based monitoring, which would have overlooked these "normal" values, continuous monitoring exposed a significant deviation 6 days early.



Distribution of Heart Rate

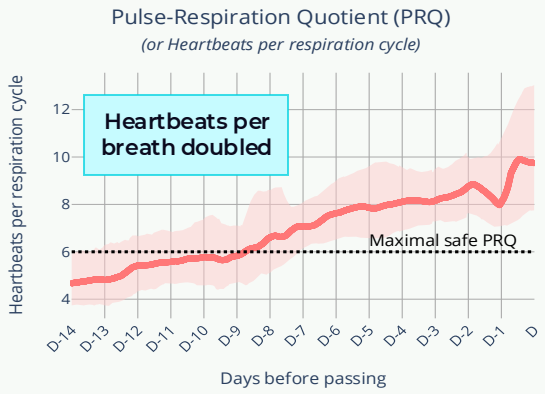
The charts show HR distributions over three timeframes: first 5 days, next 5, and final 5 days.

- In the first 5 days, the average was ~75 BPM with a wide distribution, indicating dynamic heart activity in response to body needs.
- In the next 5 days, the average rose by ~5 BPM and the distribution narrowed, suggesting reduced responsiveness.
- In the final 5 days, average continued to rise as variability narrowed further, indicating the heart became more monotonic, no longer adapting to internal or external cues.



Pulse-Respiration Quotient

PRQ measures how many times the heart beats for every breath. Both heart and respiratory rate tend to rise during exercise and fall during rest. This natural balance, normally within 3 to 6, is a strong predictor of mortality risk among critically ill patients [11]. In Rod's case, PRQ rose from 5 to 10 in the final days, meaning the heart was beating far faster than breathing could match. Such a widening gap signals growing strain and is another marker of decline.



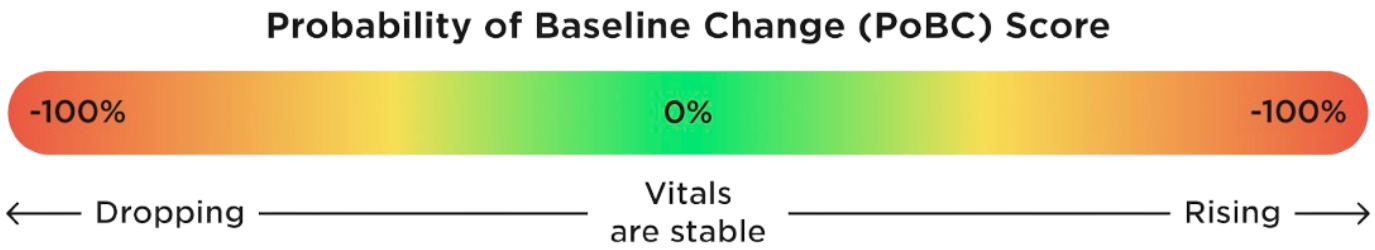
SUMMARY

Heart rate rose by 16 BPM. While still within normal range, it was a significant shift from Rod's baseline, flagged on D-6. Variability narrowed and PRQ doubled from 5 to 10, showing reduced responsiveness and abnormal cardiac–respiratory balance.

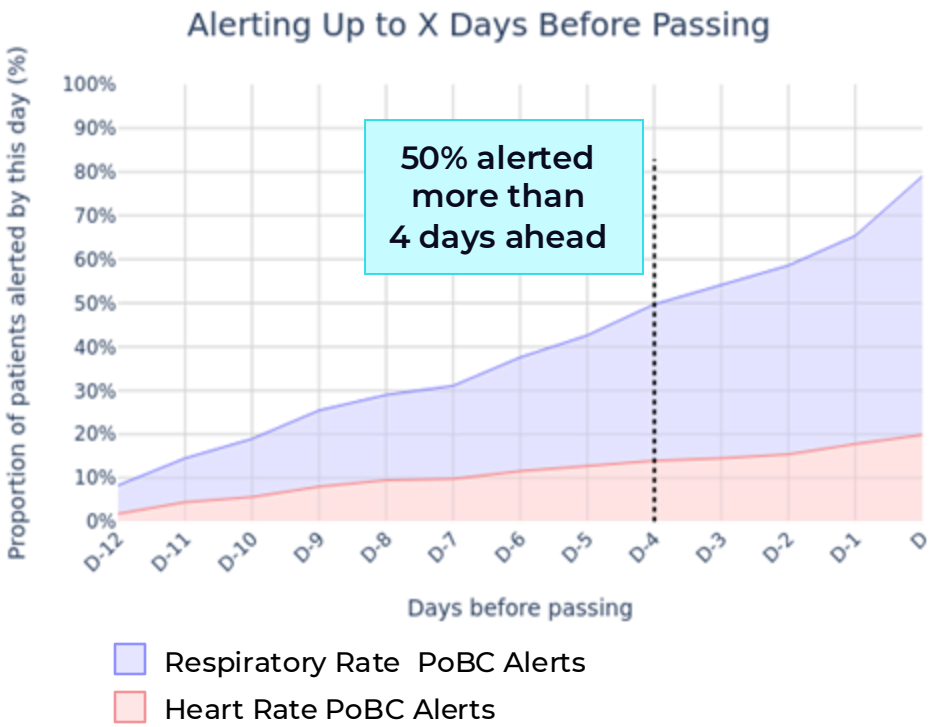
From One Story to 300+ Journeys

Rod's case provided a deeper understanding of what the XK300-H sensor can reveal at end of life. His journey made the signals feel tangible and meaningful, and it prompted a larger question: Can this device consistently detect decline before death?

Across a broader cohort of 338 patient journeys near the end of life, Xandar Kardian's Probability of Baseline Change (PoBC) score was used to signal meaningful shifts in the days leading up to death. This deviation score establishes each patient's normal resting heart and respiratory rate distribution, then tracks how far new readings deviate from that baseline. It reflects both the magnitude of the change and the direction it is moving, helping distinguish ordinary variation from significant decline.



When the PoBC score rose above +95% or fell below –95% for heart rate or respiratory rate, it marked a clear shift from the patient's baseline, more than routine variation. Using these thresholds across the cohort produced the following results:



79.5% of Patients Alerted Early [267 / 338]

5.4 Days Early Alerts on Average

Respiration Rate Alerts caught 3× more deaths than Heart Rate alerts.

Knowing Early Makes A Difference

From early insights to better care

The sensor can detect subtle physiological changes that signal the approach of death, even while vital sign readings still appear within normal ranges. Through the XKare app or Kardian dashboard, these changes can be seen as meaningful, interpretable & configurable notifications. On average, these changes were observed more than **five days in advance**, creating a window where action is possible.

- For **families**, those extra days create space for presence. They allow loved ones to share last conversations, to be physically present at the bedside, and to enter the final days prepared rather than surprised. The difference is not measured only in time, but in the quality of closure it makes possible.

- For **clinicians**, early recognition provides a chance to adapt care plans in step with decline. Subtle shifts in breathing or heart rate can prompt timely adjustments in medication, the introduction of additional comfort measures, and clearer communication with families. Care teams gain the ability to anticipate needs, becoming proactive instead of reactive.

- For **hospice providers**, foresight strengthens both care and sustainability. Continuous monitoring reduces the burden of manual checks, allows staff to focus where they are most needed, and opens access to existing reimbursement pathways.

What's next

At XK, we are building on the lessons learned from Rod's case and many other end-of-life cases to develop AI algorithms that turn continuous monitoring into predictive tools. By recognizing patterns in the data and distilling them into clear, actionable notifications, our goal is to provide timely, accurate insights that help clinicians anticipate decline earlier and guide care with confidence.

WITH XANDAR KARDIAN,
KNOW BEFORE YOU KNOW

XANDAR KARDIAN

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