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Straight to the Heart: Optimizing Telemetry Utilization with Physician Collaboration

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Learning Objectives



- Discuss the impact of an innovative, physician-driven telemetry review process.
- Outline cost savings and patient care enhancements associated with telemetry monitoring optimization.



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Stanford Health Care (SHC) and SHC Tri-Valley

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Comprehensive academic medical center

613 bed hospital (operating around 800 beds)

Telemetry available in med-surg, intermediate intensive care, and intensive care units

Complex care medical center

167 bed hospital

No acuity-adaptable units

Telemetry is a valuable but overutilized resource

Telemetry is available for patients on medical surgical wards; however, there is **no consistent or systematic way to ensure its appropriate utilization**

- At SHC, Hospital Medicine is highest utilizer of telemetry
 - ~40% of cases were inappropriate
- At SHC-TV, utilization was ~50% across the hospital
 - ~30-40% were inappropriate

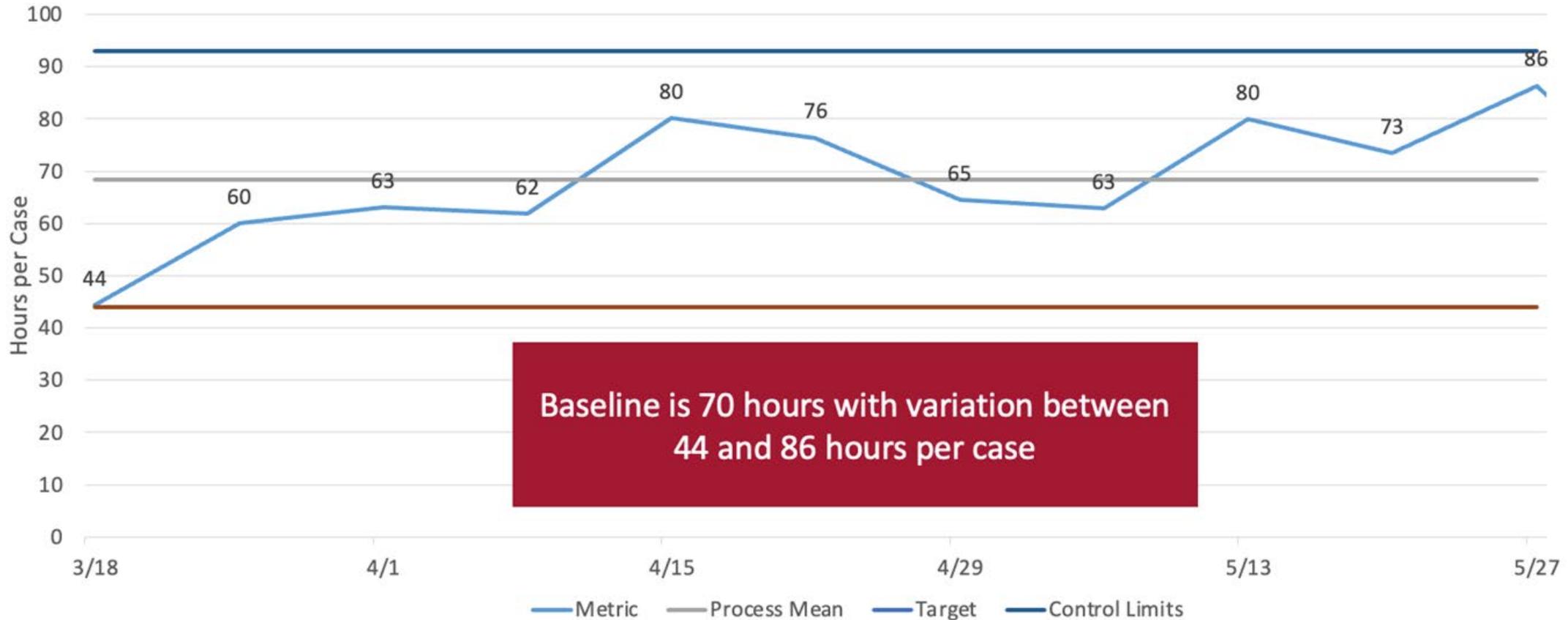
Inappropriate, or excessive, use of telemetry can lead to increased costs, alarm fatigue, patient discomfort, and low-value care



Baseline Data at SHC



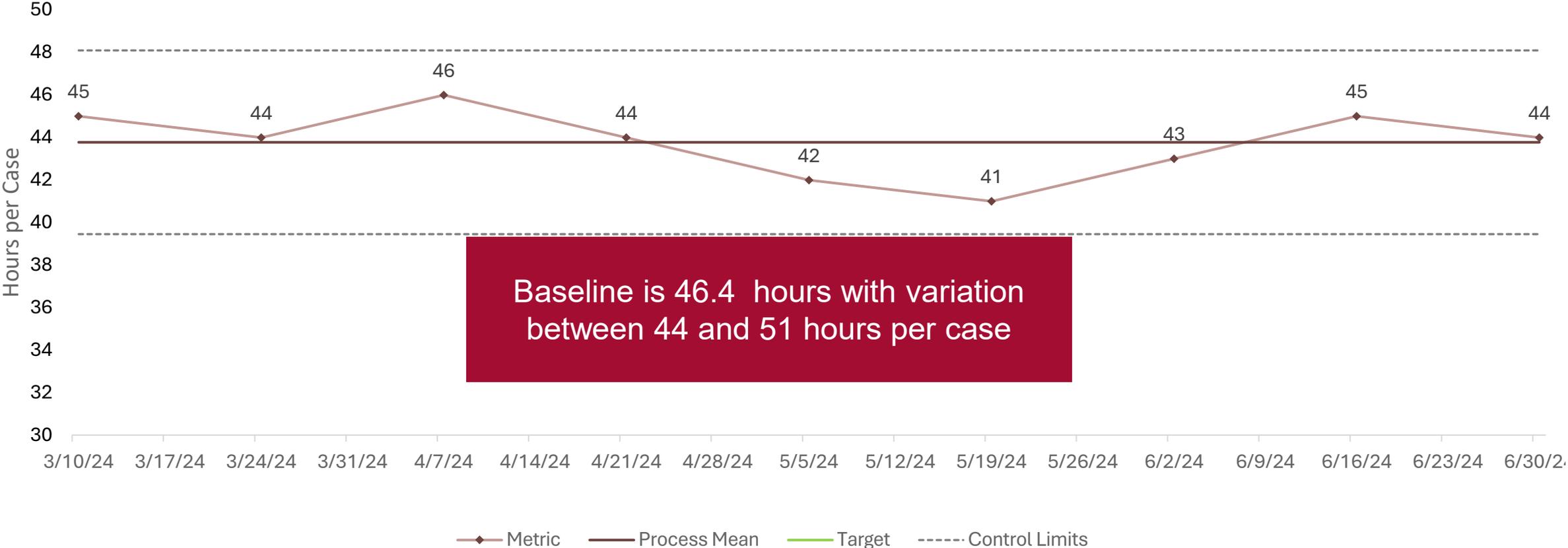
Telemetry Hours per Case for Hospital Medicine Patients



Source: Stanford Health Care

Baseline Data at SHC-TV

Telemetry Hours Per Case for Med-Surg Patients



Source: SHC Tri-Valley Hospital

Telemetry Initiation Criteria		Telemetry Discontinuation Criteria	
Category 1: ACS / Chest Pain			
1.1	Resuscitation from cardiac arrest		continue telemetry monitoring until discharge (<i>or death</i>)
1.2	Confirmed or suspected Acute Coronary Syndrome (ACS): (a) ST-Elevated MI (STEMI) (b) Non-ST-Elevated MI (Non-STEMI) (c) Unstable angina* or angina equivalent with EKG changes (d) High-risk coronary lesion: newly diagnosed critical left main disease, severe 3-vessel disease, or equivalent (e) suspected ACS: use telemetry while waiting for 2 negative troponin results or 1 negative high sensitivity troponin result received 3 hours after ED arrival		(a), (b), (c) Assuming uncomplicated clinical course, discontinue telemetry at 48 hours, anticipate discharge at 72 hours (d), (e) same as above if medically managed
1.3	Status-post Percutaneous Coronary Intervention (PCI)		(a) Post-PCI without complications: discontinue telemetry 18-24 hours post-procedure (b) Post-PCI with complications: discontinue telemetry when clinically stable
Category 2: Arrhythmia			
2.1	Status post implantation of an Automatic Defibrillator Lead or a Pacemaker Lead (can include period of time to determine PPM lead functionality)		discontinue telemetry after 24 hours unless complications arise (e.g., lead dislodgement, failure to capture, pauses, rapid pacing, cardiac tamponade, pneumothorax, etc.)
2.2	(a) Temporary pacemaker or (b) Transcutaneous pacing pads		(a) continue telemetry while temporary pacemaker is in place (b) if transcutaneous pacing pads are not used for 48 hours, reassess need for telemetry and pacing pads. Discontinue telemetry if transcutaneous pacing pads are not used
2.3	Status post ablation of an arrhythmia or cardioversion		discontinue telemetry 24 hours post-procedure if no events detected
2.4	New onset or worsening cardiac arrhythmia (including bradycardia and 2nd or 3rd degree A-V block)		discontinue telemetry once clinically stable
2.5	Initiation or titration of new antiarrhythmic medication such as dofetilide, sotalol, or other Class III antiarrhythmic		discontinue telemetry as per pharmacologic guidelines (e.g., 5-6 doses after initiation)
2.6	Atrial fib/flutter sustained heart rate over 110 for 30 mins		discontinue telemetry after 24 hours of rate control (< 110)
2.7	SVT (AVNRT or AVRT)		discontinue telemetry after 48 hours if no arrhythmia or recurrence detected
Category 3: Cardiac Surgery			
3.1	Status post Cardiothoracic/Cardiac Surgery		continue telemetry until discharge at the discretion of the cardiac surgeon

Category 4: Heart Failure

4.1	Acute heart failure requiring intravenous heart failure drugs (i.e., inotropic agents, diuretics)	discontinue telemetry 24 hours after IV to PO conversion or clinically stable
4.2	Pulmonary congestion possibly due to heart failure and room air O2 sat either (a) < 89% and less than baseline or (b) room air assessment not clinically appropriate	discontinue telemetry 24 hours after IV to PO conversion or clinically stable

Category 5: Pericardial, Myocardial, or Endocardial Disease

5.1	Acute/new moderate or large pericarditis or myocarditis and HR > 90	resolving pericarditis or myocarditis with pain controlled
5.2	Acute/new moderate or large pericardial effusion (including tamponade) and HR > 90	resolving pericardial effusion with pain controlled
5.3	Endocarditis with A-V block or new bundle branch block	discontinue telemetry once A-V block or bundle branch block resolves

Category 6: Pulmonary

6.1	Pulmonary Artery Hypertension (PAH) with systolic pulmonary artery pressure of 40 mm Hg or greater and with decompensated heart failure, acute hypoxia, or titration of PAH-directed therapy	discontinue telemetry 24 hours after IV to PO conversion (diuretics or PAH-directed therapy)
6.2	Cystic Fibrosis (CF) patients admitted for desensitization protocol	discontinue telemetry 24 hours after initiation of infusion
6.3	CF patients with FEV1<30% and RR > 24	discontinue telemetry once clinically stable (RR < 20, O2 sat at baseline), typically within 24-

Category 7: Neurology

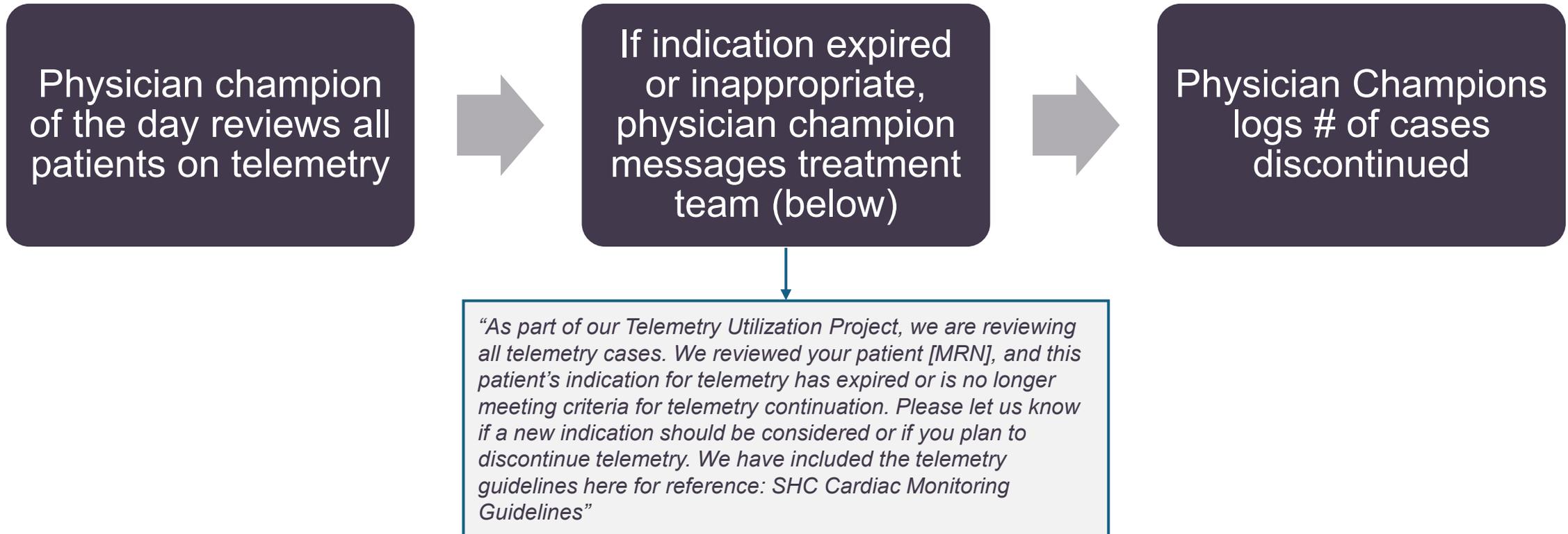
7.1	Syncope of unknown origin	discontinue telemetry after 48 hours unless arrhythmogenic cause is suspected
7.2	New diagnosis of ischemic stroke or TIA with no known atrial fibrillation	discontinue telemetry after 48 hours if no events detected

Category 8: Miscellaneous

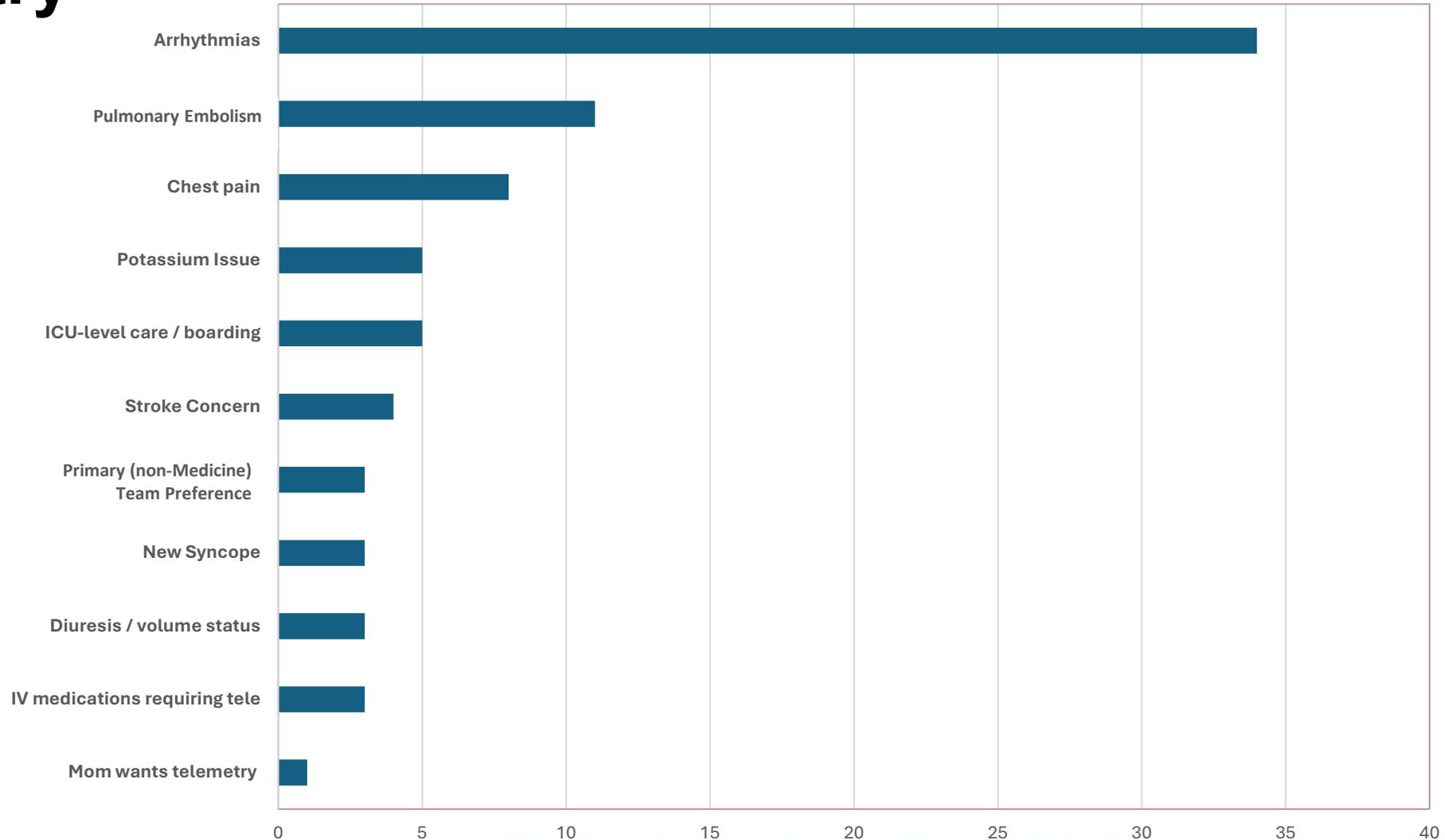
8.1	Sustained K <=3.0 (more than 6 hours) or K > 6.0	discontinue telemetry once K in normal range
8.2	(a) Mg < 1.5 and active arrhythmias; or (b) Mg < 1.0	discontinue telemetry once Mg in normal range
8.3	Poisoning or overdose from drugs with known or suspected arrhythmic effects	discontinue telemetry when patient no longer appears toxic, by drug level (if available) or through clinical assessment

Intervention: Physician-led Reviews

Workflow



Common Reasons for not de-escalating telemetry

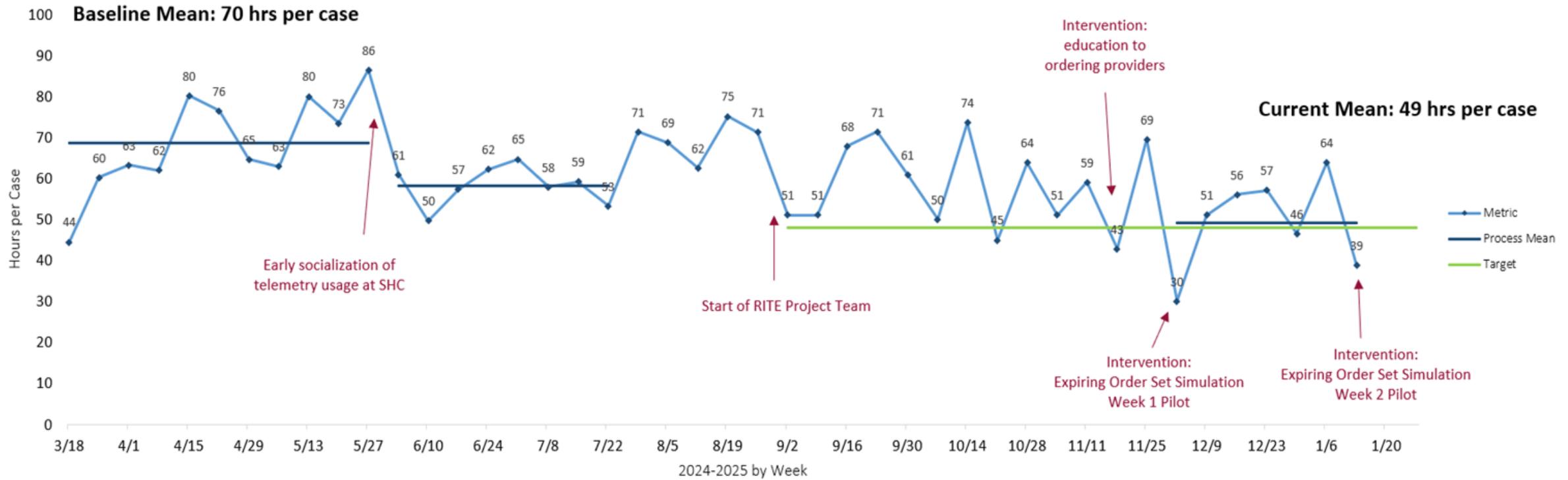


Source: Stanford Health Care and SHC Tri-Valley Hospital

Results at SHC

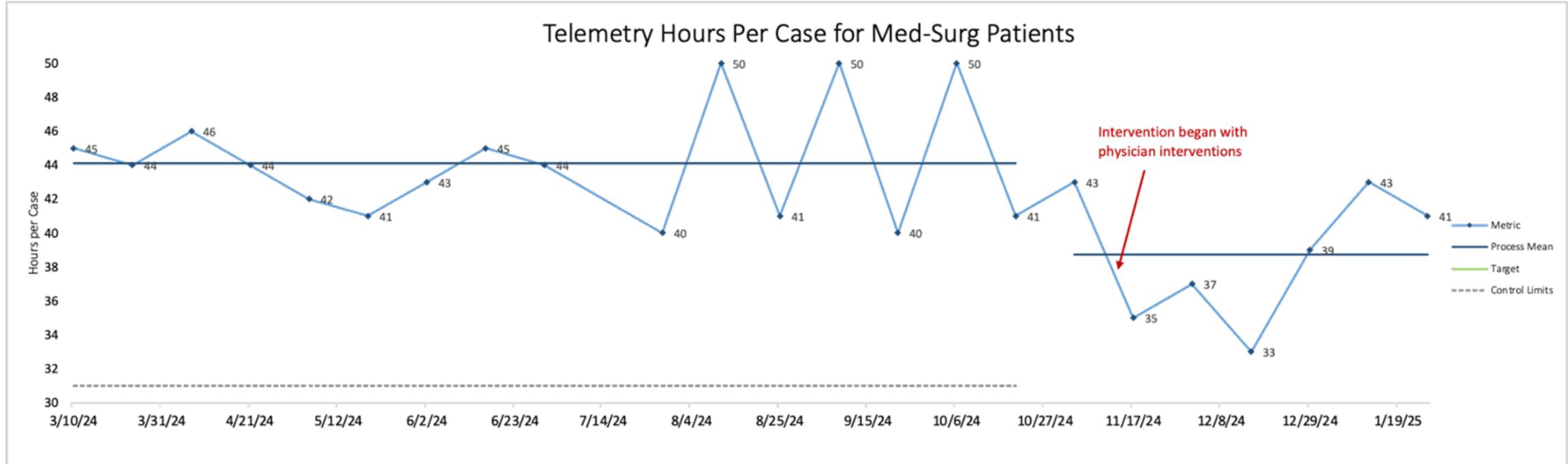


Telemetry Hours per Case for Hospital Medicine Patients



Source: Stanford Health Care

Results at SHC-TV



Intervention resulted in an average of 38.7 hours (decrease of 7.7 hours) with variation between 33 to 43 hours

Source: SHC Tri-Valley Hospital

Patient Impact

- **Reduced alarm fatigue**

- Alarms heard throughout unit, loudest at RN station (central monitoring)
- Patients in shared rooms on telemetry affect roommate(s)

- **Decreased risk of overdiagnosis and delirium**

- **Reduction in waste**

- Disposable adhesives used for every patient
- Disposable leads for some patients



Potential Cost Savings (SHC) - \$1.27 Million

Category	Metric	Value
Hospital Medicine	Inappropriate cases/year (2136 × 45%)	961
	Hours saved per case (63.5 – 48)	15.5 hours
	Estimated savings - \$25 per hour	\$372K/year
Top 5 Services	Inappropriate cases/year (3583 × 45%)	1612
	Hours saved per case (70 – 48)	22 hours
	Estimated savings - \$25 per hour	\$901K/year

Actual Cost Savings - can it be zero?

For a 28-bed unit, 0 to 8 telemetry patients have the same nursing requirement

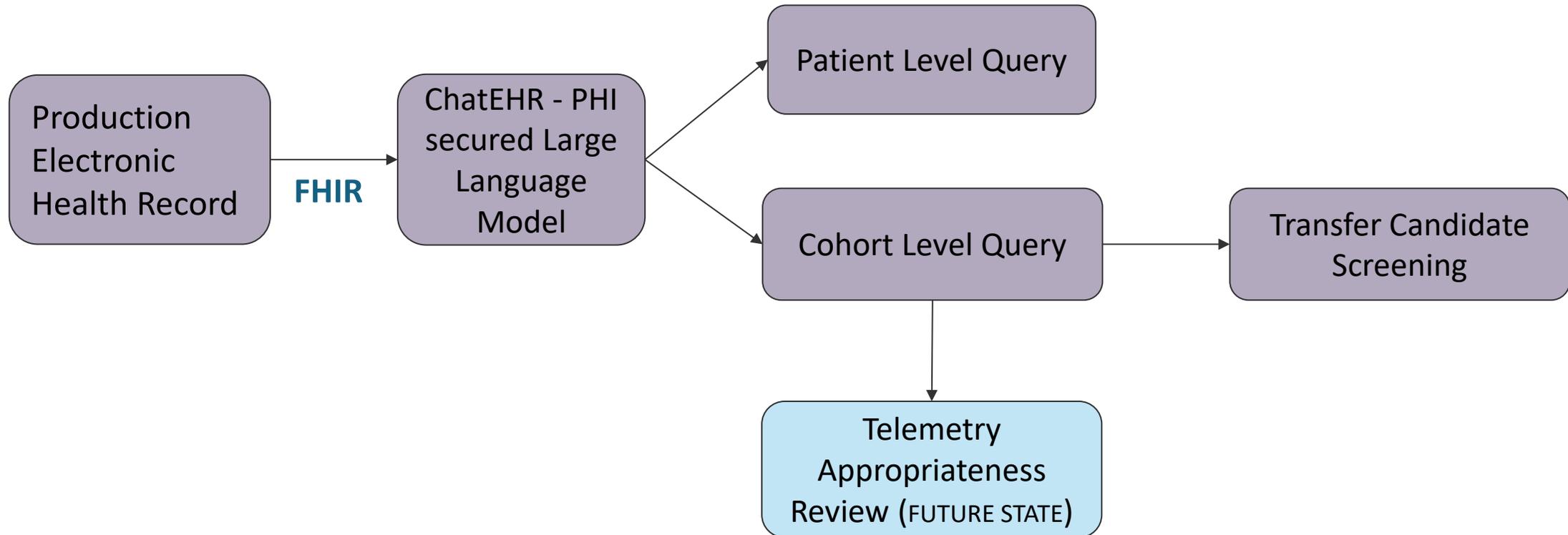
Telemetry Patients	Non-Telemetry Patients	Nurses Required	Notes
0	28	6	6 nurses × 5 patients = 30
8	20	6	2 telemetry nurses + 4 non-telemetry nurses
9	19	7	3 telemetry nurses + 4 non-telemetry nurses
28	0	7	7 telemetry nurses

For a 30-bed unit, 1 to 20 telemetry patients have the same nursing requirement

Telemetry Patients	Non-Telemetry Patients	Nurses Required	Notes
0	30	6	6 nurses × 5 patients = 30
1	29	7	1 telemetry nurse + 6 non-telemetry nurses
20	10	7	5 telemetry nurses + 2 non-telemetry nurses
21	9	8	6 telemetry nurses + 2 non-telemetry nurses
30	0	8	8 telemetry nurses + 0 non-telemetry nurses

Intervention: AI Application (ChatEHR)

ChatEHR project, developed with focus on patient-level query, but can be utilized to query an entire hospital cohort.



FHIR: Fast Healthcare Interoperability Resources

Example of ChatEHR Patient Level Query



ChatEHR

Session start time: Thu Jul 10 2025

Time Range: 1 Week lookback (07/03/2025 — 07/10/2025)

Data sources (1): clinical-notes

Hi! I'm ChatEHR. Here to help you securely chat with the patient's medical record. Provide feedback by clicking 🍌

Welcome to ChatEHR

User ID: [redacted] • MRN: [redacted]

1. Select a Time Range

Time lookback | Date Selection | Encounter lookb... (coming soon)

1 week lookback | 3 month lookback | 1 year lookback

2. Select Data Sources

By Source | By Place of Service (coming soon)

Documents: Select All | Clear

- Notes
- CareEverywhere Notes
- Diagnostic Reports (Labs, Imaging, Pathology, Radiology)
- Lab Results
- Vital Signs
- Procedure Orders
- Surgical Notes
- Medications

Launch ChatEHR

ChatEHR

Session start time: Thu Jul 10 2025

Time Range: 1 Week lookback (07/03/2025 — 07/10/2025)

Data sources (8): clinical-notes, care-everywhere, diagnostic-reports

Refresh

Here to help you securely chat with the patient's medical record. Provide feedback by clicking 🍌

What's the differential for the patient's Acute Renal Failure

The differential diagnosis for [redacted] Acute Renal Failure, based on the clinical data provided, includes:

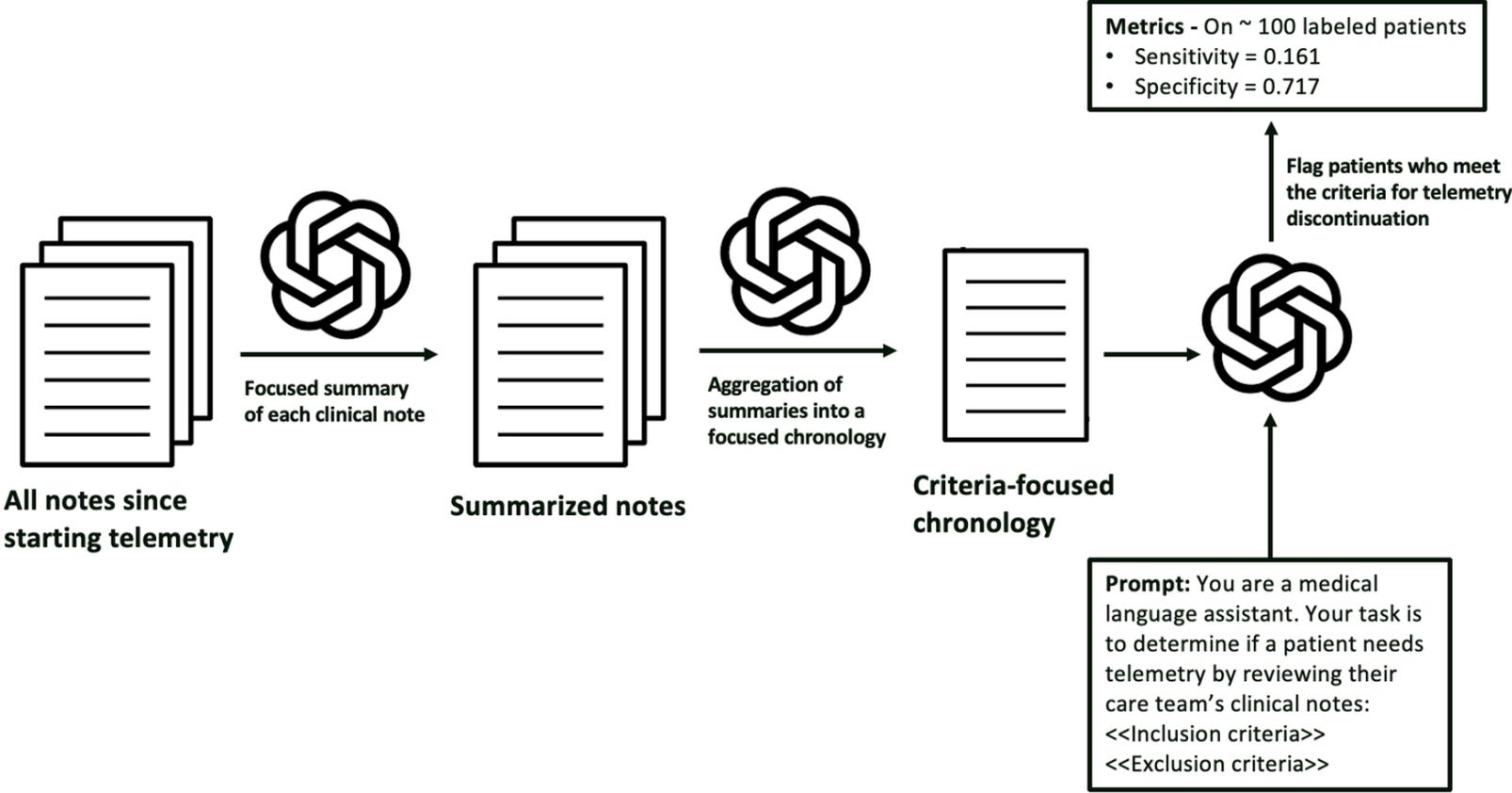
- Acute Tubular Necrosis (ATN):** Suggested by worsening creatinine (Cr) levels after contrast exposure on 6/24/25 and ongoing renal dysfunction unresponsive to volume expansion or diuretic therapy. The timing after IV contrast and associated hypotension from abdominal hematoma and shock supports ATN.
- Hepatorenal Syndrome (HRS):** Considered given liver failure and low urine sodium (<27), though less likely as the patient did not respond to empiric HRS treatment with albumin and octreotide and remained nonoliguric.
- Sepsis-Associated AKI:** Possible in setting of intermittent fevers, tachycardia, and elevated inflammatory markers (CRP 111), though infectious workup has thus far been negative or non-conclusive.
- Acute Blood Loss Anemia-Related AKI:** Secondary to large abdominal wall hematoma causing hemorrhage and associated transfusion requirements.
- Contrast Nephropathy:** Given IV contrast administration around the time of AKI onset.
- Other causes:** Less likely but include glomerulonephritis (GN), given proteinuria and hematuria with pending serologies (ANA, ANCA, C3, C4, SPEP, UPEP).

In conclusion, the working differential primarily includes ATN (due to ischemia and nephrotoxic injury), HRS, and sepsis-associated AKI in the setting of acute alcohol-associated liver failure with associated complications. Continued monitoring and further testing are indicated.

Generation time: 7/10/2025, 11:07:51 AM - Lookback: 1 Week

Ask a question...

Poor Performance of ChatEHR Telemetry Pipeline



Challenge noted: Token Number and Output Quality



Context Overflow



Context Rot

Mediocre drawings by Thomas Lew, MD
(supposed to be doctor holding overflowing bucket (left);
doctor looking for needle in the haystack (right))

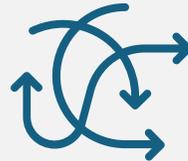
Challenge: Data Quality and Completeness



**Inconsistent
documentation
practices**



**Variability in
documentation
styles**



**Missing data
elements**



Temporal factors

Challenge: Temporal Reasoning

- In addition to missing time points, the Large Language Models (LLM) frequently struggled to accurately reason with time points even when they were present.
- This was problematic as many of the telemetry indications expire after a certain time-period of stability.

7/26/2025 – 7/21/2025 = 1



Lessons Learned

- Peer-to-peer **influence matters**
- Theoretical savings \neq actual savings
- Hospital structure shapes results
- **LLMs are promising**, but not plug-and-play
- Collaboration is everything!

Key Takeaways

- Define “appropriate use” clearly
- Audit your baseline
- Start with physician-led reviews
- Plan for scalability from day one
- Invest in your data foundation

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Questions?



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