

Engineering Structural Workflow Efficiencies in the Outpatient Imaging Center: The Synthesis of Human Intervention (HI) and Artificial Intelligence (AI) for Actionable Incidental Findings

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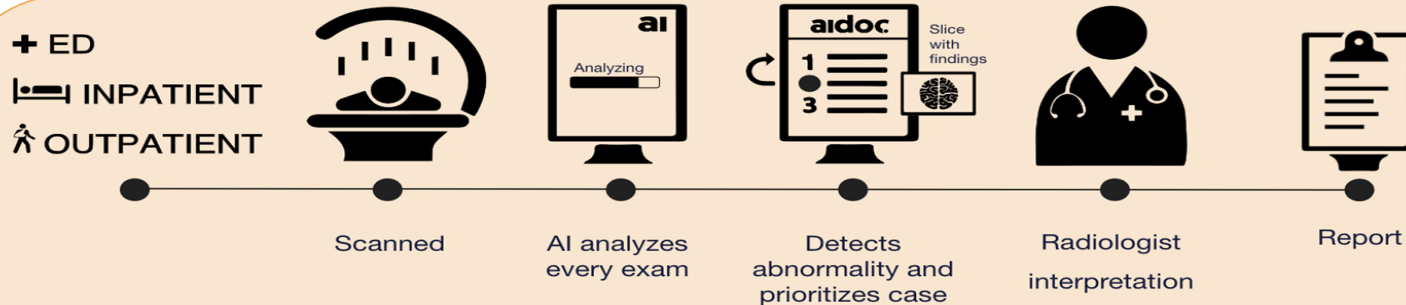


Workflow Categories for AI - Detected Pathologies

- **Actionable:** All imaging findings that are clinically significant, which will require clinical and/or radiological further action and follow - up.
- **Critical:** All imaging findings that require immediate clinical intervention/disposition, ideally before patient leaves imaging department.
- **Noncritical:** All imaging findings that can be conveyed after patient leaves imaging department.
- **Related:** All imaging findings that are sought/expected to be discovered for the ordered specific imaging test.
- **Incidental:** All imaging findings that are incidentally (not sought or expected) discovered for the ordered specific imaging test.
- **Turn Around Time (TAT):** Time from initial imaging acquisition to final report completion.

Introduction

- Incidental imaging findings occur in 5% - 30% of imaging studies.
- Actionable incidental findings (AIFs) present an opportunity for radiologists to lead the next steps in patient management.
- Our research group investigated the impact of an AI-guided triage workflow on the timely identification of actionable incidental findings; incidental pulmonary embolism (iPE) and intracranial hemorrhage (ICH) in the outpatient (OP) setting.



Turn Around Time

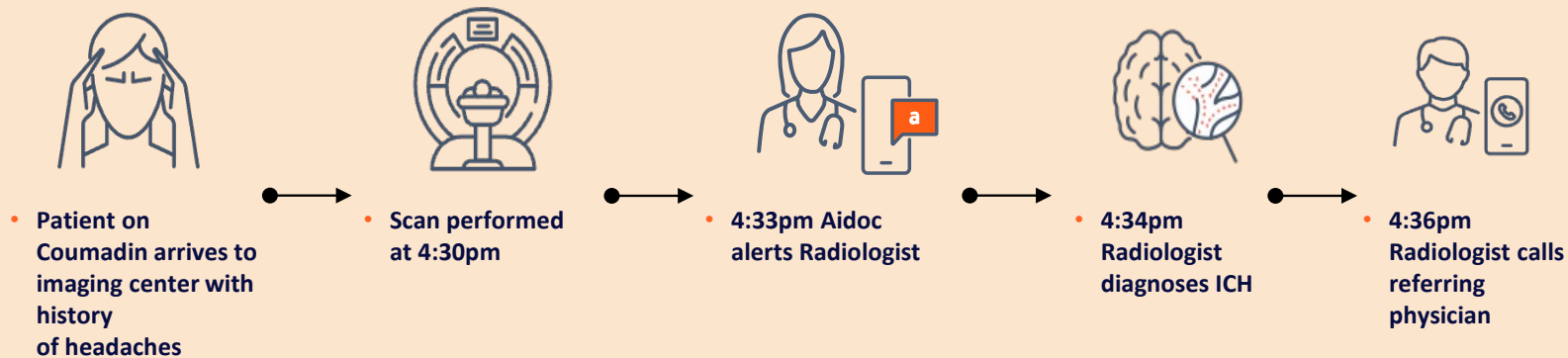
Turn Around Time (TAT): Time from initial imaging acquisition to report completion.

Example impact of AI on standard of care

Current Standard of Care



Standard of Care w/ AI



Methods

Implementation :

Deployed a computer aided triage solution to analyze all imaging scans for iPE (contrast CTs w/ chest) and ICH (non - contrast head CTs) in the outpatient setting. Active notifications pushed by the AI system for suspected positives to radiologists.

Data Collection:

- Collected case level TAT metric for AI-positive and AI-negative cases of iPE and ICH.
- Captured variables such as imaging acquisition time, notification time (if applicable), and report completion time.

Analysis:

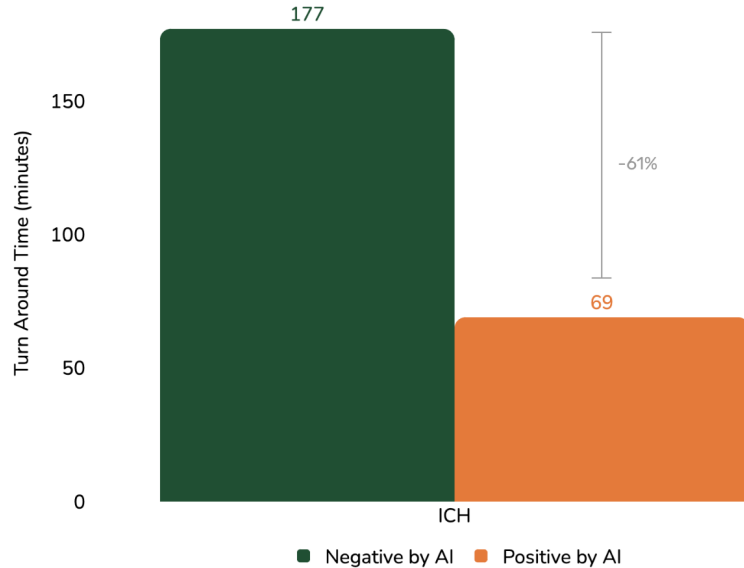
- Compared TAT for AI-positive vs. AI-negative cases within each pathology (iPE and ICH).
- Assessed the impact of AI prioritization on TAT for suspected positive cases compared to standard cases.

Outcome Measure:

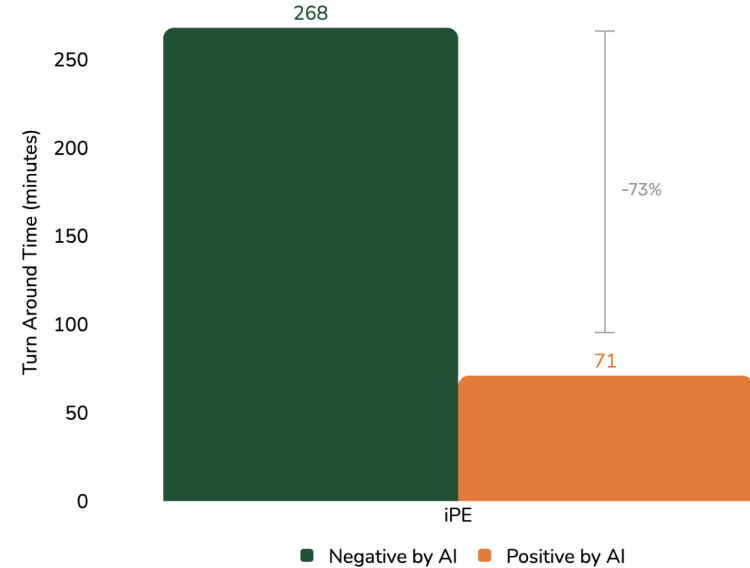
- Evaluated whether AI triage reduced TAT in suspected positive cases of both iPE and ICH, and the downstream clinical impact on patient management.

Results: Positive Prioritization Time

Median Turn Around Time



Median Turn Around Time



Study period: July 2023 to February 2024. **AI flagged:** 51 patients with iPE. 150 patients with ICH.

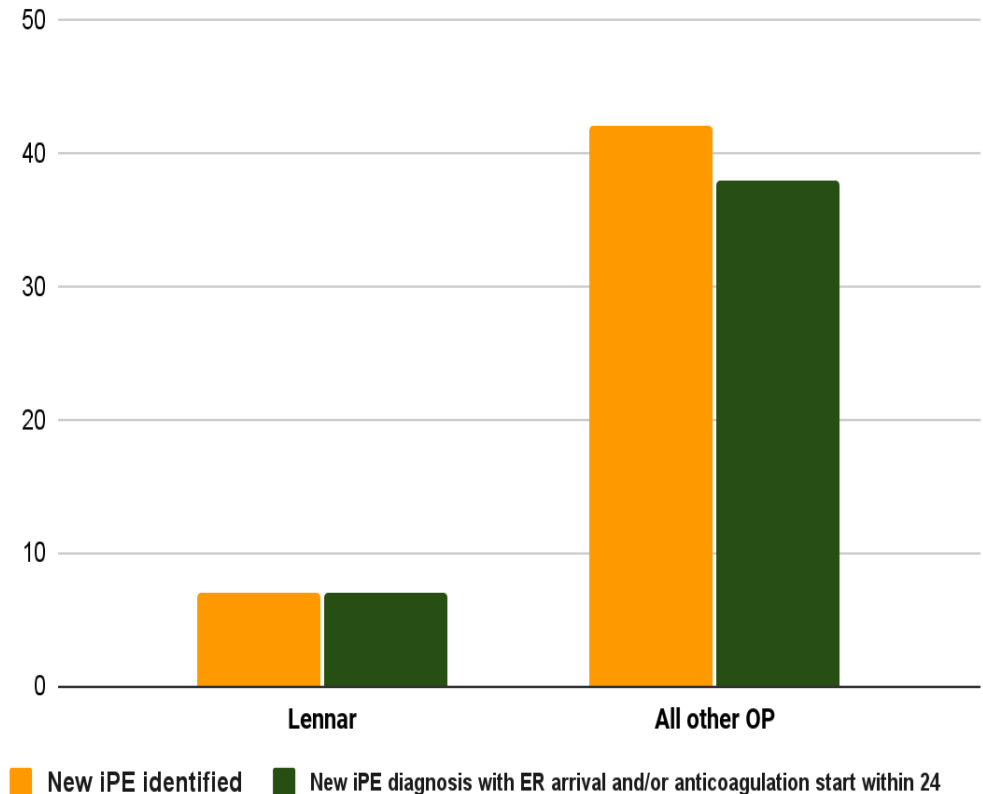
Positive Prioritization Time :

- iPE Median TAT for suspected positive iPE: 71.3 minutes (vs. 267.6 minutes for suspected negative cases).
- ICH Median TAT for suspected positive ICH: 69.15 minutes (vs. 176.9 minutes for negative cases).

Impact of POCAID + ARNP: iPE

Additional Analysis : 2/6/2024 - 9/30/2024

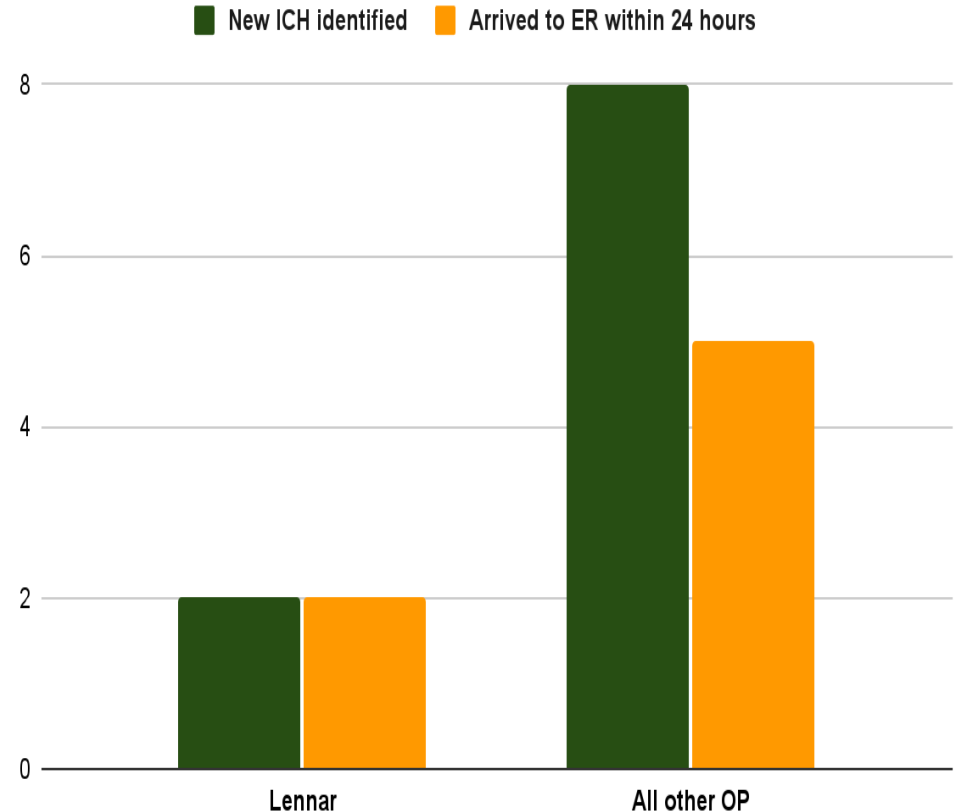
- Lennar (w/ NP) versus all other outpatient sites
- Lennar (**n=8**) iPE
 - n=1 (12%) already on anticoagulation for known PE
 - Of the n=7 with new finding of incidental PE:
 - 100% began anticoagulation or arrived to the ER within 24 hours
- All other OP sites (**n=58**) iPE
 - n= 16 (27%) already on anticoagulation for known PE
 - Of the n=42 with new iPE:
 - 38 (90%) began AC and/or ER arrival within 24 hours
 - $p=0.02$



Impact of POCAID + ARNP: ICH

Additional Analysis : 2/6/2024 - 9/30/2024

- Lennar (w/ NP) versus all other outpatient sites
- Lennar (**N=9**) ICH
 - n=7 (78%) already known/chronic ICH
 - n=2 (22%) with new findings of ICH
 - 100% arrived to the ER within 24 hours
- All other OP sites (**N=54**) ICH
 - n= 46 (85%) already known/chronic ICH
 - n=8 with new findings of ICH
 - 5 (62%) arrived to the ER within 24 hours
 - $p=0.03$
 - 2 (25%) saw their neurosurgeon outpatient, 1 (12.5%) unknown



Rapid ICH and iPE Intervention

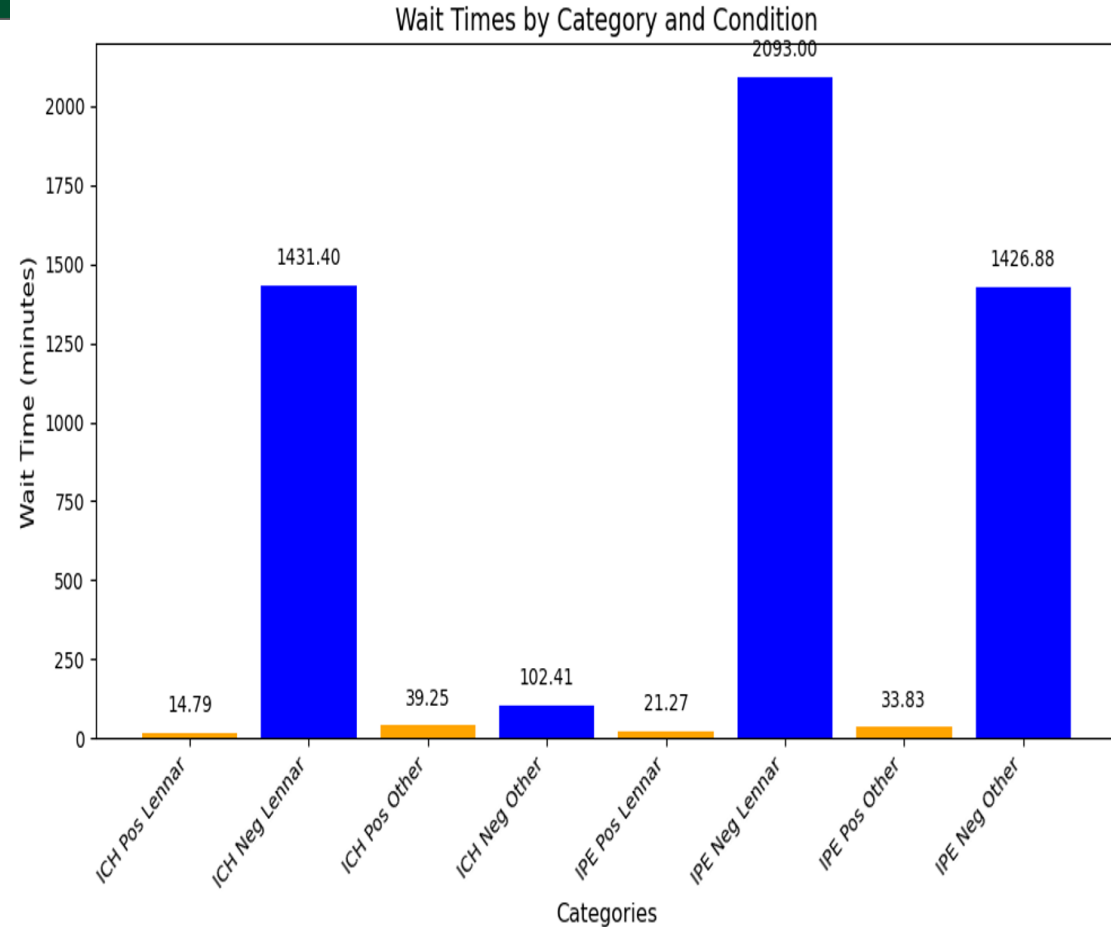
Positive Prioritization Time at outpatient center with NP is significantly less than TAT without NP.

Impact of Early Detection in ICH:

- **Mortality Rates:** Approximately 50% of ICH-related deaths occur within the first 72 hours, predominantly due to neurological complications.
- Early identification allows for timely medical interventions that can mitigate these risks.

Impact of Early Intervention in PE:

- Studies show that **initiating treatment within 24 hours** of PE detection is associated with a **20-30% reduction in mortality** compared to delayed treatment.
- For **high-risk PE patients**, early anticoagulation and possible interventions (e.g., thrombolysis or catheter-assisted procedures) are critical to survival.



Clinical Significance

- AI found 51 iPE and 150 ICH in the outpatient setting in 32 weeks.
- **Faster detection and triage:** AI significantly improved positive prioritization time for iPE and ICH, expediting the management of actionable incidental findings and transitioning patients to the emergency department.
- Expedient intervention in iPE and ICH shown to lead to reduced mortality/morbidity. Patients detected and managed with ARNP and holistic POCAID clinical team lead to decreased mortality.