DIGITAL FIRST RESPONDERS: FIXING PATIENT SAFETY GAPS WITH AI

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BIO

- ENA Position Statement Committee, Chair-Elect (2019), Member (2018-2021)
- STN Government Affairs & Public Policy Committee (2018-2023)
- Pathway to Excellence Coordinator
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These tools are designed to support, but not replace, clinical judgment, licensed providers, or emergency care.

Always consult a qualified healthcare provider for diagnosis, treatment, and medical advice.

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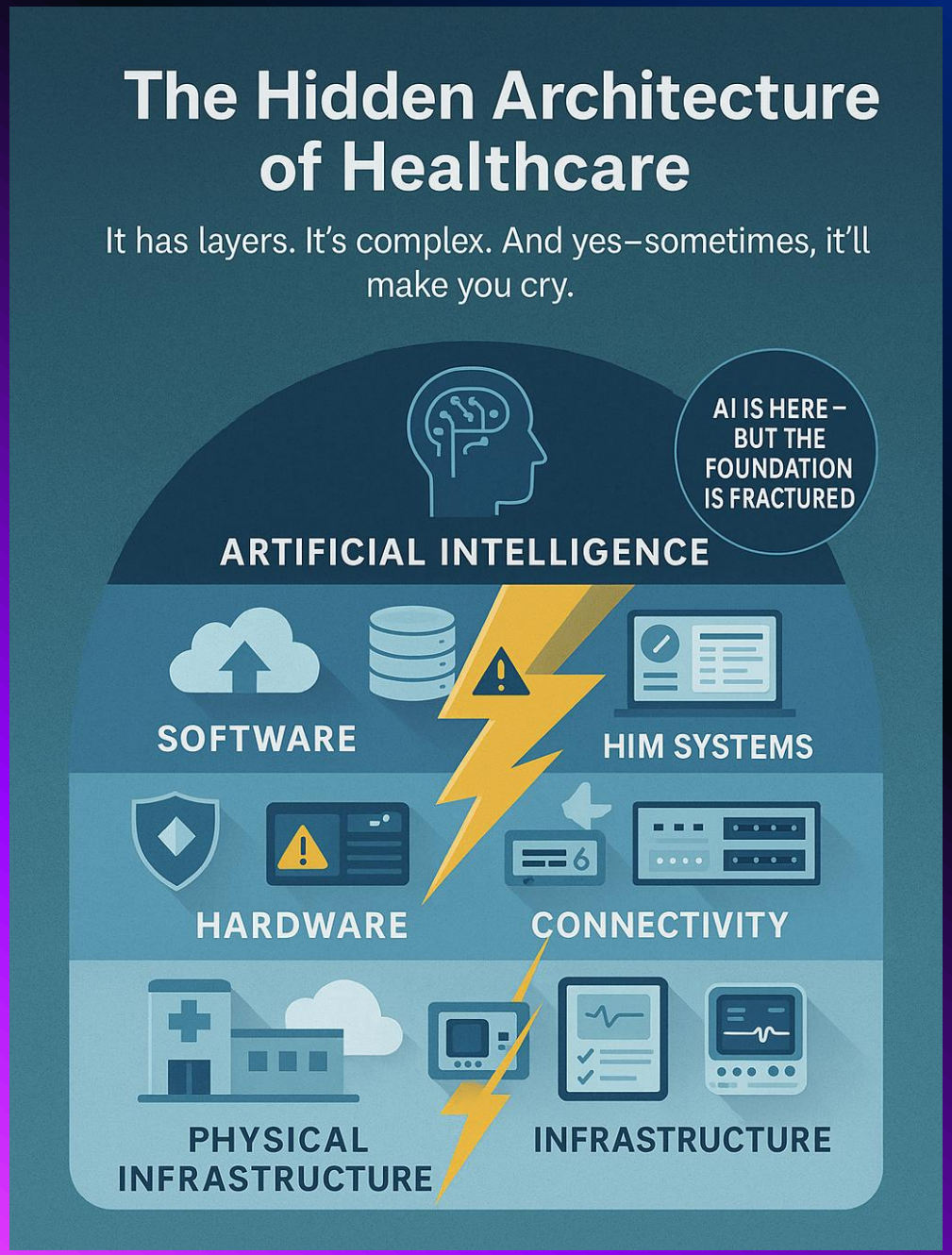
I. BUILDING BLOCKS:
FOUNDATIONS OF HEALTHCARE + AI TAXONOMY



FRACTURED HEALTHCARE ARCHITECTURE

- **Leading the way**: they've modernized core systems, stabilized networks, and built toward a more intelligent environment.
- **Mid-transformation**: making smart upgrades where they can but still navigating constraints like budgets.
- **Deeply dependent**: on legacy tech, unsupported software, flat networks, and unpatchable devices.

HEALTHCARE SYSTEMS: THE ROAST NOBODY ASKED FOR

- Patch Tuesday is celebrated annually.
- Half the biomedical devices run unsupported Windows, the other half run vibes.
- The most effective DLP strategy is system crashes.
- The only Zero Trust in the building is between IT and clinical staff.



HEALTHCARE HORROR STORY: CYBER BECAME A MEDICAL EMERGENCY



- All departments and staff forced into manual mode
- Hundreds of patients diverted mid-care to other facilities
- Receiving hospitals may lack proper beds, staff, or equipment
- Clinicians forced to make high-stakes decisions without data
- Accreditation, safety, and public trust put at risk
- Cyberattacks in healthcare don’t just steal data, they threaten lives



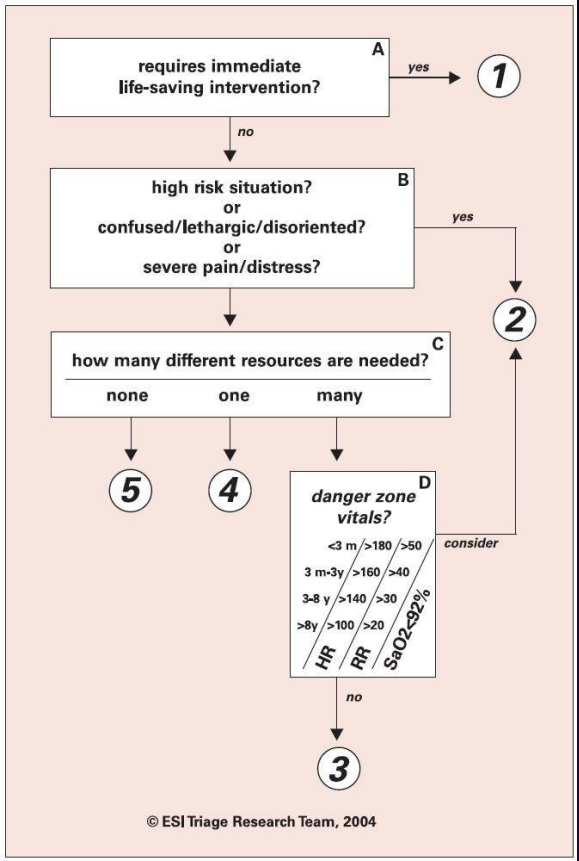
CALL TO ACTION: MODERNIZE HEALTHCARE INFRASTRUCTURE

- ✓ Audit/modernize the infrastructure
- ✓ Break silos; push interoperability
- ✓ Invest in infrastructure for adaptability
- ✓ Start small, scale smart
  - ✓ AI pilots in mature environments

II. EMERGENCY AND TRAUMA CARE

CLINICAL REALITIES
&
AI OPPORTUNITIES

EMERGENCY SEVERITY INDEX (ESI)



- 94% of hospitals in the United States use the ESI triage algorithm
- Emergency Department (ED) triage takes 5 minutes or less
- Efficient patient assessment and prioritization based on medial urgency and scarce resources

Agency for Healthcare Research and Quality (AHRQ). *Emergency Severity Index (ESI) Triage Algorithm, Version 4.*

HOW ED TRIAGE WORKS …



This is what we do NOT want
(Games, life stories, babysitting)

This is what we DO want
(Fast, focused, flawless)



NURSE ADHERENCE TO ESI ALGORITHM

- A retrospective observational study examined the triage distribution of 954,847 ED encounters at 25 hospitals.
- The estimated (human nurse) adherence to the ESI algorithm and assigning triage categories was as low as 60%.

Chmielewski, Nicholas DNP, RN, CEN, CENP, NEA-BC, FAEN; Moretz, Jason MHA, BSN, RN, CEN, CTRN. ESI Triage Distribution in U.S. Emergency Departments. Advanced Emergency Nursing Journal 44(1):p 46-53, January/March 2022. | DOI: 10.1097/TME.0000000000000390

ML / AI IN ED TRIAGE

1,142 studies screened → 29 included

ML / AI outperformed traditional triage in accuracy

Improved risk assessment, disease identification, and care quality

Accurately predicted hospitalization and length of stay

TL;DR ML / AI can redefine triage precision in the ED



Tyler, Samantha, et al. "Use of artificial intelligence in triage in hospital emergency departments: a scoping review." *Cureus* 16.5 (2024): e59906.

AI SCORES BETTER THAN MDS?

WILL KNIGHT BUSINESS JUN 30, 2025 9:00 AM

Microsoft Says Its New AI System Diagnosed Patients 4 Times More Accurately Than Human Doctors

The tech giant poached several top Google researchers to help build a powerful AI tool that can diagnose patients and potentially cut health care costs.



- This doesn't mean AI is replacing physicians. It reflects progress.
- Microsoft claims stem from internal and narrow use cases; not broad clinical practice.
- It's about combining AI's speed and scale with human insight and empathy.

Knight, W. (2025, June 30). Microsoft Says Its New AI System Diagnosed Patients 4 Times More Accurately Than Human Doctors. Wired. https://www.wired.com

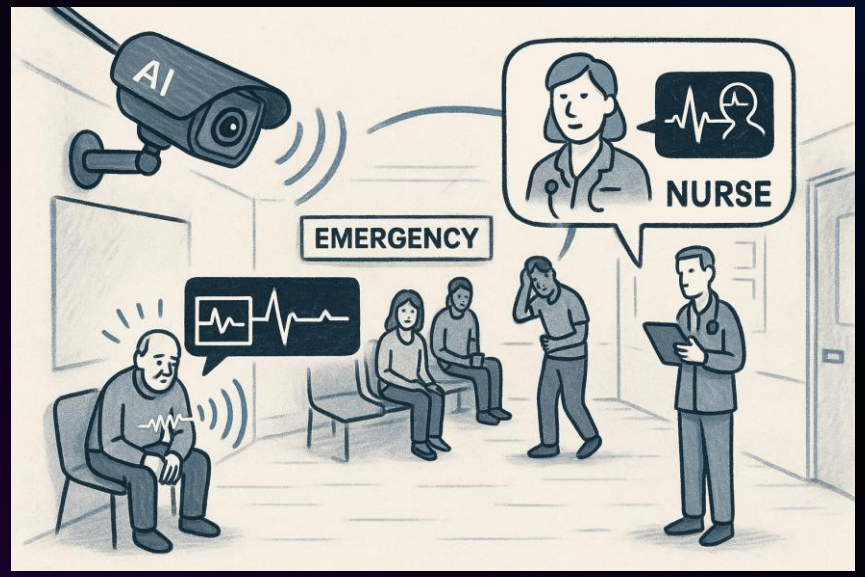
AI CAMERAS:
FROM SECURITY TO SYMPTOMS



Current Snapshot	Future Snapshot
Primary use: Security	Dual Role: Security & Patient Monitoring
Monitor entry/exit, restricted zones	Detect clinical red flags, real time alerts to triage/rapid response teams
Detect unauthorized access and loitering	ESI AI Vision, flags deteriorating conditions based on thermal imaging & vital signs
Used by security teams only	Feeds data to EHR, dashboards, and workflows

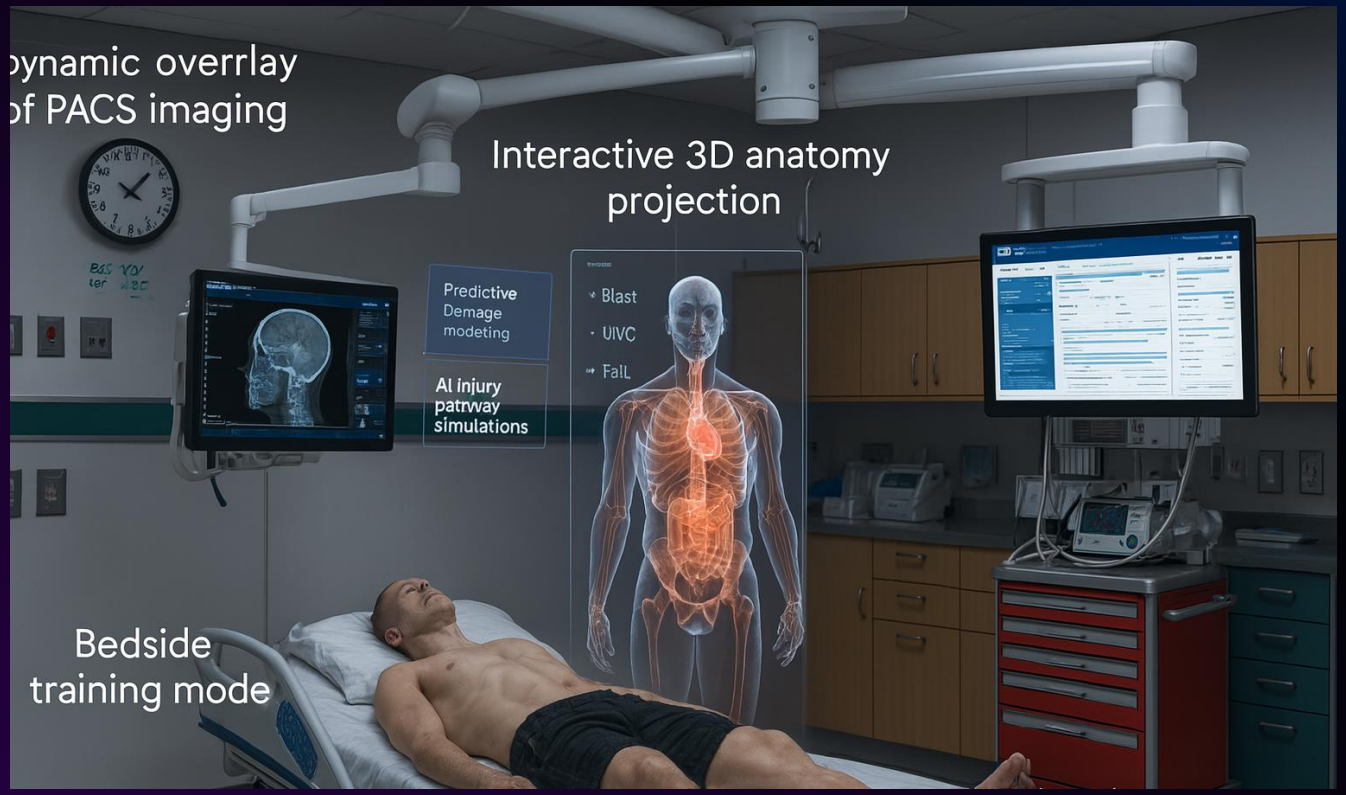
HOW AI CAMERAS FUNCTION IN WORKFLOWS

1. **Detection** – Trained on clinical models (like ESI or FAST) to recognize real-time symptoms.
2. **Deployment** – Run on the edge (local devices like Verkada, Axis) or in the cloud, with secure hospital network feedback.
3. **Integration** – Connect via secure APIs to EHRs & dashboards.
4. **Automation** – With provider sign-off, they can trigger alerts (e.g., seizure in Room 3), notify teams, and auto-generate reports.



LIVE AI ANATOMY: TRAUMA IN 3D

1. Dynamic overlay of PACS imaging
    a. Predictive damage modeling
2. Interactive 3D anatomy projection
    a. Highlight zones based on injury
3. AI Injury pathway simulations
    a. Blast, MVC, fall,
4. Integrate with EHR (History, surgery, medications, labs, vitals, imaging)
5. OR and ICU predictions



HEALTHCARE ACADEMIA

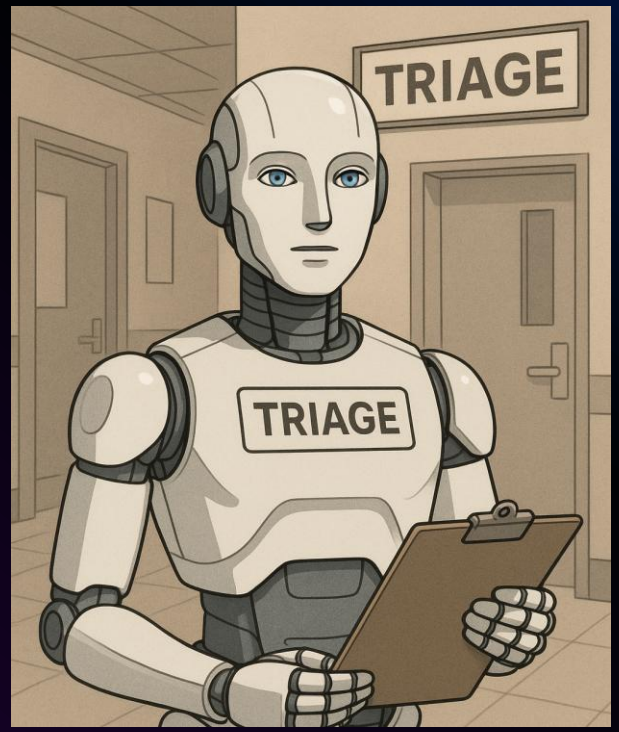
- Immersive AI SIM labs with avatar
- Personalized learner analytics
- Disease progression “time-lapse”
- Digital-twin practice playground
- Bedside training mode
  - Show consequences of delays, alternative interventions, reply post resuscitation



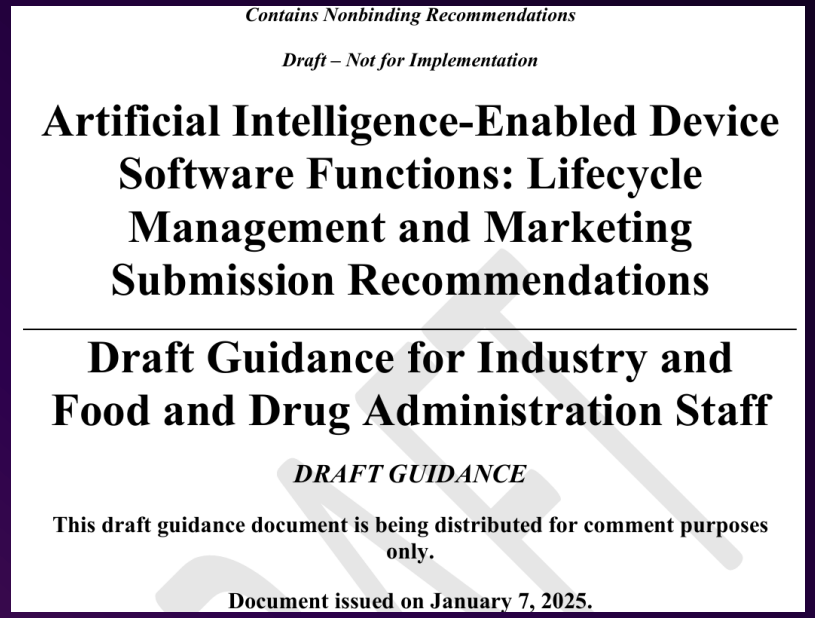
APPLICATION OF HUMANOID ROBOTS

The goal isn't to replace human clinicians but to extend their reach, reduce burnout, and improve patient throughput, safety, and experience.

- General Hospital Use
  - Front desk, greeter, equipment transport, language translation
- Emergency Department / Trauma
  - Triage partner, patient monitoring, pre-charting support, family liaison, telepresence, de-escalation assistant, rehabilitation, disaster relief, & education simulations



HUMANOID ROBOTS: FROM CONCEPT TO CLINICIAN



Contains Nonbinding Recommendations

Draft – Not for Implementation

Artificial Intelligence-Enabled Device Software Functions: Lifecycle Management and Marketing Submission Recommendations

Draft Guidance for Industry and Food and Drug Administration Staff

DRAFT GUIDANCE

This draft guidance document is being distributed for comment purposes only.

Document issued on January 7, 2025.

Artificial Intelligence-Enabled Device Software Functions: Lifecycle Management and Marketing Submission Recommendations

FDA Approval Pathway:

In clinical settings, humanoid robots must be classified as **medical devices** and go through FDA review.

Classification

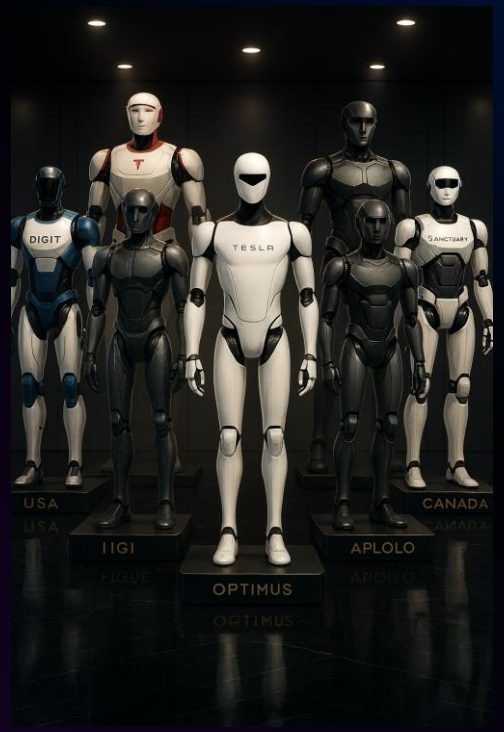
- Class I (low) | Transport | General controls
- Class II (moderate) | Triage | 510(k) premarket clearance
- Class III (high) | Surgery | PMA (Premarket Approval)

Current Market: Robots are for specific tasks (da Vinci for surgery)

Future Prediction: I can envision the 1st humanoid robot for non-invasive support like triage within the next 5 years.

HUMANOID ROBOTS: COMMERCIAL MATURITY

Country	Manufacturer	Robot	Reference
China	Fourier Intelligence	GR-1 / GR-2	FOURIER-Robotics
USA	Agility Robotics	Digit	agilityrobotics.com
China	Unitree Robotics	H1 / H1-2	Roboworks
China	UBTECH Robotics	Walker S1	en.jiemian.com
USA	Figure AI	Figure 02	BMW Group



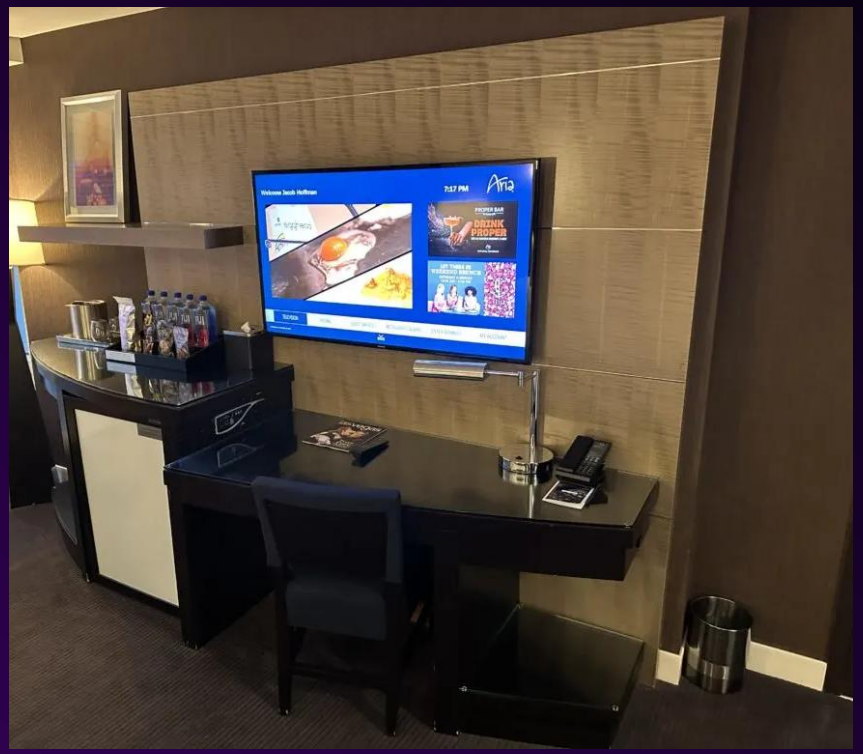
THERE'S AN AGENT FOR THAT: SMARTER NURSE HANDOFFS

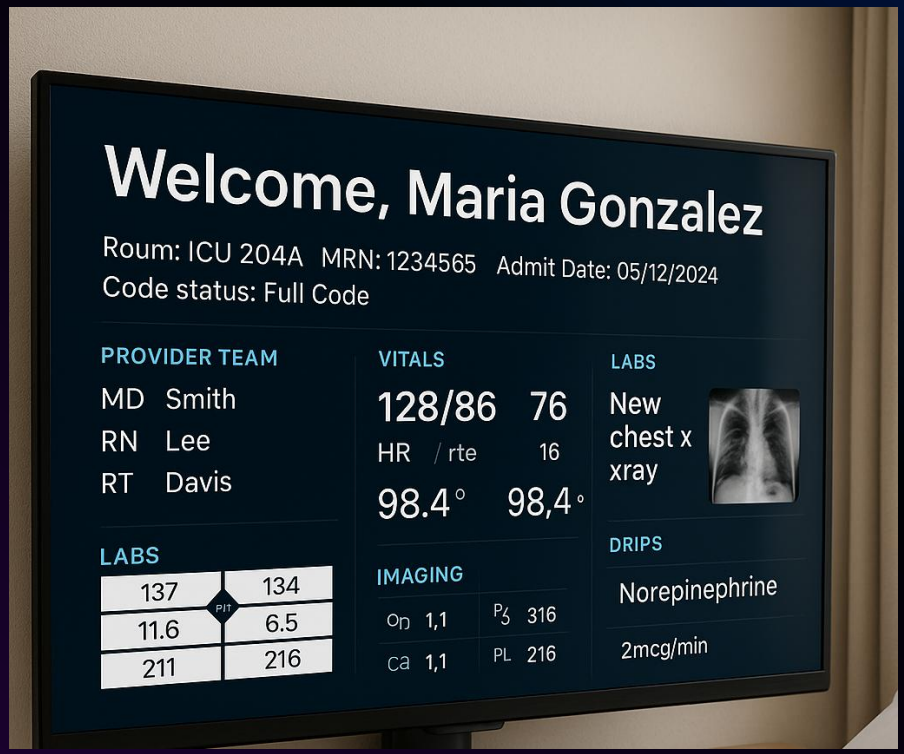
- AI dictates patient notes
- Train AI to pull the right data for the right department (ED, ICU, OR)
- Save clinical time and improve accuracy
- Dynamic handoff report updated in real time

- Cleveland Clinic's ED digital handoff report
  - Shaves off 15 minutes on every nurse-to-nurse handoff
  - A nurse with 4 patients can return nearly **1 hour** to direct care
  - If there are 10 nurses on 1 unit, this gives back 10 hours to direct patient care per shift (q12 hrs).

Cleveland Clinic. *Electronic Handoff Report Replaces Cumbersome Workflow.* Consult QD, Sept 23 2024.

REAL-TIME UPDATES PATIENTS DESERVE





Hoffman, Jake. "*Aria Deluxe King Room Review (Strip View) – Look Inside!*" *Las Vegas Then and Now*, 18 May 2023, https://lasvegasthenandnow.com/aria-deluxe-king-room-review-strip-view/.

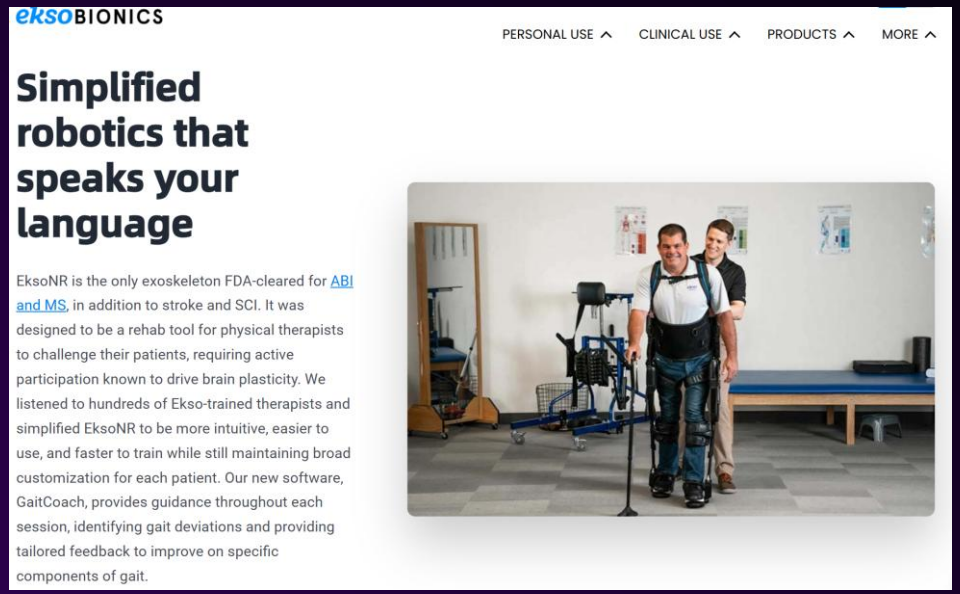
TELE MEDICINE

1. AI Powered Diagnostics
    a. Help diagnose skin cancer
2. Smart Triage and Chatbots
    a. 24/7 guidance, decision tree
3. Remote Monitoring
    a. Wearables alert clinicians (glucose)
4. Language Translation & Accessibility Tools
    a. Real time translation and audio-visual enhancements for disabilities



Shickel, B., Rashidi, P., Thapa, I., & Johnson, A. E. W. (2023). *An explainable AI-enabled telehealth platform for early detection of sepsis in remote settings*. **IEEE Journal of Biomedical and Health Informatics**, 27(5), 2100–2110. https://doi.org/10.1109/JBHI.2023.3247650

REHAB REINVENTED: AI POWERING RECOVERY



Adaptive AI rehab programs

- Real time patient progress

Remote Based Therapy

- Wearables enable care beyond office/clinic

Gamified Therapy

- VR engagement boosts motivation/adherence

Exoskeletons (EksoNR)

- AI enabled gait and limb training devices (Stroke, SCI, MS)

Ekso Bionics. (n.d.). *EksoNR robotic exoskeleton for neurorehabilitation*. https://eksobionics.com/eksonr/

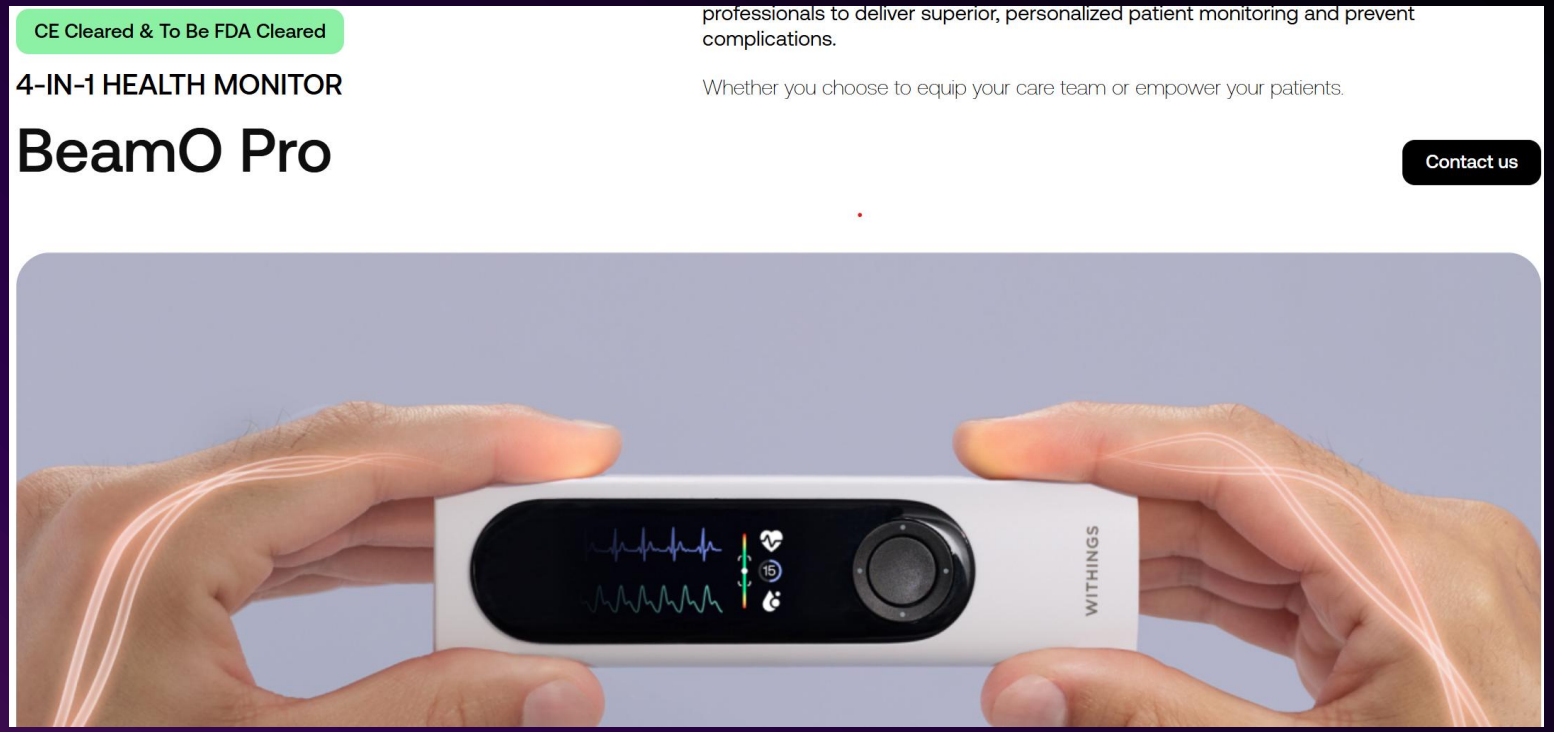
HOME AS A HEALTH CARE HUB (HAHH)

1. Remote monitoring
   a. Track vitals, predictive models
2. Decision support
   a. Image analysis (wounds), diagnostics
3. Automation of routine tasks
   a. Medication reminders, charting
4. Connect as hub
   a. Smart home integration, voice assistant, IoT sensors)



U.S. FDA. (2025). *Home as a health care hub Idea Lab*. Retrieved from https://www.fda.gov/medical-devices/home-health-care-hub/idea-lab

BEYOND THE BEDSIDE: EXTENDING THE CLINICAL PERIMETER



- Enables hospital-level monitoring from home, reducing re-admissions.
- BeamO Pro is a 4-in-1 MultiScan measuring temperature, heart, respiratory, and Telehealth.
- Integrates with EHR and patient portals.

ETHICAL & PRIVACY SAFEGUARDS

- Appoint AI Ethics Board (clinicians, legal, patient rep) to pre-vet models & vendors
- Maintain human-in-the-loop for all life-critical decisions
- Adopt “privacy by design”
- Algorithmic bias & efficacy audits, traceability, transparency
- Robust consent (post signage, obtain informed consent)
- Secure edge/cloud architectures

BUSINESS ALIGNMENT: AI THAT MOVES METRICS

Operational Efficiency:

- ED Throughput
- Average Length of Stay (ALOS)
- OR Utilization & First Case On-Time Starts

Quality / Accreditation:

- Time to CT / Imaging Compliance
- Door-to-Needle Time (Stroke)
- Door-to-Balloon Time (STEMI)
- Mortality Index / Risk-Adjusted Outcomes

Finance:

- Denial Rate / Clean Claims Rate
- Readmission Penalties (targeted follow-up)

Academics:

- Clinical Documentation Quality
- Procedure Exposure + Simulation Training

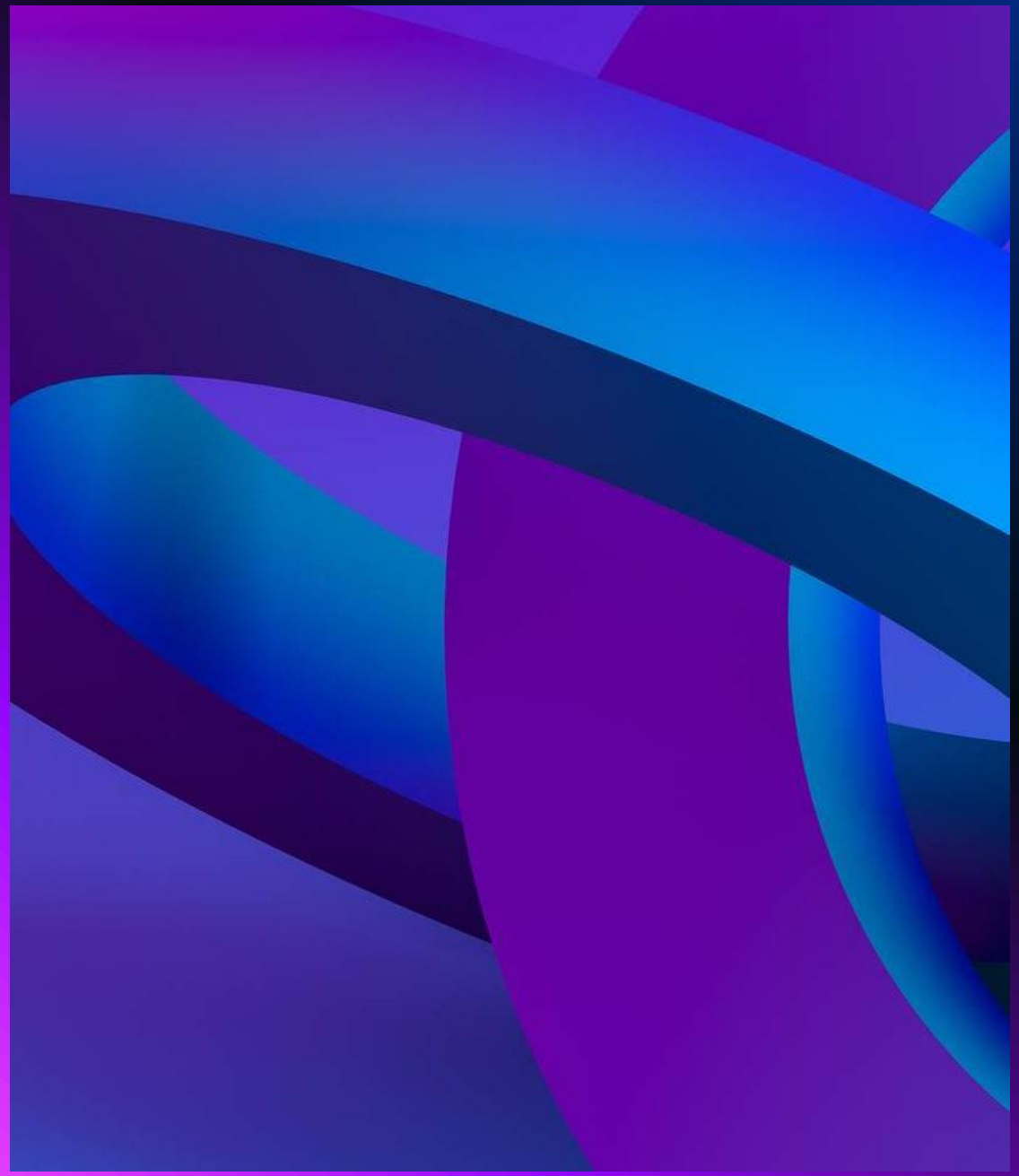
Each AI solution can tie back to a healthcare metric that matters

IN TRIAGE BAYS WHERE SECONDS COUNT,
LET SENSORS WHISPER WHAT CHARTS CAN’T SHOUT.

YOUR “FIRST RESPONDER” MAY RUN ON CODE,
WATCHING VITALS ON A STEALTHY NODE.

BUT TECH ALONE WON’T KEEP FOLKS WHOLE,
IT’S HACKERS AND HEALERS ON THE SAME PATROL.

SO HACK WITH HEART, DESIGN WITH CARE,
AND LEAVE NO PATIENT UNAWARE.



THANK YOU

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ORIGIN STORY: IMAGES OF CHANGE

The Change Analysis: Images of Change

HRM-587N-61546

By: Jennifer [redacted]

For: Professor Shelton

November 10, 2013



- **Grad school spark**: Kinect powered triage sidekick
- **Vision**: real-time patient monitoring
- **Reality**: Kinect flopped, concept endured
- **Today**: AI cameras make it possible & scalable
- **Next Step**: Help bring this *Digital First Responder* to the frontlines of ED care …

Build. Hack. Pilot. Share.

CASE STUDY: DEPLOYING AI VISION @ AIMC

AIMC Hospital Snapshot

- Level 1 Trauma Center | 650 beds
- 80 ED Bays: trauma/resus, psych, pods, fast track
- 275 patients daily
- 12–20 arrivals per hour
- Visitors: 25–60+ individuals

Deployment

- 24 AI cameras: ceiling-mounted, panoramic, zero blind spots
- Optimize throughput
- Enhance safety
- Monitor crowding | Surges | Decompress