Innovation in Obstetrics: Early Warning and Artificial Intelligence

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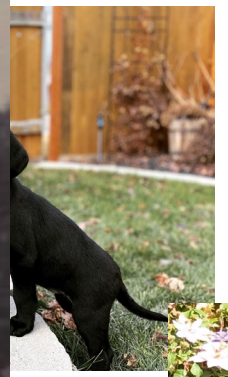
Disclosure

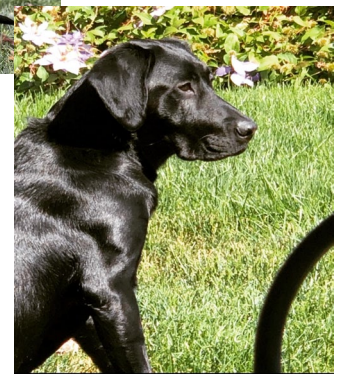
I am employed with PeriGen, Advanced Software Solutions that is briefly highlighted in this presentation.

Objectives

Highlight	• Innovations in Fetal Monitoring
Reflect	• On our Current Perinatal Landscape
Discuss	• Artificial Intelligence Innovation in Healthcare & OB
Review	• Early Warning AI Support in OB

A Bit About Me & My Why

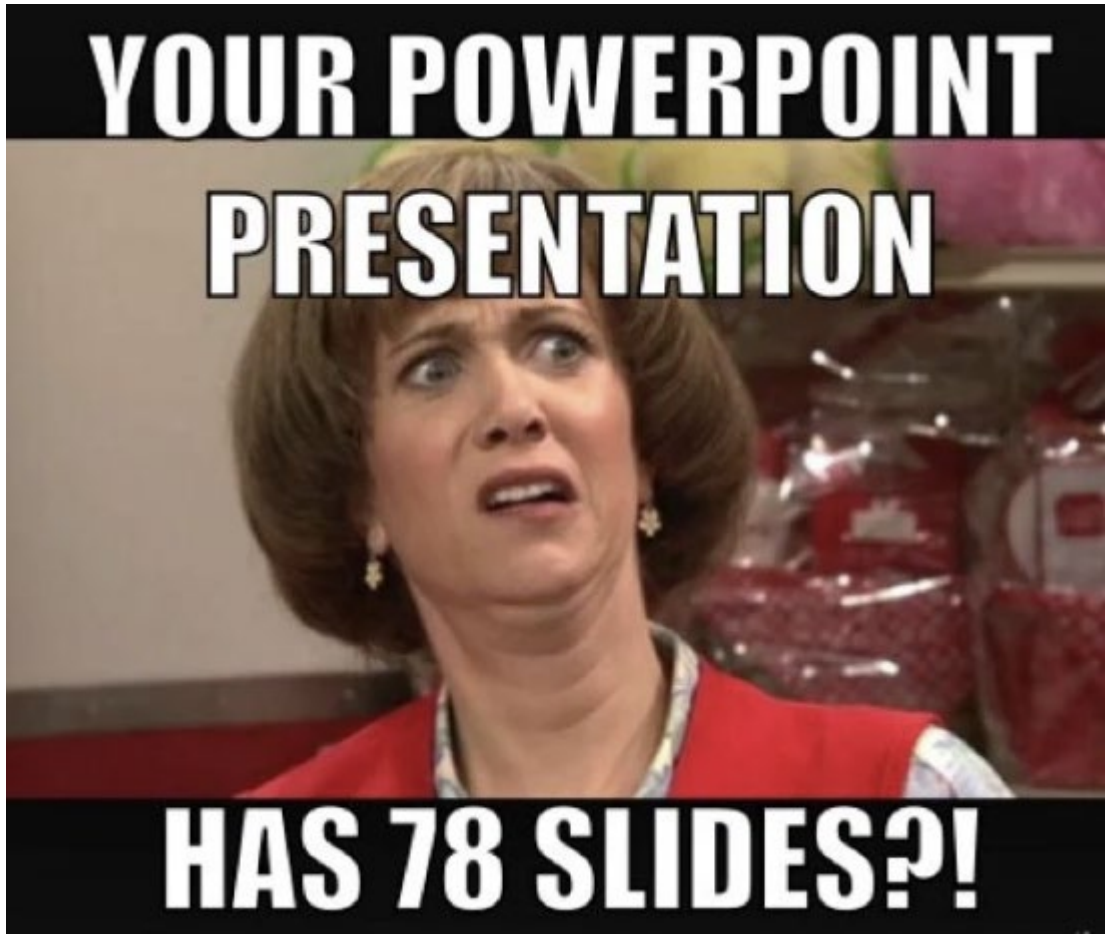




A Bit About Me & My Why

Laughter is a Gift...

"Every time you smile at someone, it is an action of love, a gift to that person, a beautiful thing." ~ Mother Teresa



Fetal Monitoring Innovations

Electronic Fetal Monitoring

Electronic Fetal Monitoring

Electronic Fetal Monitoring

1968	1980's	1990s	Current State
• First commercially available	• Widely utilized in the acute care setting	• Tracing is digitized – can see it on a computer screen (instead of paper printout)	• Central Fetal Monitoring • NICHD Language

Modern fetal monitoring systems include computer analysis of EFM signals.

Originally developed because EFM interpretation is subjective and there continues to be disagreement in analysis among healthcare professionals.

EFM Science Advances

Engagement Moment

How many have encountered disagreement in the analysis of an EFM strip among your healthcare professional team?

WHY INNOVATION?

55%
FETAL BRAIN INJURIES AVOIDABLE

Hypoxic Ischemic Encephalopathy
Most frequently identified theme is the use and interpretation of EFM in labor.[1]

60%
BIRTH-RELATED CEREBRAL PALSY AVOIDABLE

Most common problem is related to interpretation, assessment, and communication of EFM. [2]

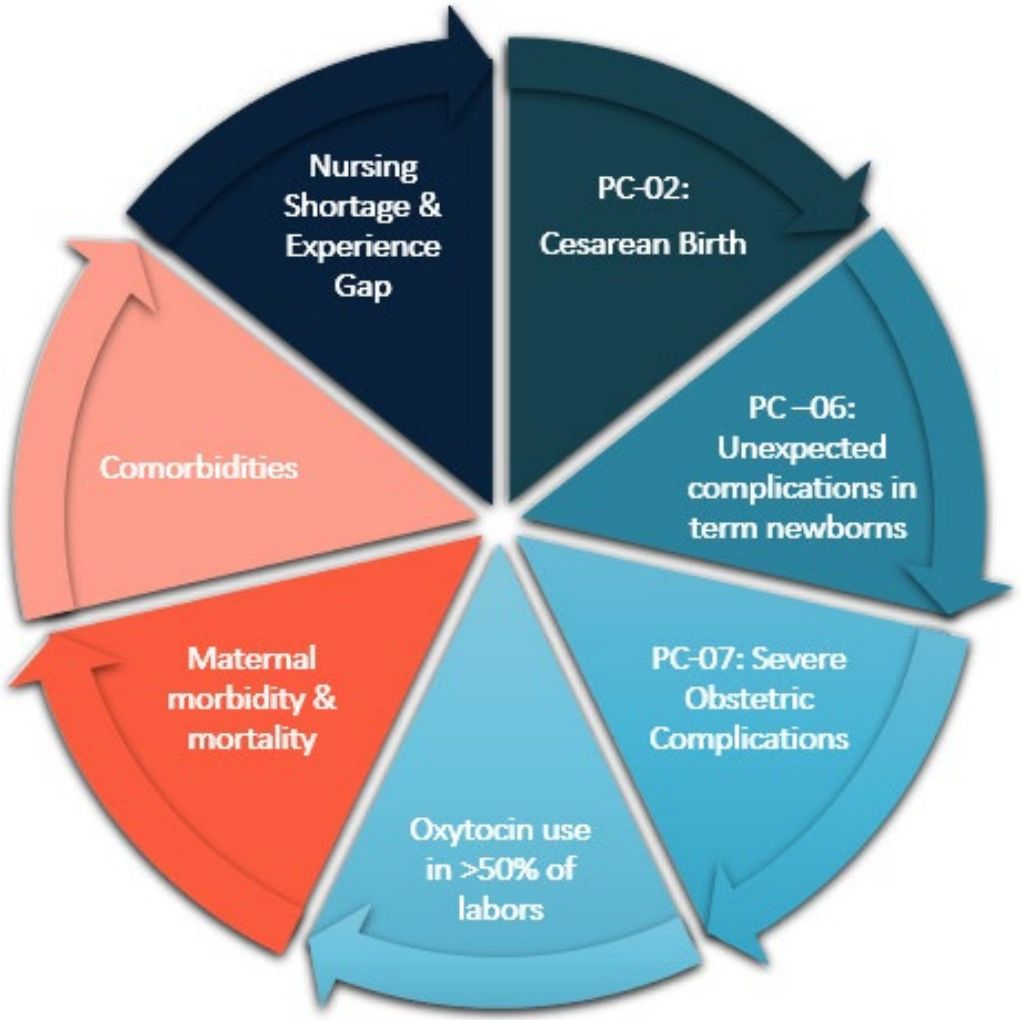
> 80%
PREGNANCY-RELATED DEATHS AVOIDABLE

25% occurred on the day of delivery or within a week after delivery.[3]

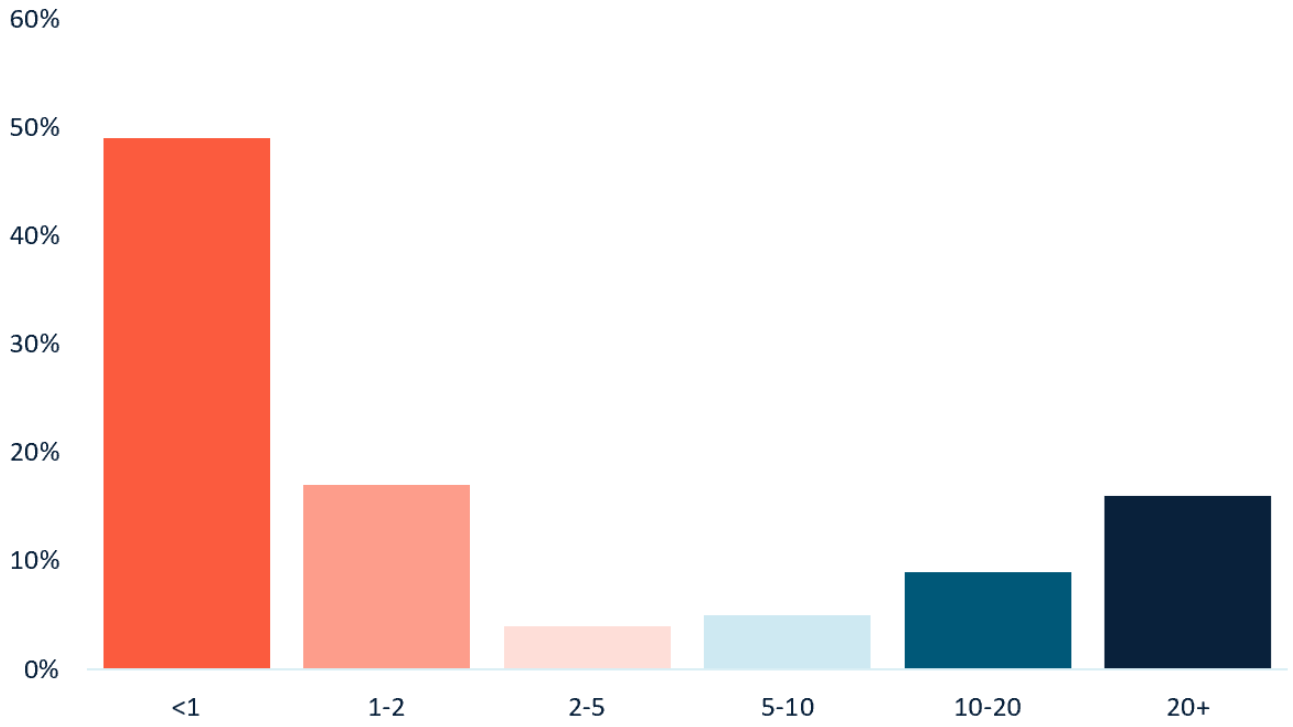
Chief Problems: Delayed recognition and intervention to clinical warning signs[4]

1. Sadler LC, et al AJOG 2016;214(6):747.e1-8
2. Berglund S et al BJOG 2008:115;316-23 3
3. Hnesich,D. (2022). *CDC: Over 80% of pregnancy-related deaths are preventable: AHA News*. American Hospital Association | AHA News. https://www.aha.org/news/headline/2022-09-19-cdc-over-80-pregnancy-related-deaths-are-preventable
4. *Main EK, et al. Obstet Gynecol. 2015;*

Referenced studies were not all conducted in the United States.


Nursing Shortage & Experience Gap
PC-02: Cesarean Birth
PC –06: Unexpected complications in term newborns
PC-07: Severe Obstetric Complications
Oxytocin use in >50% of labors
Maternal morbidity & mortality
Comorbidities

Nursing Experience Gap



Data from a MLOC Level 3 facility with 2700 deliveries per year
25% of the 20+ year category are in administrative roles

66% of L&D nurses at this healthcare organization have less than 2 years experience

Engagement Moment

How would you describe the years of L&D experience on your nursing unit(s)?

WHAT ARE HUMAN FACTORS AND WHY DO THEY MATTER

Human Factors Science

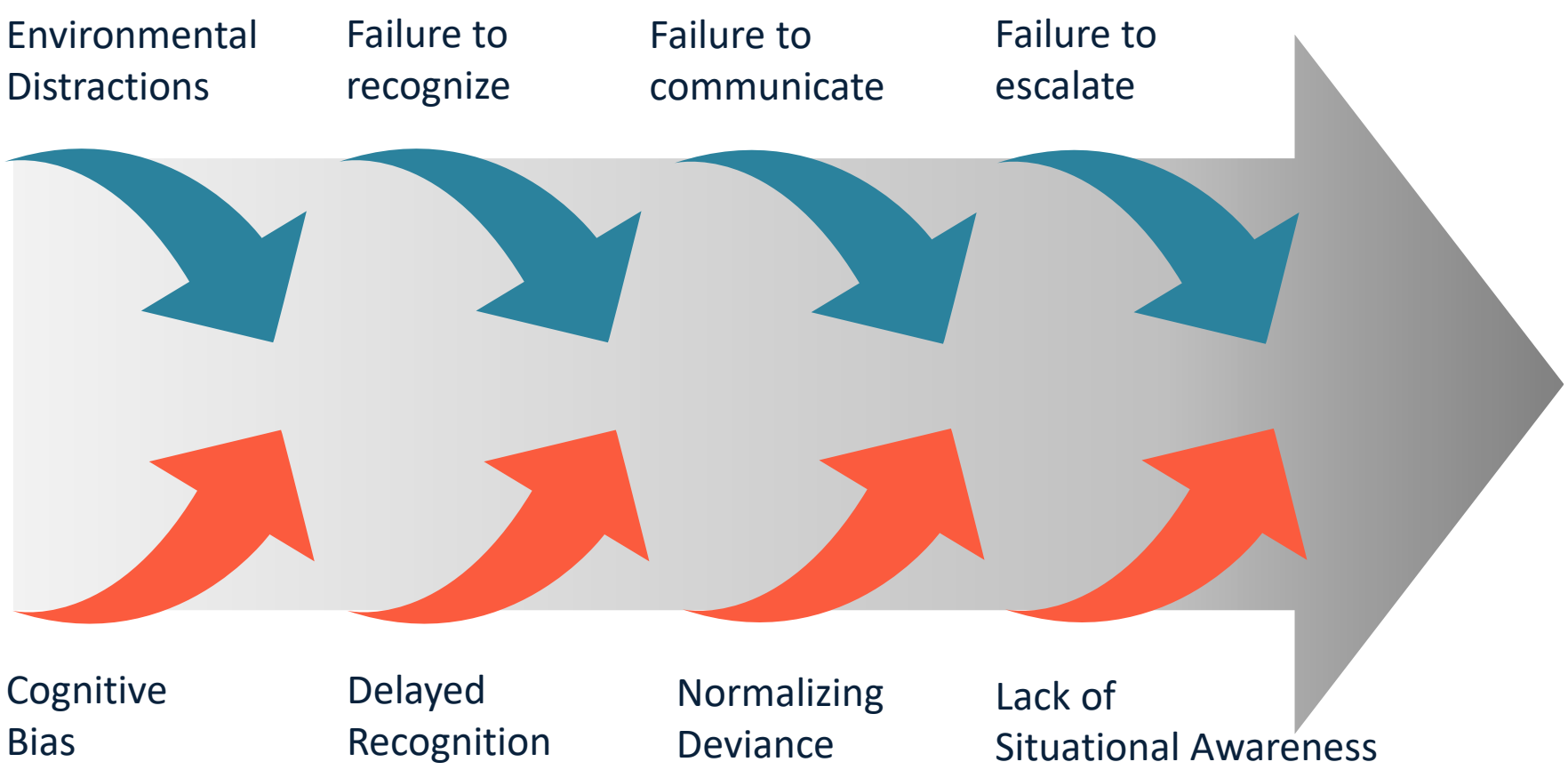
Looks at factors like stress, fatigue, and workload and their impact human effectiveness and error rates.

Especially important in high-risk industries like healthcare, aviation, and nuclear power.

Understanding how people process information, make decisions, and avoid errors under different conditions.

Examining how physical and social environments influence human actions and decision-making.

HUMAN FACTORS THREATENING PATIENT SAFETY



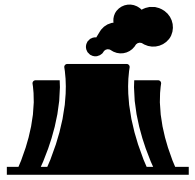
THREATS TO PATIENT SAFETY

Situational Awareness

Summed up as knowing what is going on around you in your environment (Stephens, 2017).

Utilized and well understood for years in industries with complex work environments where error has high, potentially catastrophic, risk for harm such as

Aviation



Nuclear power

Air Traffic Control

Situational Awareness

Focused assessment of your current environment using input from all five senses, and the ability to evaluate for risks or safety threats.

Poor situational awareness skills have been associated with error and accidents.

(Brady & Goldenhar, 2014; Cheng et al., 2020)

Engagement Moment

Can you think of an example in OB where situational awareness is critical?

Situational Awareness During Second Stage

Prolonged second stage increases the risk of adverse maternal and neonatal outcomes

- Increased rates of postpartum hemorrhage
- Chorioamnionitis
- Perineal injury
- Admission to the neonatal intensive care unit

Situational Awareness Humor

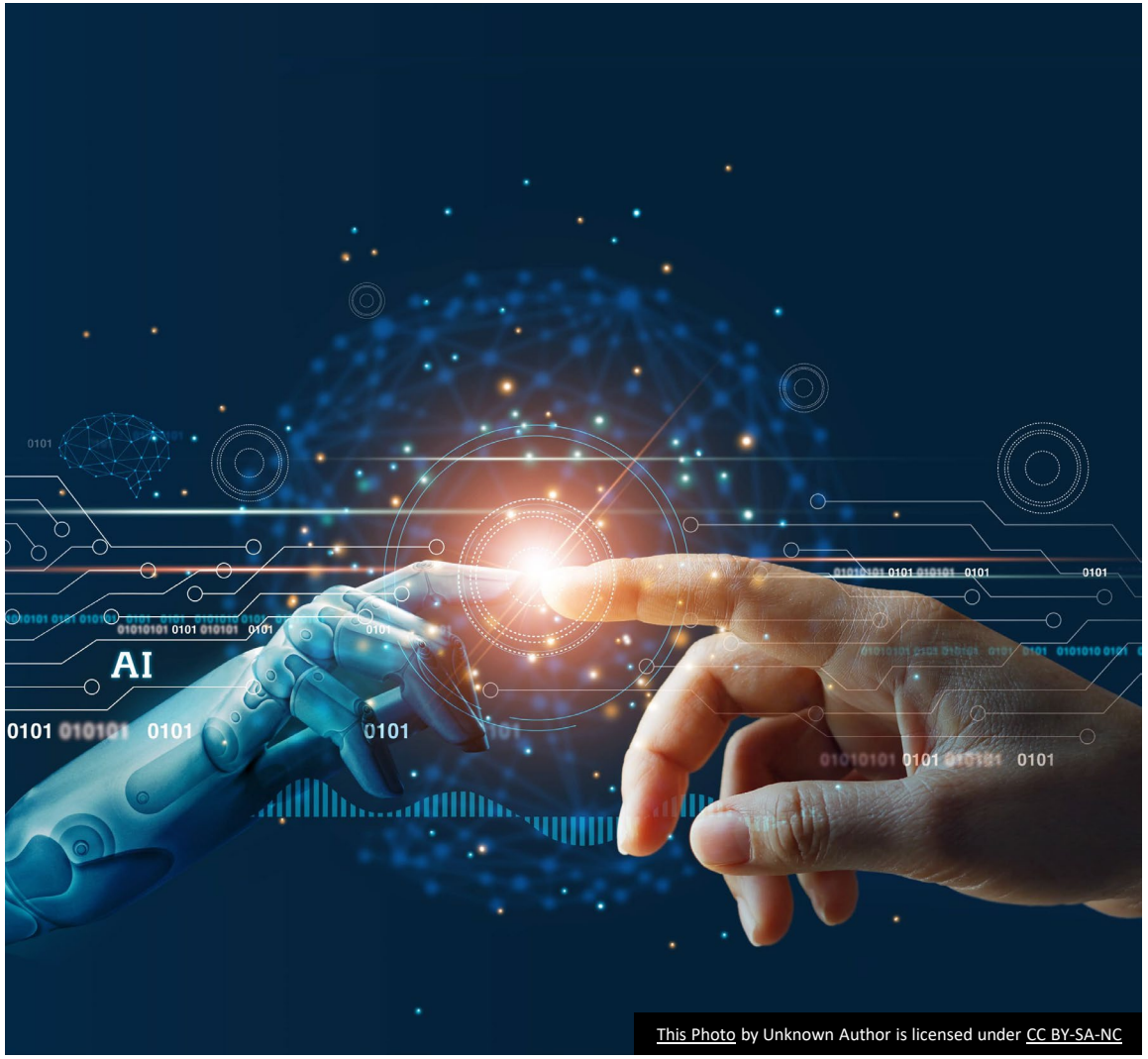
Selective Attention

The process by which individuals focus and select on input for processing while simultaneously suppressing irrelevant or distracting information.

Often called the cocktail party effect. You focus on what your friend is saying rather than every single noise present in the background.

Attention is a limited resource; selective attention allows us to tune out unimportant details and focus on what matters.

https://www.youtube.com/watch?v=vJG698U2Mvo



Innovation and Artificial Intelligence

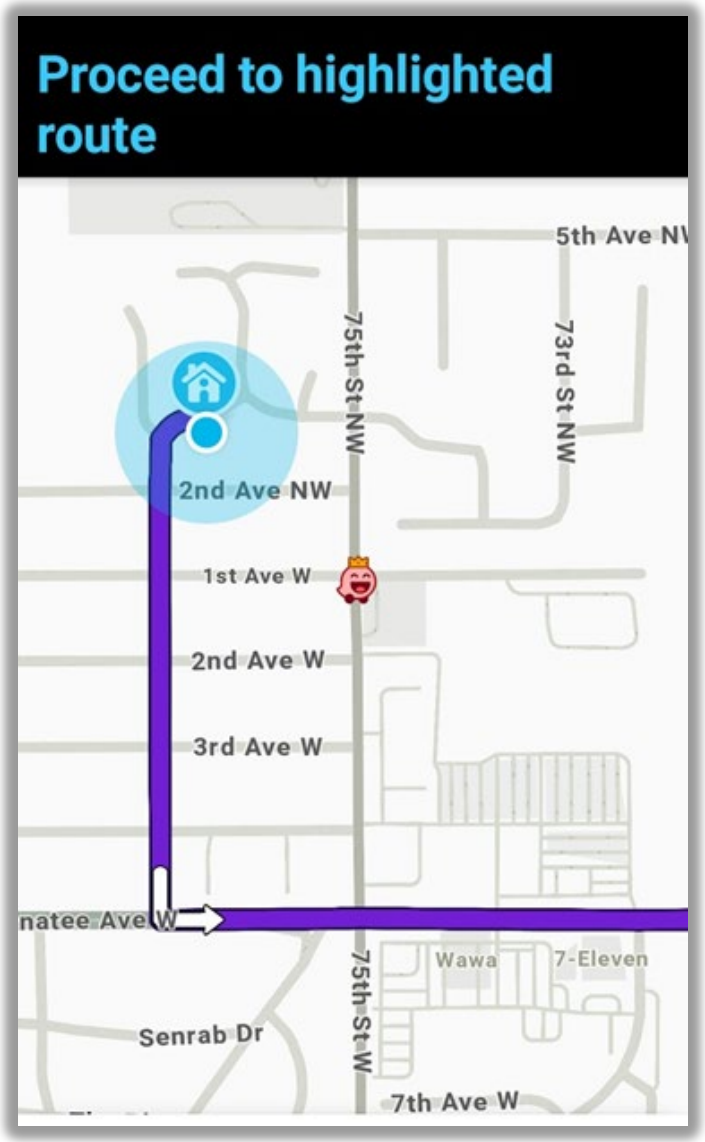
Mitigating Human Factors with Artificial Intelligence

"Artificial intelligence is not a substitute for human intelligence; it is a tool to amplify human creativity and ingenuity."

– Fei-Fei Li, Co-Director of the Stanford Institute for Human-Centered Artificial Intelligence and IT Professor at the Graduate School of Business

ARTIFICIAL INTELLIGENCE

THINK ABOUT THIS…



The narrative of artificial intelligence in healthcare ~~is beginning~~ ~~has begun~~ has taken off.

AI in Healthcare

Basic Types of Artificial Intelligence

Rule-Based AI (Narrow AI): Follows pre-set rules to solve specific problems. For example, clinical decision support systems that alert you when a patient's vital signs are abnormal

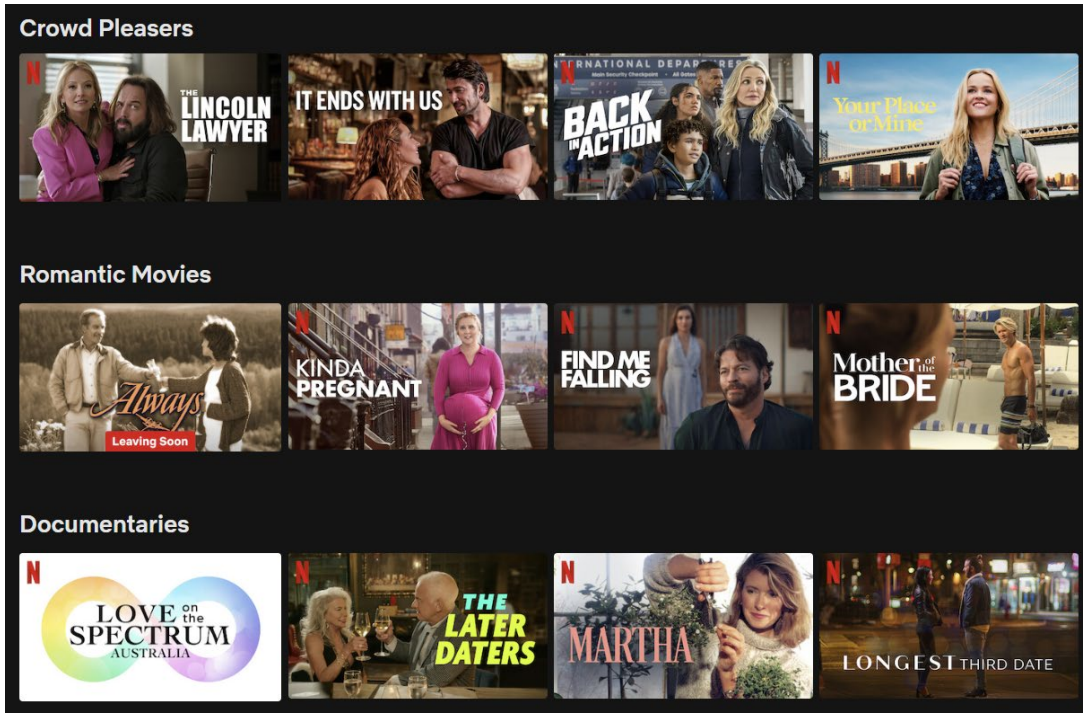
Machine Learning: This AI learns from data to improve over time. It is used in tools like predictive models that identify patients at risk for complications

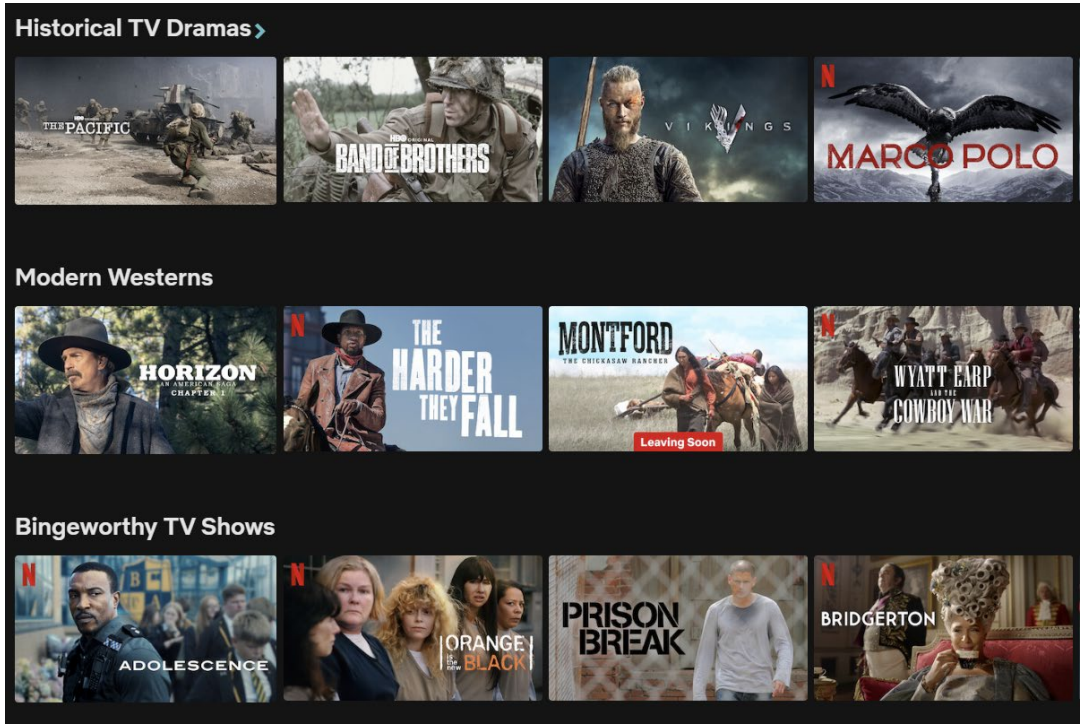
Natural Language Processing (NLP): This helps computers understand and process human language, like converting patient notes into structured data or summarizing clinical documentation.

Generative AI: This type creates content, such as creating real-time patient notes during consultations, pathology generative AI augments microscopic imagery to improve cancer detection and classification.

Engagement Moment

Can you think of Examples of AI such as Machine Learning and Natural Language Processing





AI: THINK ABOUT THIS

Why did the machine learning model break up with its data?

It found someone with better features!

Artificial Innovation in Healthcare


Understanding AI in Medicine
AI utilizes machine learning, deep learning, and automation to improve medical processes.
Enhances diagnosis, treatment planning, drug research, and patient care.


AI in Medical Diagnostics
Improving Accuracy in Diagnosis
AI-powered imaging assists in early detection of diseases such as cancer and neurological disorders.
AI enhances medical record analysis for better disease prediction.

Diagnosing Rare Disease (Oct 2022)

Study from the Harvard Medical School and Brigham and Women's Hospital

Artificial Intelligence Model Can Support Rare Disease Diagnoses, Treatment

New research shows how an artificial intelligence model can function as a search engine for databases to support the diagnosis and treatment of various rare conditions.

Source: Getty Images

By Mark Melchionna

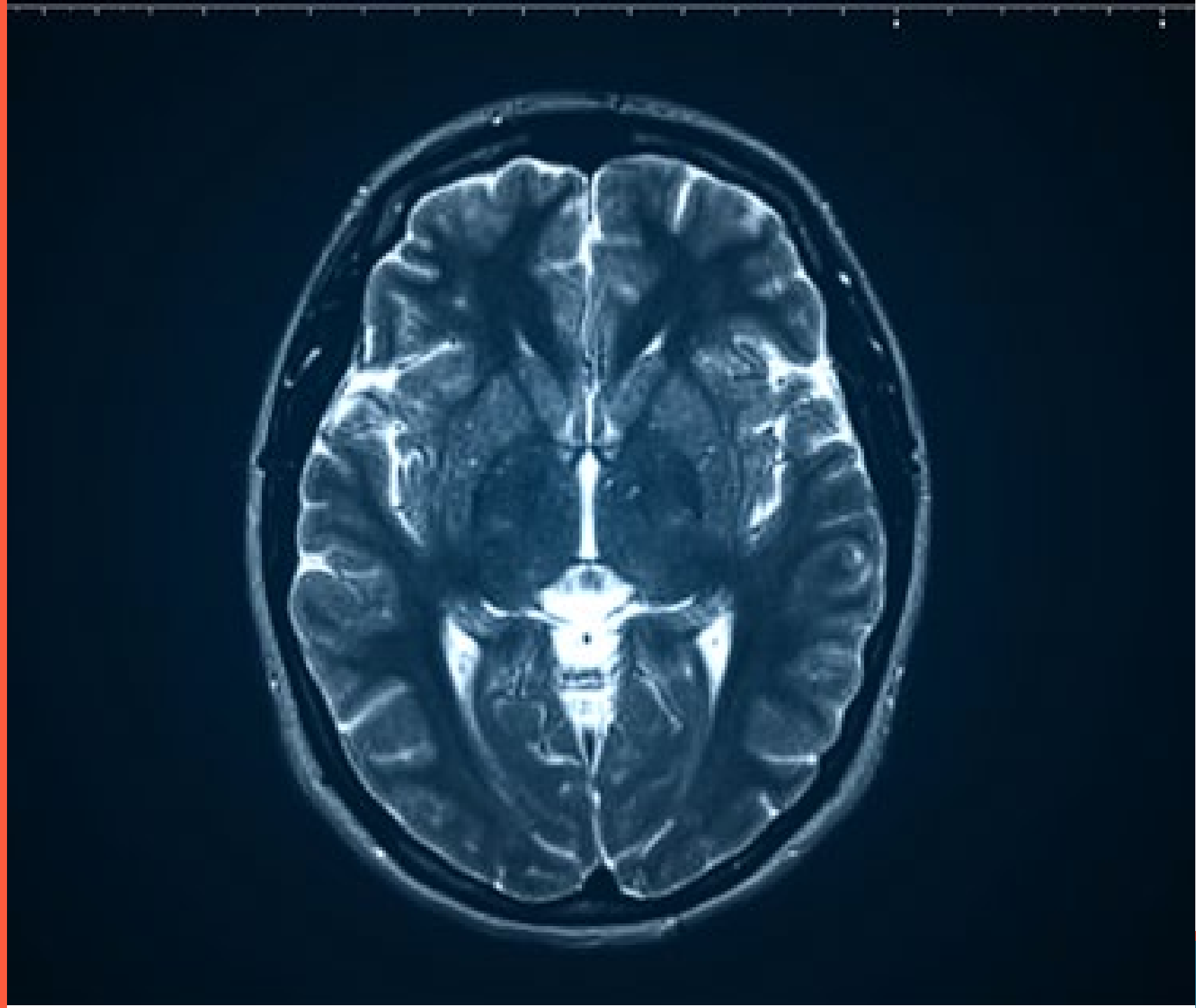
October 20, 2022 - Investigators from the Mahmood Lab at Harvard Medical School and Brigham and Women's Hospital found that **an artificial intelligence (AI) model**, known as

Ohio Cleveland Clinic

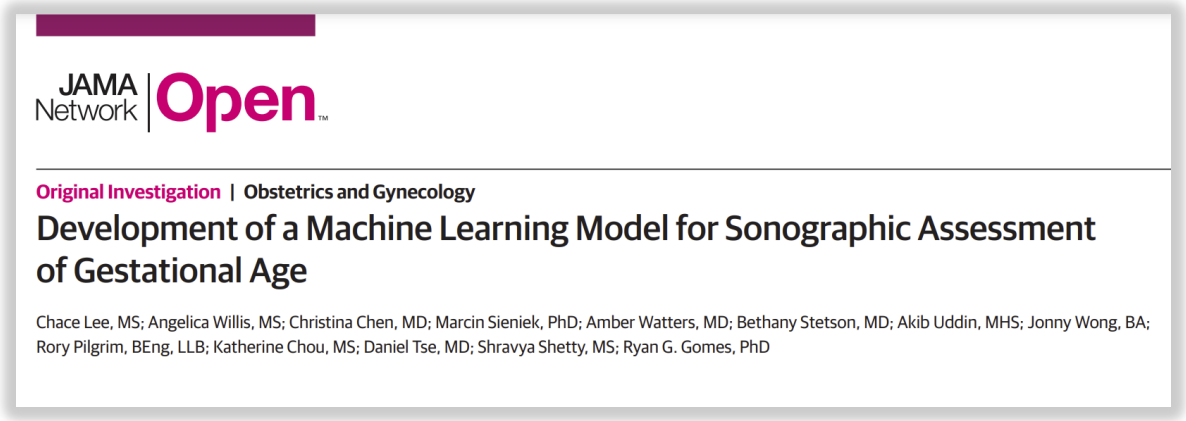
Viz.ai in its stroke response.

The algorithm detects occlusions or blockages to reduce the response time.

Reduced response time greatly impacts how badly the brain is damaged.



Hudson, C. (2023, July 6) *How 5 healthcare organizations are investing in AI for patient care*. Modern Healthcare. https://www.modernhealthcare.com/technology/ai-patient-care-cleveland-clinic-providence-adventhealth?utm_source=modern-healthcare-the-digital-health-deal&utm_medium=email&utm_campaign=20230707&utm_content=article3-readmore



JAMA Network Open

Original Investigation | Obstetrics and Gynecology

Development of a Machine Learning Model for Sonographic Assessment of Gestational Age

Chace Lee, MS; Angelica Willis, MS; Christina Chen, MD; Marcin Sieniek, PhD; Amber Watters, MD; Bethany Stetson, MD; Akib Uddin, MHS; Jonny Wong, BA; Rory Pilgrim, BEng, LLB; Katherine Chou, MS; Daniel Tse, MD; Shravya Shetty, MS; Ryan G. Gomes, PhD

Can an AI model predict gestation age with higher accuracy than standard fetal biometry-based estimates using ultrasonography videos?

Findings

AI models were statistically superior to standard fetal biometry based gestational age estimates derived from images captured by expert sonographers.

Conclusion

Findings suggest that AI models can empower trained ultrasonographers to estimate gestational age with higher accuracy.

Lee, C., Willis, A., Chen, C., Sjieniek, M., Watters, A., Stetson, B., Uddin, A., Wong, J., Pilgrim, R., Chou, K., Tse, D., Shetty, S., & Gomes, R. (2023) Development of a machine learning model for sonographic assessment of gestational age. *JAMA Network Open, 6*(1): e2248685. https://doi:10.1001/jamanetworkopen.2022.48685


AI in Personalized Treatment
Optimizing Treatment Plans
AI tailors treatment plans based on patient genetics, history, and real-time data.
Predictive analytics improve decision-making and reduce risks.

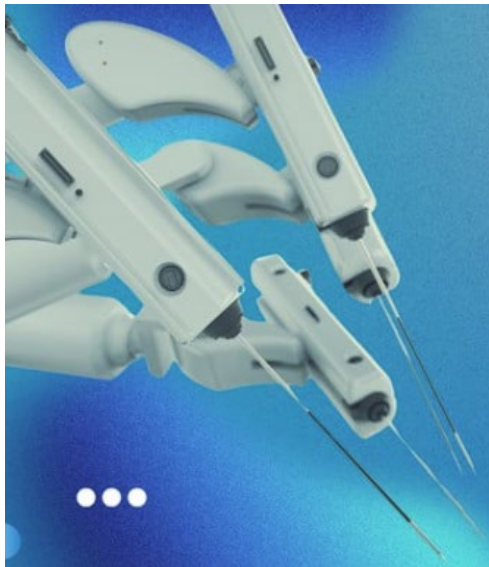

AI in Drug Research
Accelerating Drug Discovery
AI speeds up drug development by predicting molecular interactions.
Reduces costs and time required to develo new medications.

AI in Remote Patient Monitoring

Real-Time Health Tracking

Wearable AI devices monitor vitals and detect irregularities.

AI alerts healthcare providers about potential medical conditions.



AI-Assisted Surgery

Enhancing Precision in Surgery

AI-driven robotic systems assist surgeons with accuracy and minimally invasive techniques.

Reduces human error and improves surgical outcomes.

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The Future of AI in Healthcare

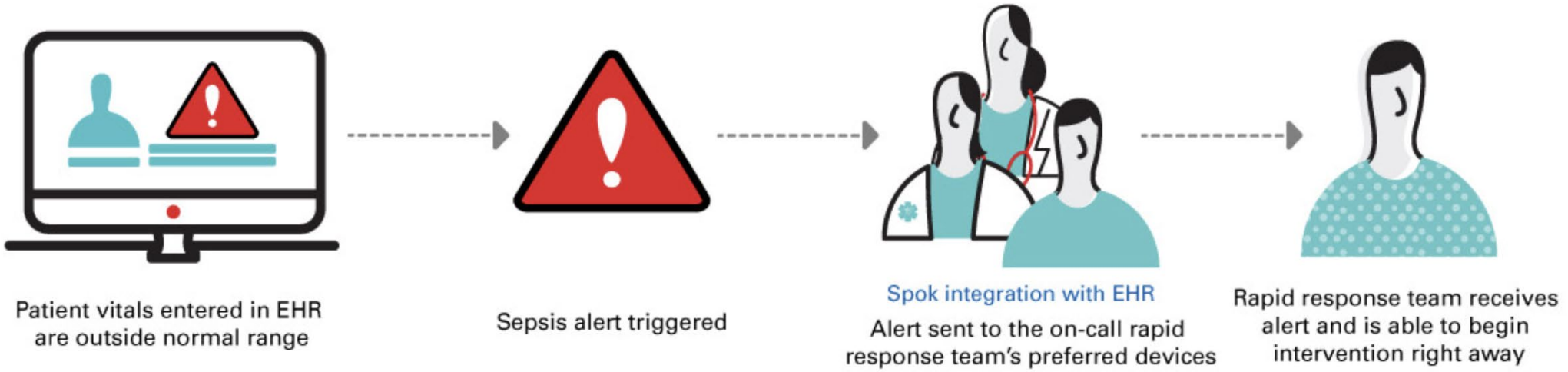
Evolving AI Technologies

AI advancements in precision medicine and real-time diagnostics.

Integration with telehealth for remote patient management.

Continuous improvement of AI capabilities in medical decision-making.

My Experience



Early Warning AI for Sepsis

Early Warning Systems

Early warning systems are broadly utilized in healthcare facilities as a tool to identify patients at risk for deterioration.

(Brady et al., 2013; Cheng et al., 2020; de Vries et al., 2017; Norman et al., 2018).

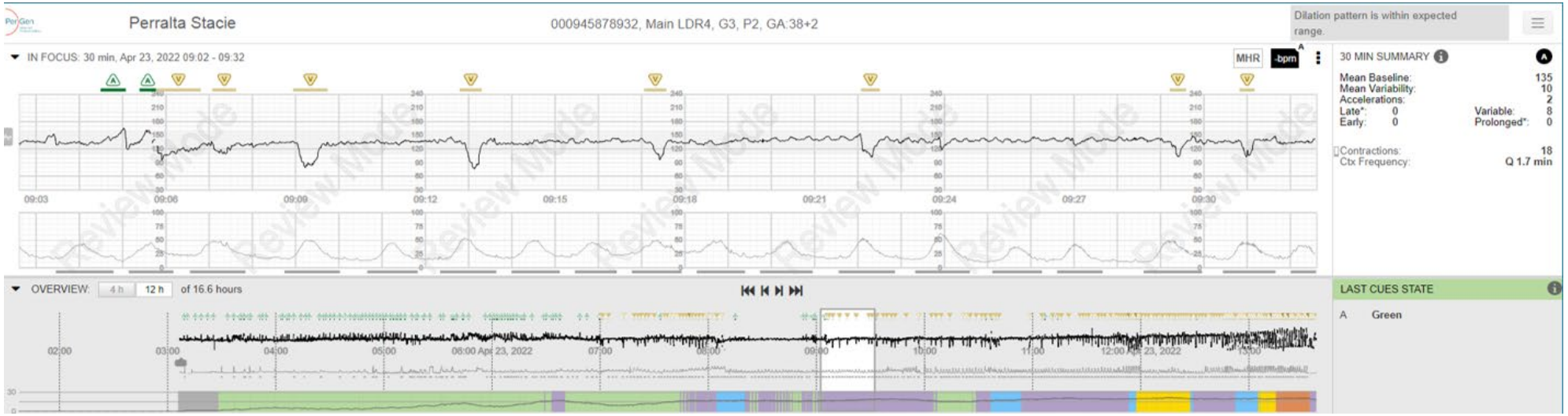
Bring a general increase in situational awareness to frontline staff.

This in turn promotes earlier recognition, notification, and intervention.

Use of early warning systems has demonstrated a reduction in serious safety events

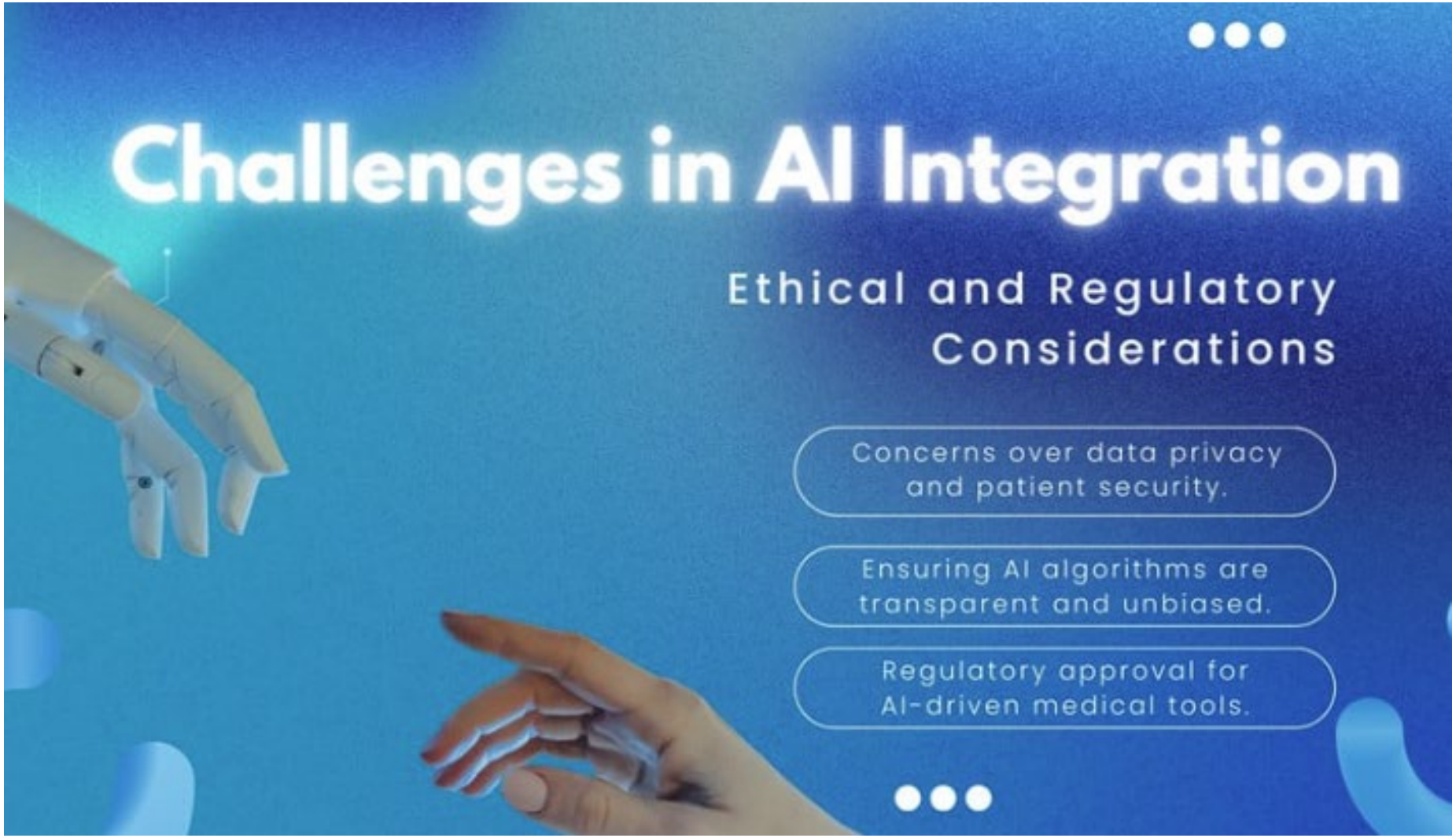
(Brady et al., 2013; de Vries et al., 2017; McElroy et al., 2019; Stephens, 2017).

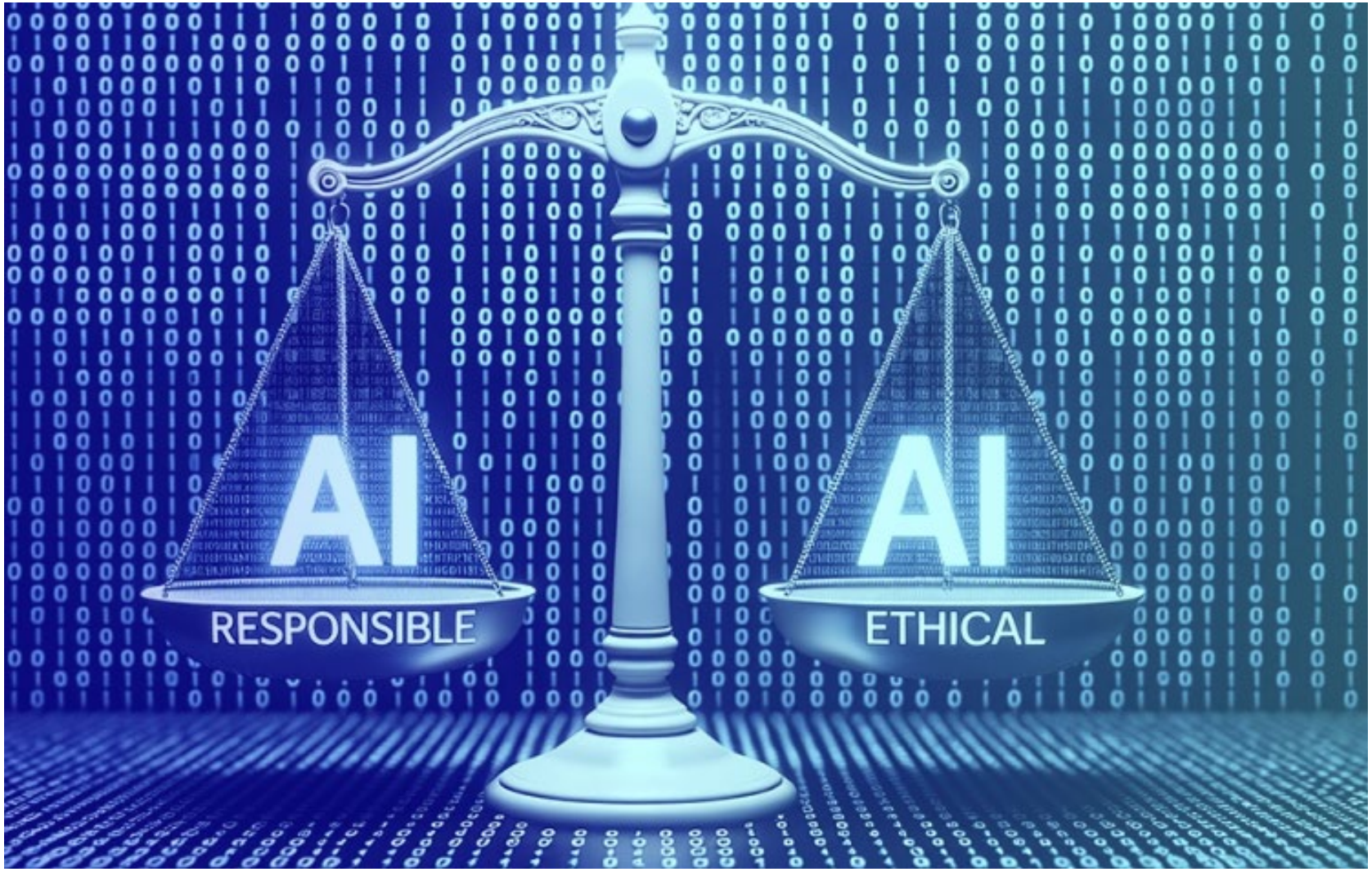
PeriGen Early Warning System



Supervised Learning: The algorithm is trained on labeled or "ground truth" data.

- The model was created using Supervised Machine Learning with Neural Networks
- This model was trained using ground-truth "labeled datasets"
  - Hundreds of hours of tracings were labeled by a set of MFM physicians "truthers", experts in EFM,
  - Using a computerized tool to mark features of the tracings


Challenges in AI Integration
Ethical and Regulatory Considerations
Concerns over data privacy and patient security.
Ensuring AI algorithms are transparent and unbiased.
Regulatory approval for AI-driven medical tools.


AI
RESPONSIBLE
AI
ETHICAL

Coalition for HealthCare Artificial Intelligence (CHAI): Validation and Reliability

Certain AI/Machine learning enabled technologies may be considered Software as a Medical Device (SaMD) and thus subject to regulation.

In cases where these technologies are regulated as SaMD, process validation is **mandated prior to use**.

Vigilance Cues falls into this category and is validated by the FDA prior to commercial release.

CHAI

Recognizes the enormous potential of AI to improving the quality and efficiency of healthcare delivery

Proposes a framework for adoption. Focus on health impact, fairness, ethics, and equity principles to ensure that AI in healthcare benefits all populations including groups from underserved and under-represented communities.

The report summarizes recommendations to help educate end users on how to evaluate AI technologies to drive responsible adoption.

Goal = Ensure health AI tools to support high-quality care, increase trustworthiness among the healthcare community, and meet the needs of patients and providers.

Coalition for HealthCare Artificial CH (CHAI)

Oversight provided by

- U.S. Department of Commerce's National Institute of Standards and Technology (OSTP).
- Agency for Healthcare Research and Quality (AHRQ)
- Centers for Medicare & Medicaid Services(CMS)
- U.S. Food and Drug Administration (FDA)
- Office of the National Coordinator for Health Information Technology (ONC)
- National Institutes of Health (NIH)

Workgroup included leadership from:

- University of California-Berkeley
- University of California Health
- University of California San Francisco
- University of California Office of the President
- Duke Health
- Google
- Johns Hopkins University
- Mayo Clinic
- Microsoft
- Optum
- SAS
- Stanford Medicine
- Vanderbilt University Medical Center


THIS HAT WITH
THIS BRACELET?
GIRL PLEASE.

Thank you!

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