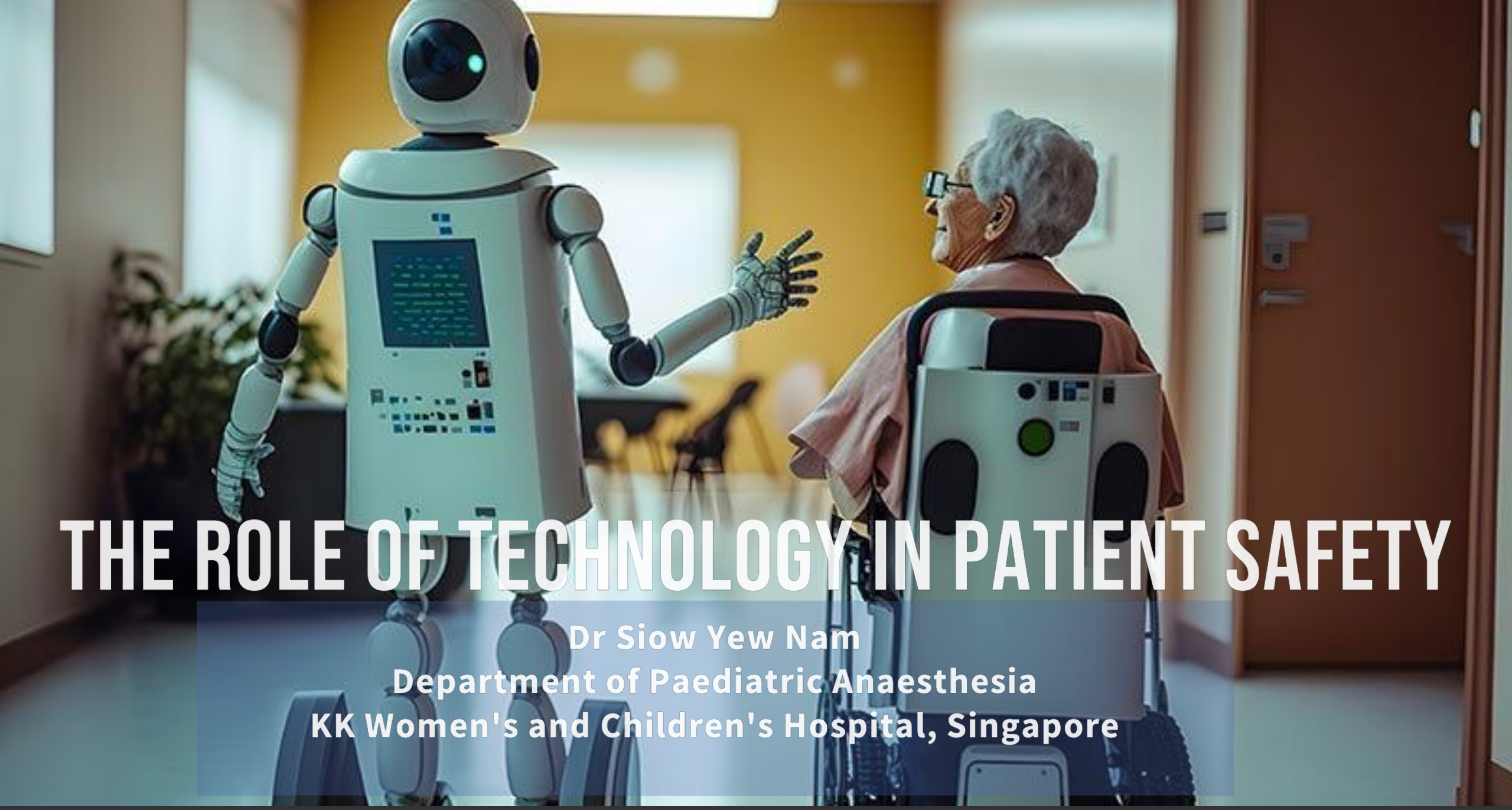


THE ROLE OF TECHNOLOGY IN PATIENT SAFETY

Dr Siow Yew Nam
Department of Paediatric Anaesthesia
KK Women's and Children's Hospital, Singapore

DISCLOSURES

TECHNOLOGY

HEALTH TECHNOLOGY IS THE APPLICATION OF ORGANIZED KNOWLEDGE AND SKILLS IN THE FORM OF DEVICES, MEDICINES, VACCINES, PROCEDURES, AND SYSTEMS DEVELOPED TO SOLVE A HEALTH PROBLEM AND IMPROVE QUALITY OF LIFE

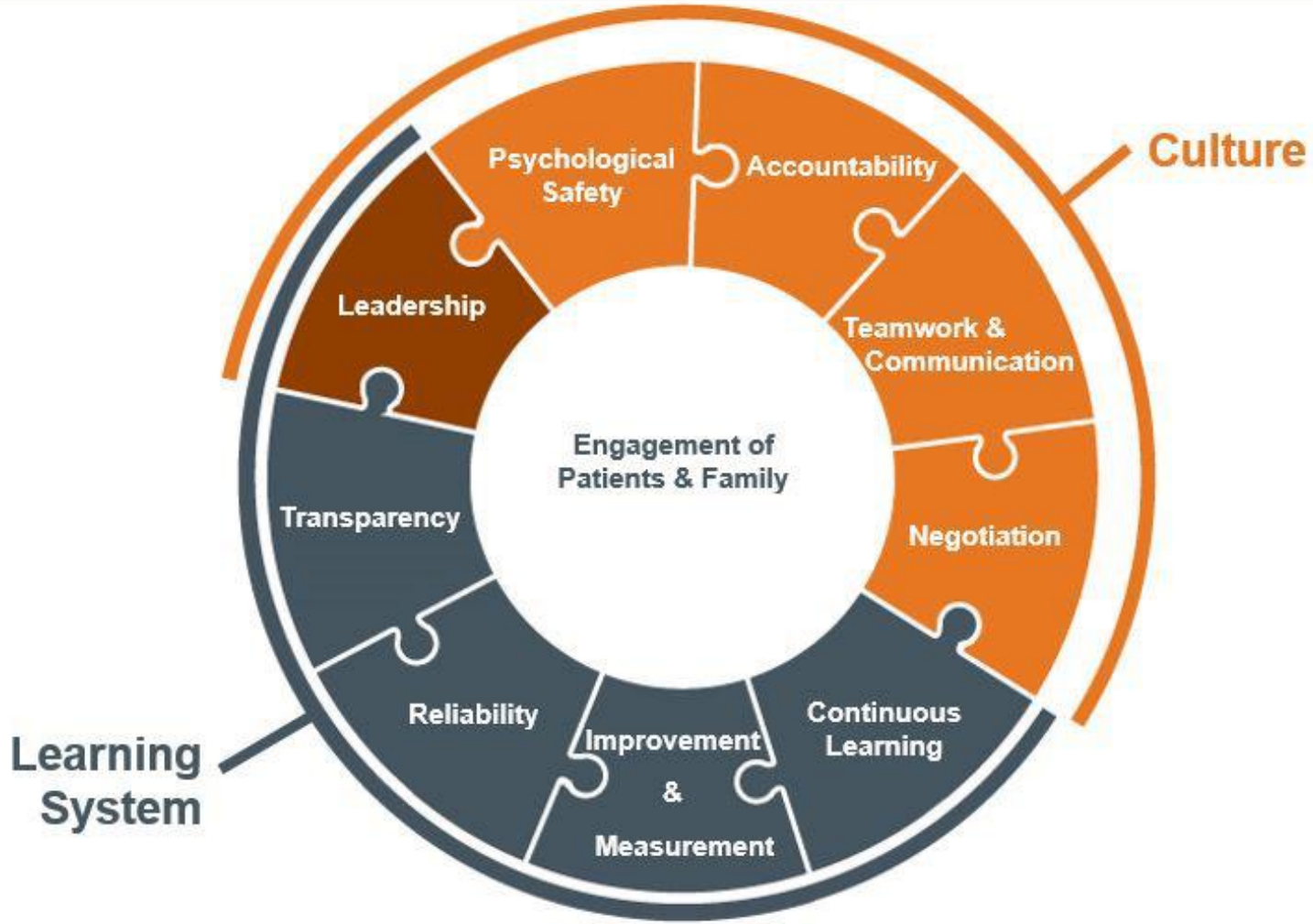
WHO

PATIENT SAFETY

A FRAMEWORK OF ORGANIZED ACTIVITIES THAT CREATES CULTURES, PROCESSES, PROCEDURES, BEHAVIOURS, TECHNOLOGIES AND ENVIRONMENTS IN HEALTH CARE THAT CONSISTENTLY AND SUSTAINABLY LOWER RISKS, REDUCE THE OCCURRENCE OF AVOIDABLE HARM, MAKE ERROR LESS LIKELY AND REDUCE IMPACT OF HARM WHEN IT DOES OCCUR.

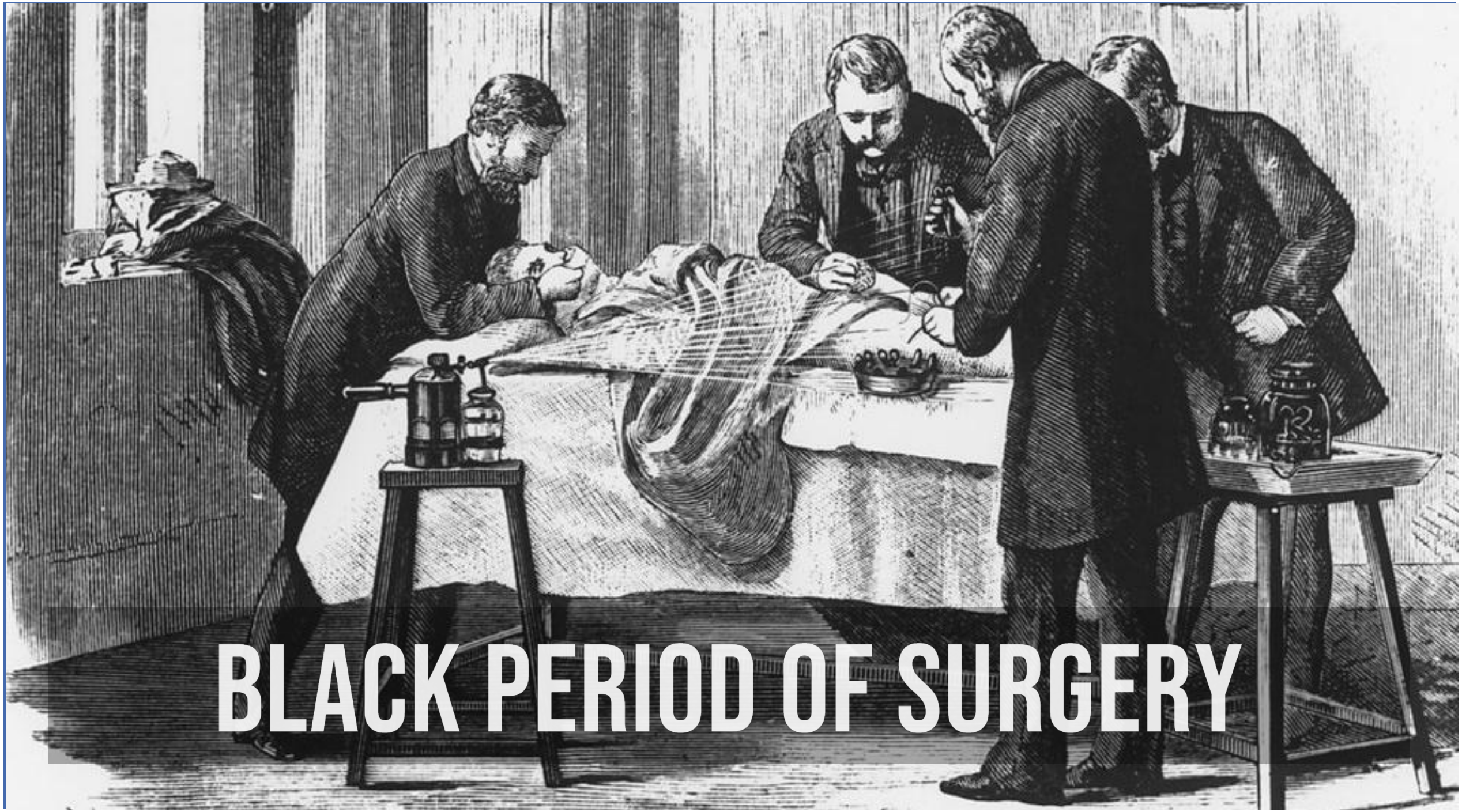
WHO

Framework for Safe, Reliable, and Effective Care



Source: Frankel A, Haraden C, Federico F, Lenoci-Edwards J. *A Framework for Safe, Reliable, and Effective Care*. White Paper. Cambridge, MA: Institute for Healthcare Improvement and Safe & Reliable Healthcare; 2017. (Available on ihi.org)

PROMISE AND PERIL



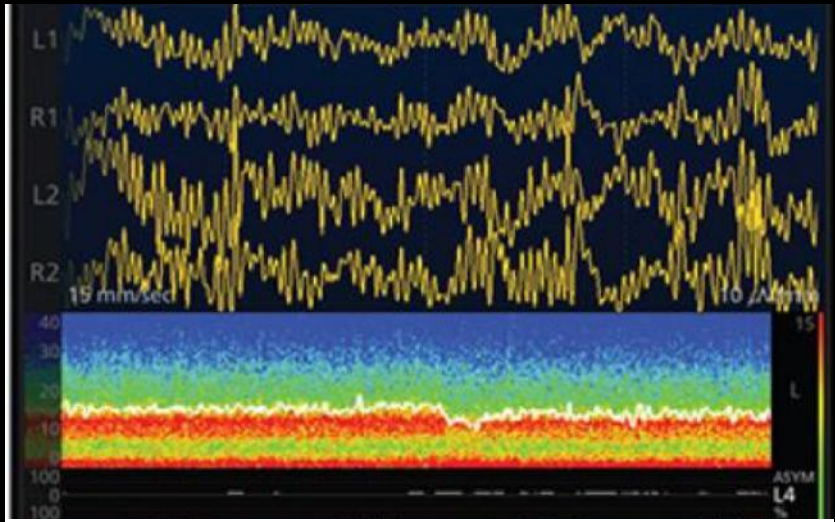
BLACK PERIOD OF SURGERY

"TO ERR IS HUMAN" INSTITUTE OF MEDICINE, 1999

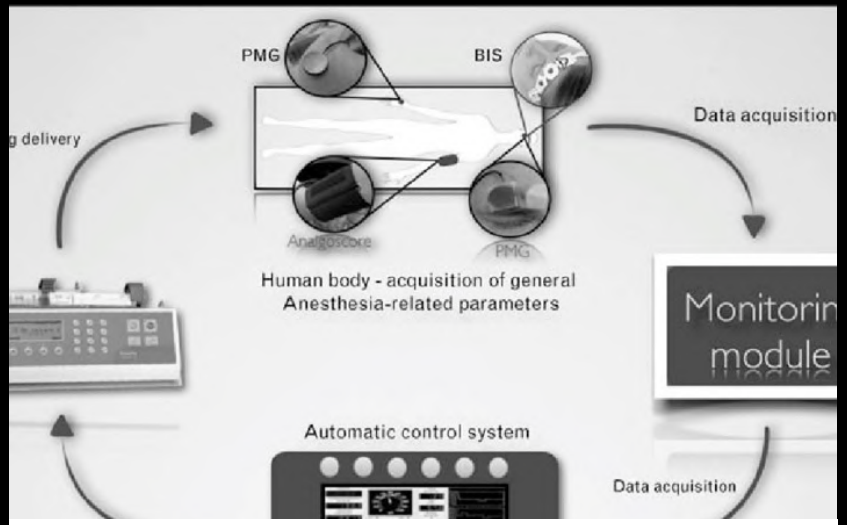
'... ANESTHESIOLOGY REDUCED ANESTHESIA MORTALITY RATES .... TO ONE DEATH PER 200,000-300,000 ANESTHETICS ADMINISTERED'

DELIVERY SYSTEMS

AIRWAY EQUIPMENT

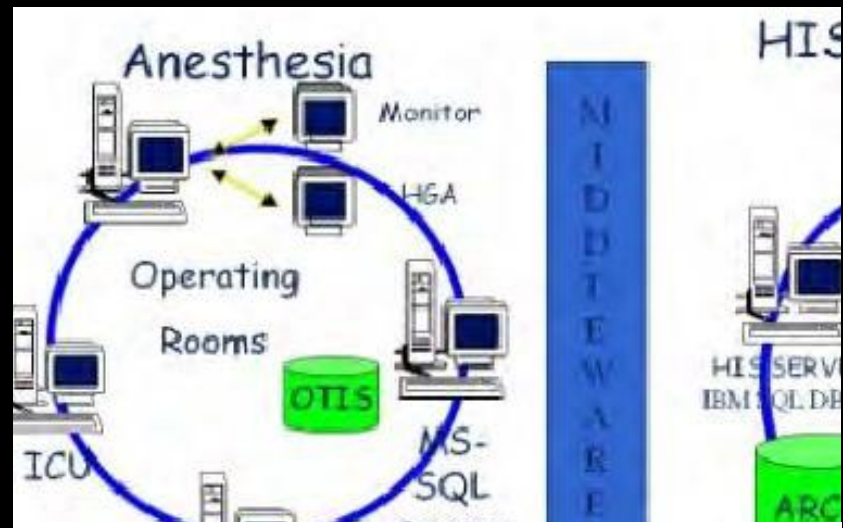


MONITORING



AUTOMATION

ULTRASOUND, RA



HEALTH INFORMATION TECH

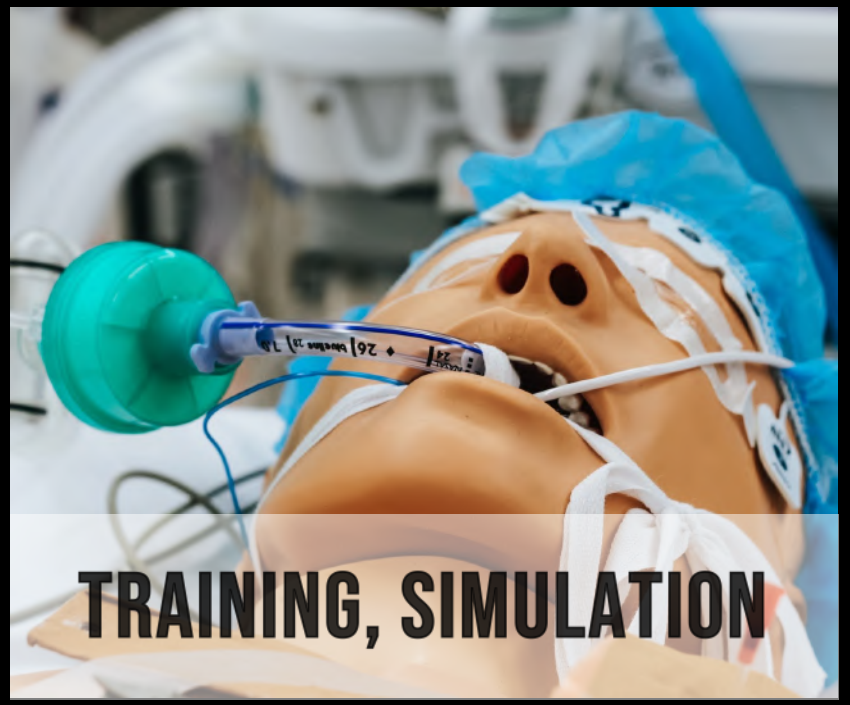

SYSTEM SCIENCE, HRO

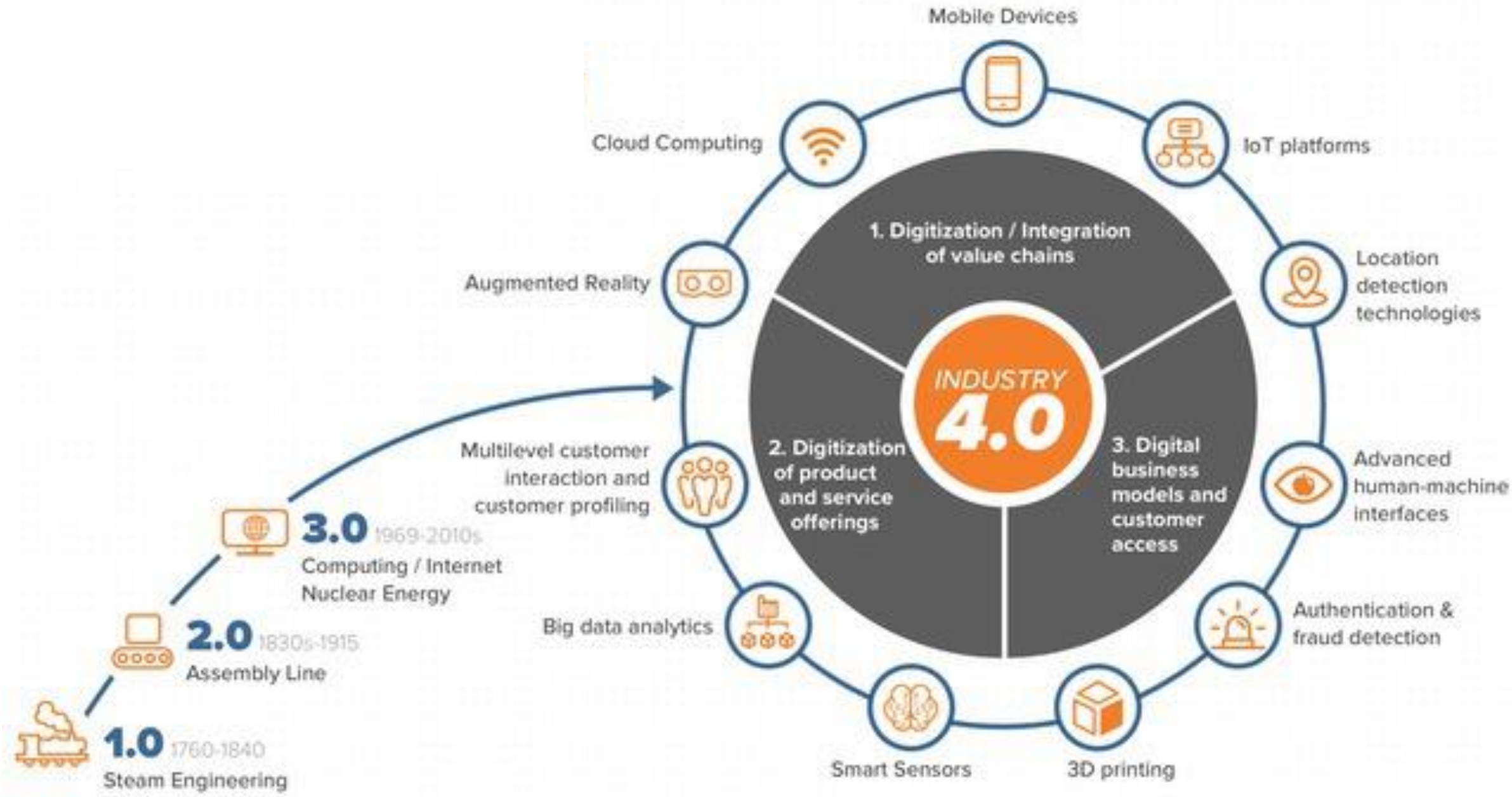

HUMAN FACTORS


INCIDENT REPORTING


CHECKLIST PROTOCOLS


TEAMS NTS


TRAINING, SIMULATION


Mobile Devices
Cloud Computing
IoT platforms
Augmented Reality
Location detection technologies
1. Digitization / Integration of value chains
INDUSTRY 4.0
2. Digitization of product and service offerings
3. Digital business models and customer access
Multilevel customer interaction and customer profiling
Advanced human-machine interfaces
3.0 1969-2010s
Computing / Internet
Nuclear Energy
Big data analytics
Authentication & fraud detection
2.0 1830s-1915
Assembly Line
Smart Sensors
3D printing
1.0 1760-1840
Steam Engineering


AGE OF COGNIZANCE

WHAT IS ARTIFICIAL INTELLIGENCE?

Machine Learning

Using sample data to train computer programs to recognize patterns based on algorithms.

Neural Networks

Computer systems designed to imitate the neurons in a brain.

Natural Language Processing

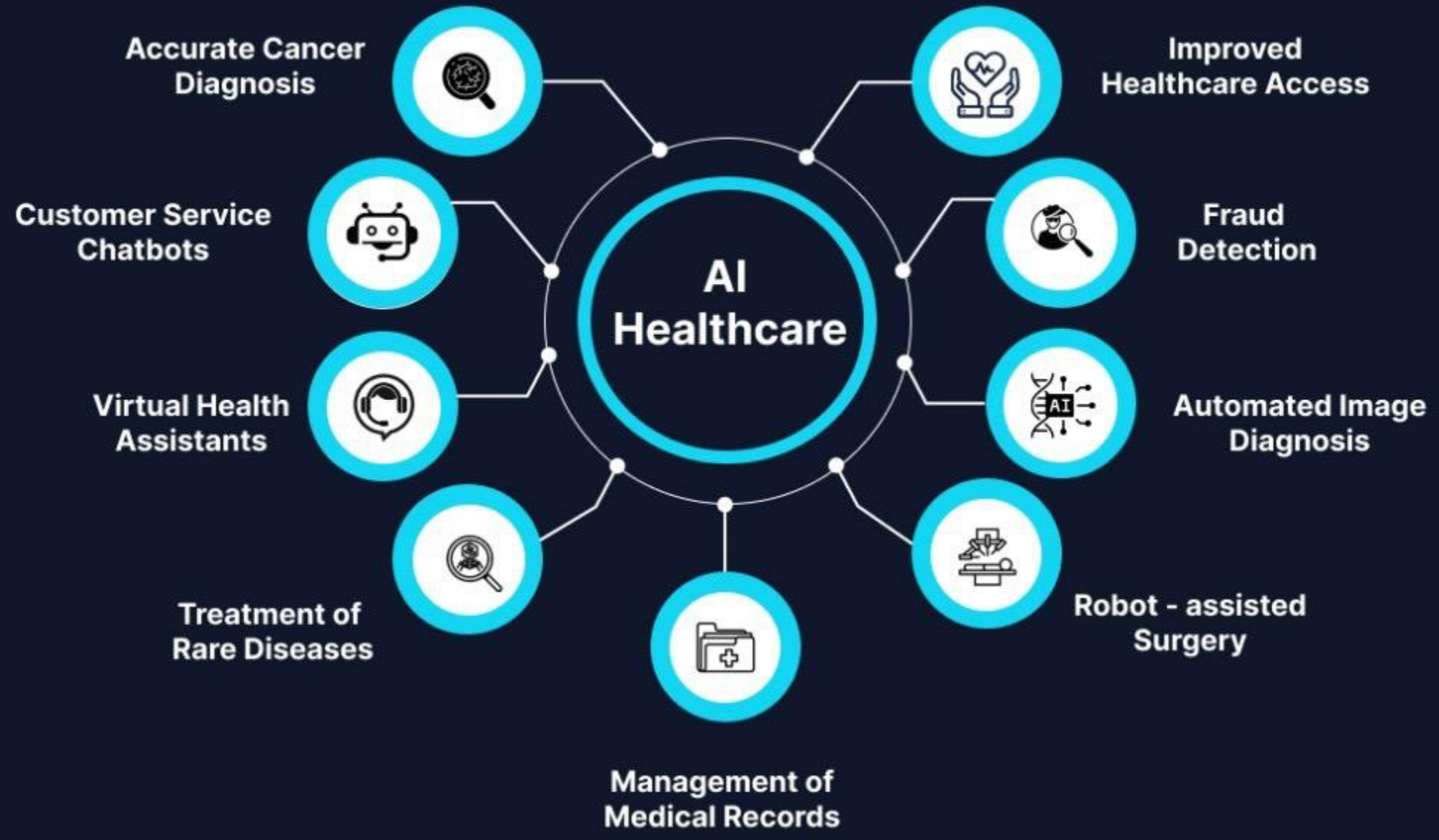
The ability to understand speech, as well as understand and analyze documents.

Robotics

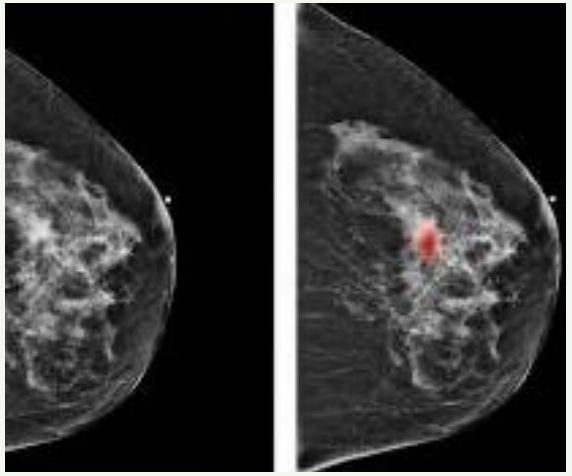
Machines that can assist people without actual human involvement.

The Motley Fool

Role of AI in Healthcare



COMPUTER VISION AND MEDICAL IMAGING



Breast Cancer Detection

McKinney SM, et al. International evaluation of an AI system for breast cancer screening. Nature. 2020;577(7788):89-94.

Diabetic Retinopathy Diagnosis

Gulshan V, et al. Development and validation of a deep learning algorithm for detection of diabetic retinopathy in retinal fundus photographs. JAMA. 2016;316(22):2402-2410.

Skin Cancer Detection

Esteva A, et al. Dermatologist-level classification of skin cancer with deep neural networks. Nature. 2017;542(7639):115-118.

Face Recognition for Pain

Computer Mediated Automatic Detection of Pain-Related Behavior: Prospect, Progress, Perils Front Pain Res (Lausanne). 2021; 2: 788606.

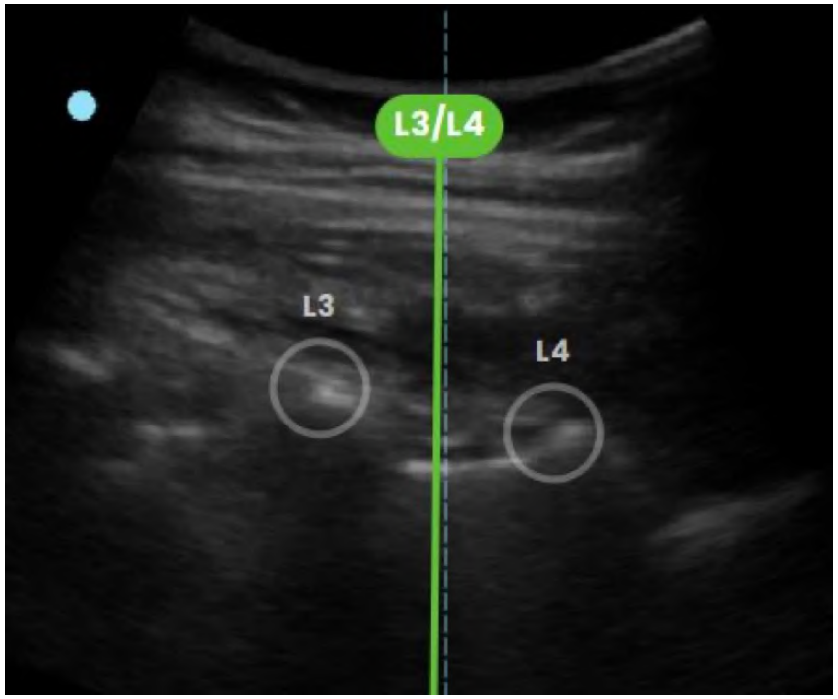
- uSINE by KKH
  ultrasound-guided Spinal anesthesia with Integrated NEedle guidance system

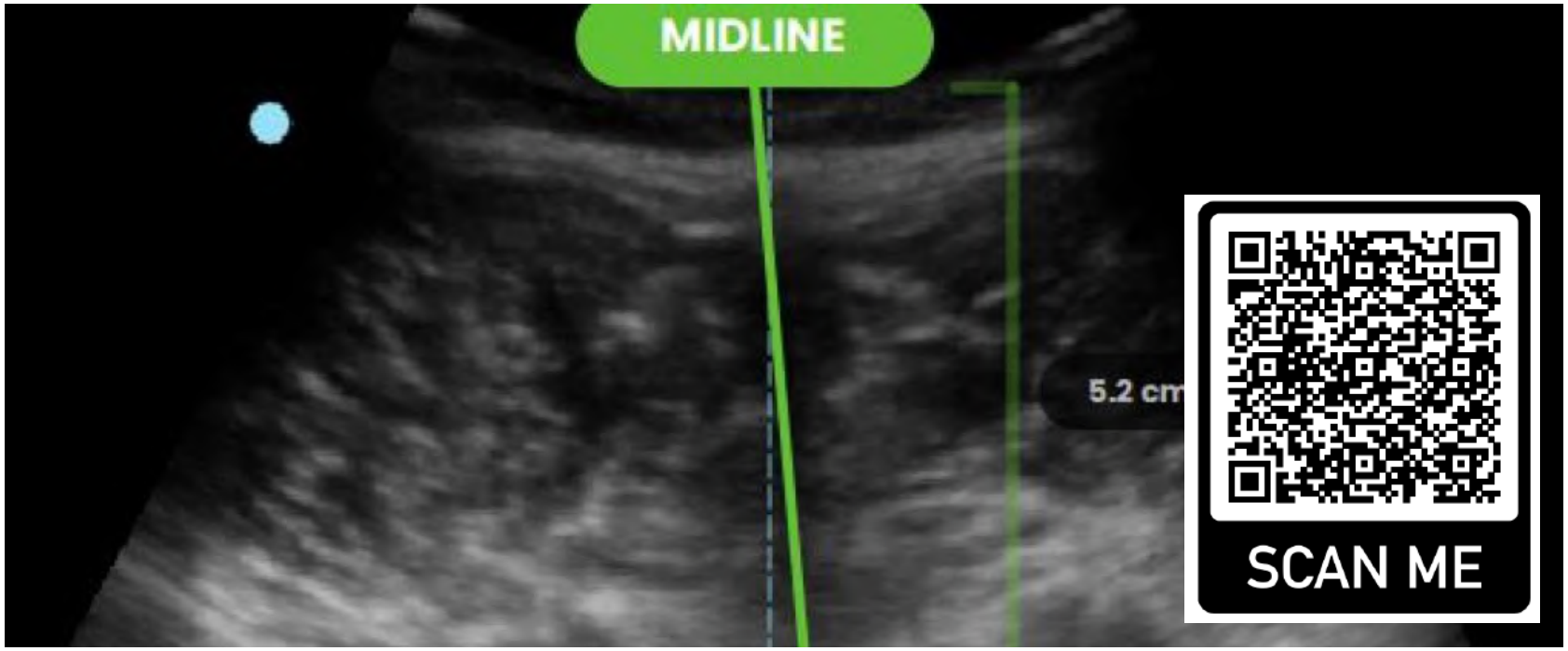
70% > 92%

NORMAL WEIGHT PATIENTS

43% TO 82%

OBESE PATIENTS





ENHANCEMENTS OF EHR AND CPOE

Electronic Health Record-based Innovations

Computerized Physician Order Entry (CPOE)

Preventing Medication Errors
Alerts Optimisation
Improved Data management
Predictive analytics

AI TECHNOLOGIES FOR EHR DOCUMENTATION

- **Nuance Communications**
  - **Dragon Medical One**
  - **Dragon Ambient eXperience (DAX)**
- **Epic Systems**
  - AI Ambient Listening Technology
- **Ambient AI Scribes**
- **Tali AI**

RISK PREDICTION + DETECTION (MONITORING)

AI for Predicting Clinical Deterioration

Nemati S, et al. An interpretable machine learning model for accurate prediction of sepsis in the ICU. Crit Care Med. 2018;46(4):547-553.

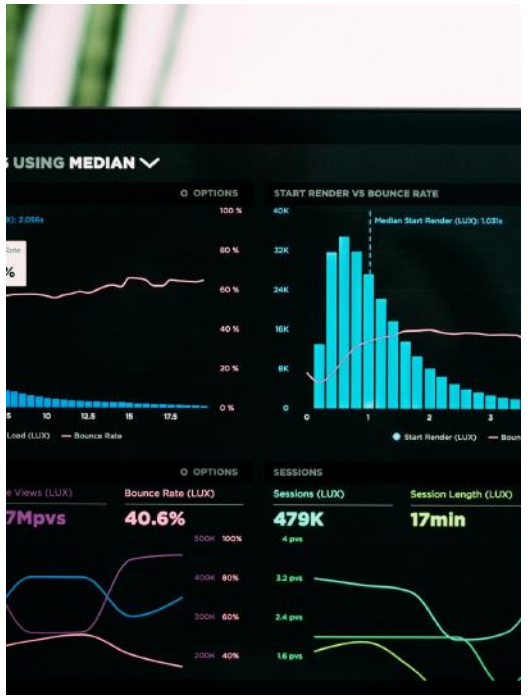
AI for Predicting Cardiac Arrest

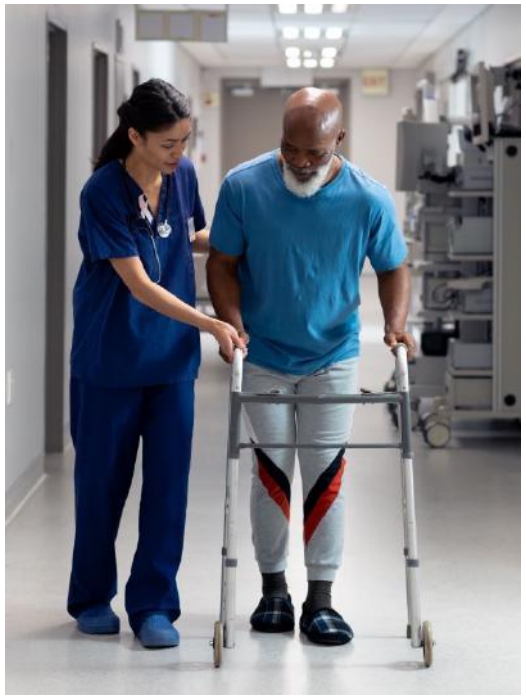
Kwon JM, et al. An algorithm based on deep learning for predicting in-hospital cardiac arrest. J Am Heart Assoc. 2018;7(13):e008678.

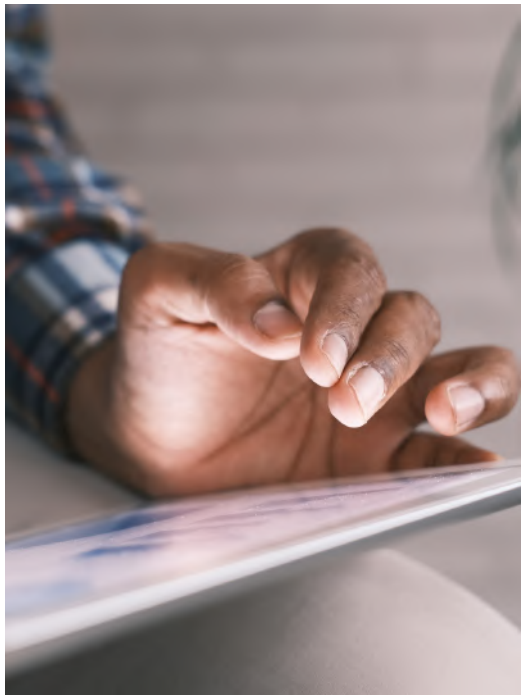
AI for Predicting Acute Kidney Injury

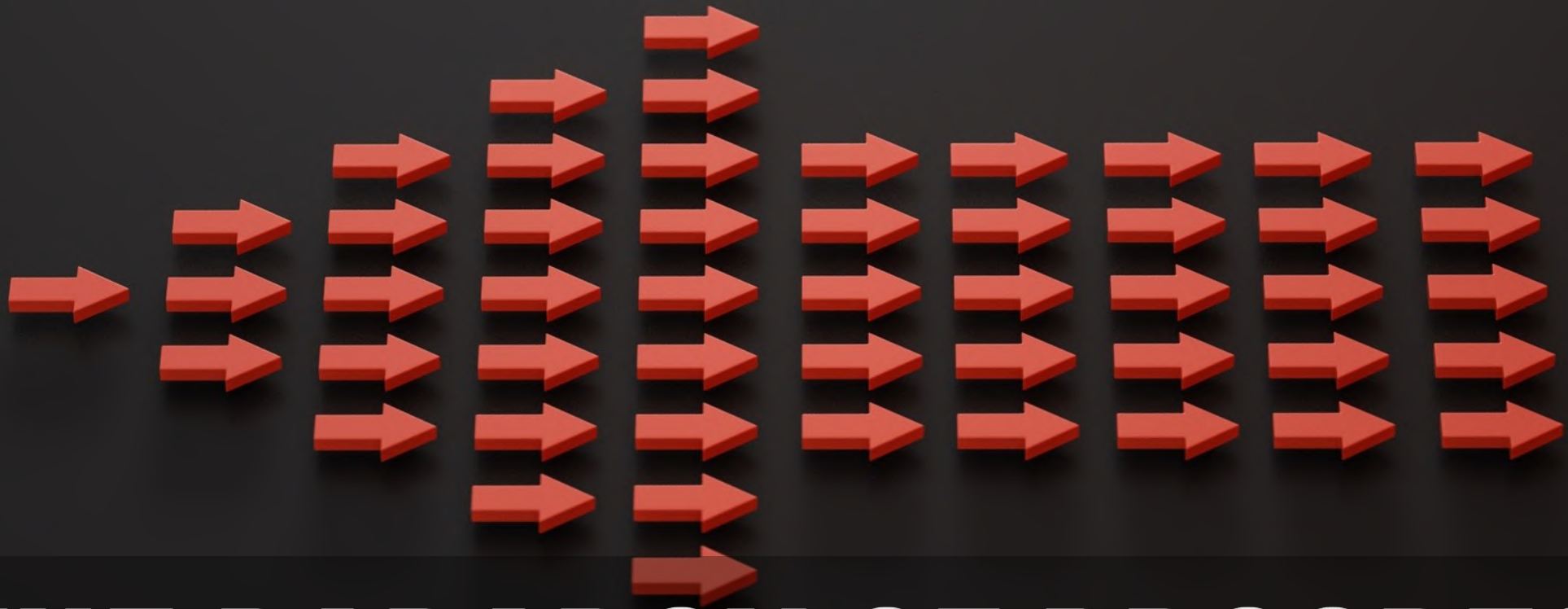
Tomašev N, et al. A clinically applicable approach to continuous prediction of future acute kidney injury. Nature. 2019;572(7767):116-119.

FALLS
INFECTION CONTROL
INCIDENT REPORTING
LEADERSHIP
CULTURE
TEAMWORK
TRAINING
COMMUNICATION









THE PARADOX OF PROGRESS

TECHNOLOGY AND PATIENT SAFETY

ADVANTAGES OF TECHNOLOGICAL SOLUTIONS

- Scalability
- Accuracy and reliability
- Efficiency + Productivity
- Data Analysis
- Standardization

TECHNOLOGY AND PATIENT SAFETY

CHALLENGES OF TECHNOLOGICAL SOLUTIONS

- Resource + Implementation
- Usability isues
- Validation of Evidence
- Data privacy, security
- New, unintended Risks

The effects and preventability of 2627 patient safety incidents related to health information technology failures: a retrospective analysis of 10 years of incident reporting in England and Wales

Guy Martin, Saira Ghafur, Isabella Cingolani, Joshua Symons, Dominic King, Sonal Arora, Ara Darzi

Summary

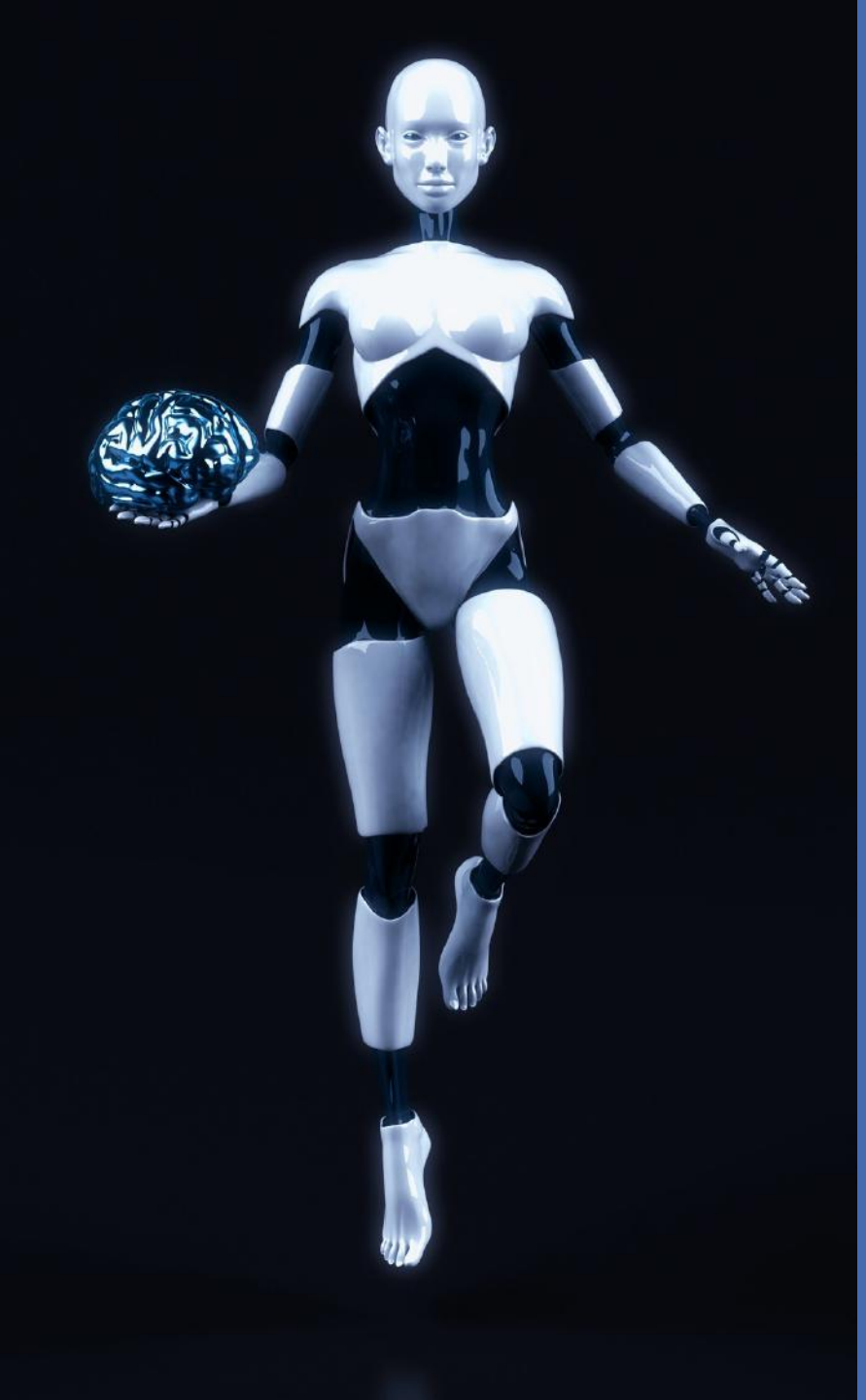
Background The use of health information technology (IT) is rapidly increasing to support improvements in the delivery of care. Although health IT is delivering huge benefits, new technology can also introduce unique risks. Despite these risks, evidence on the preventability and effects of health IT failures on patients is scarce. In our study we therefore sought to evaluate the preventability and effects of health IT failures by examining patient safety incidents in England and Wales.

Lancet Digital Health 2019; 1: e127–35

See **Comment** page e104

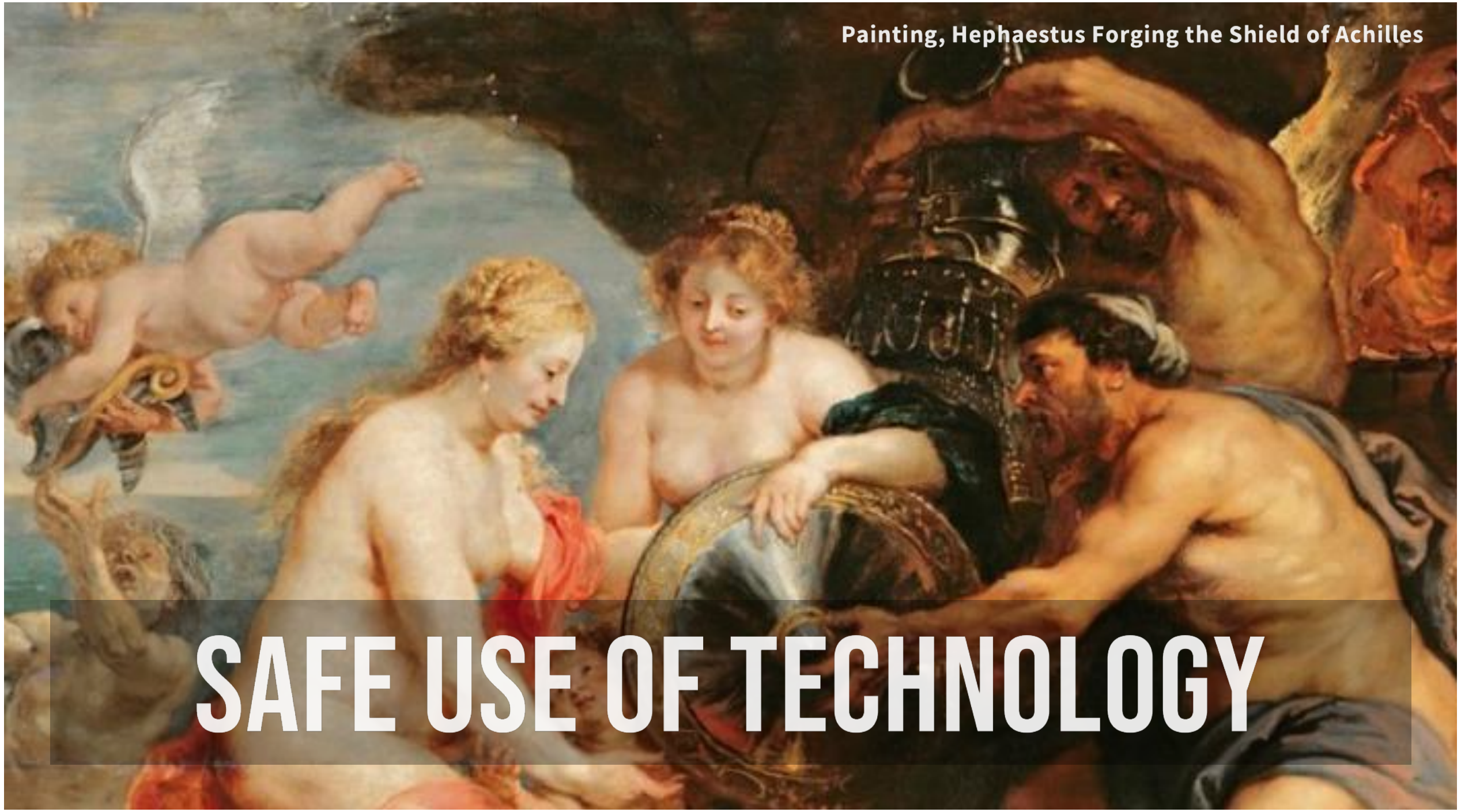
National Institutes of Health Research Patient Safety Translational Research Centre,

The majority of incidents (75%) were deemed preventable

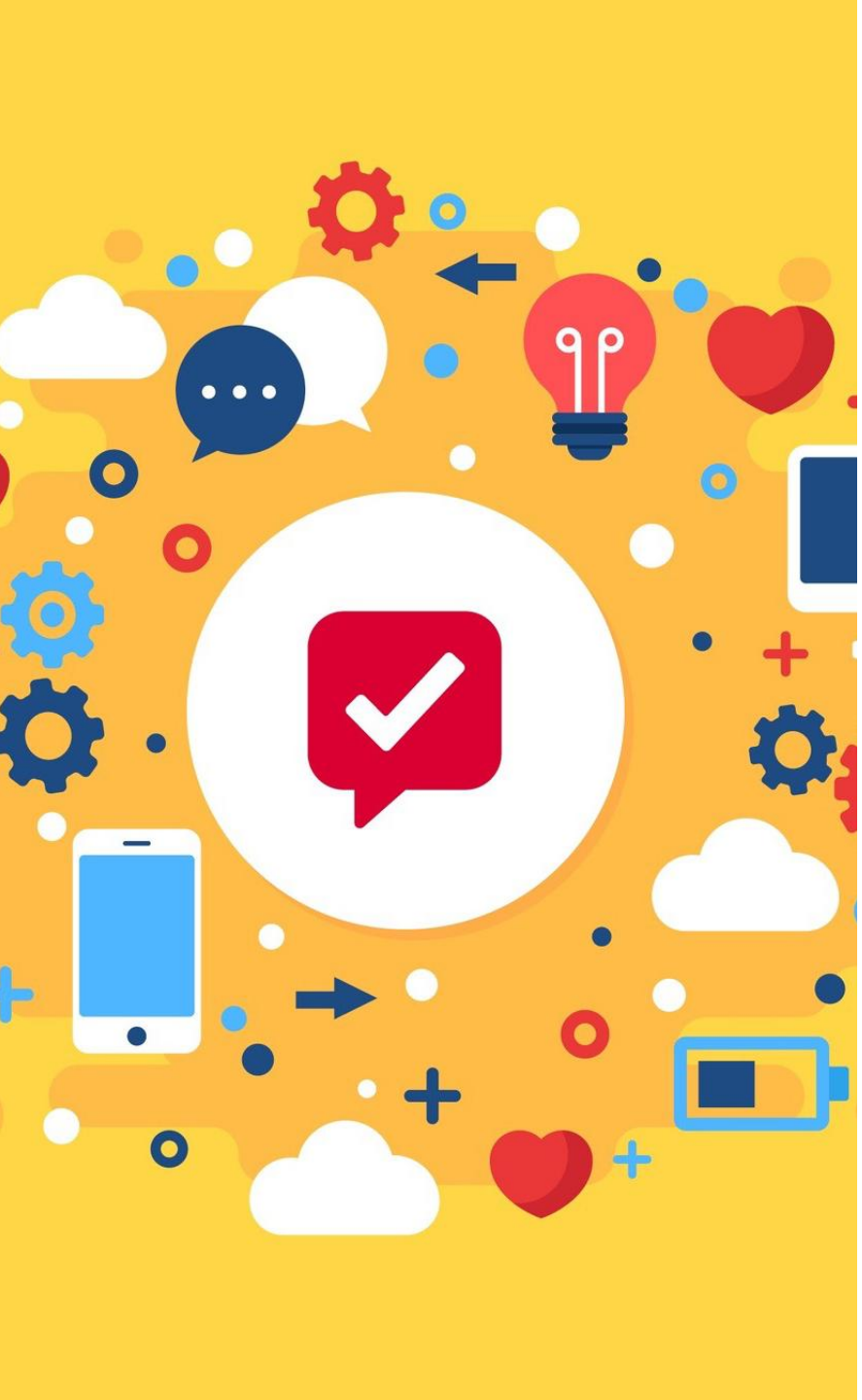


ADDITIONAL CHALLENGES ABOUT IMPLEMENTING AI

- Lack of transparency in AI decision-making: "Black Box"
- Data quality and bias
- Rapid rate of development
- Ethics, accountability



SAFE USE OF TECHNOLOGY



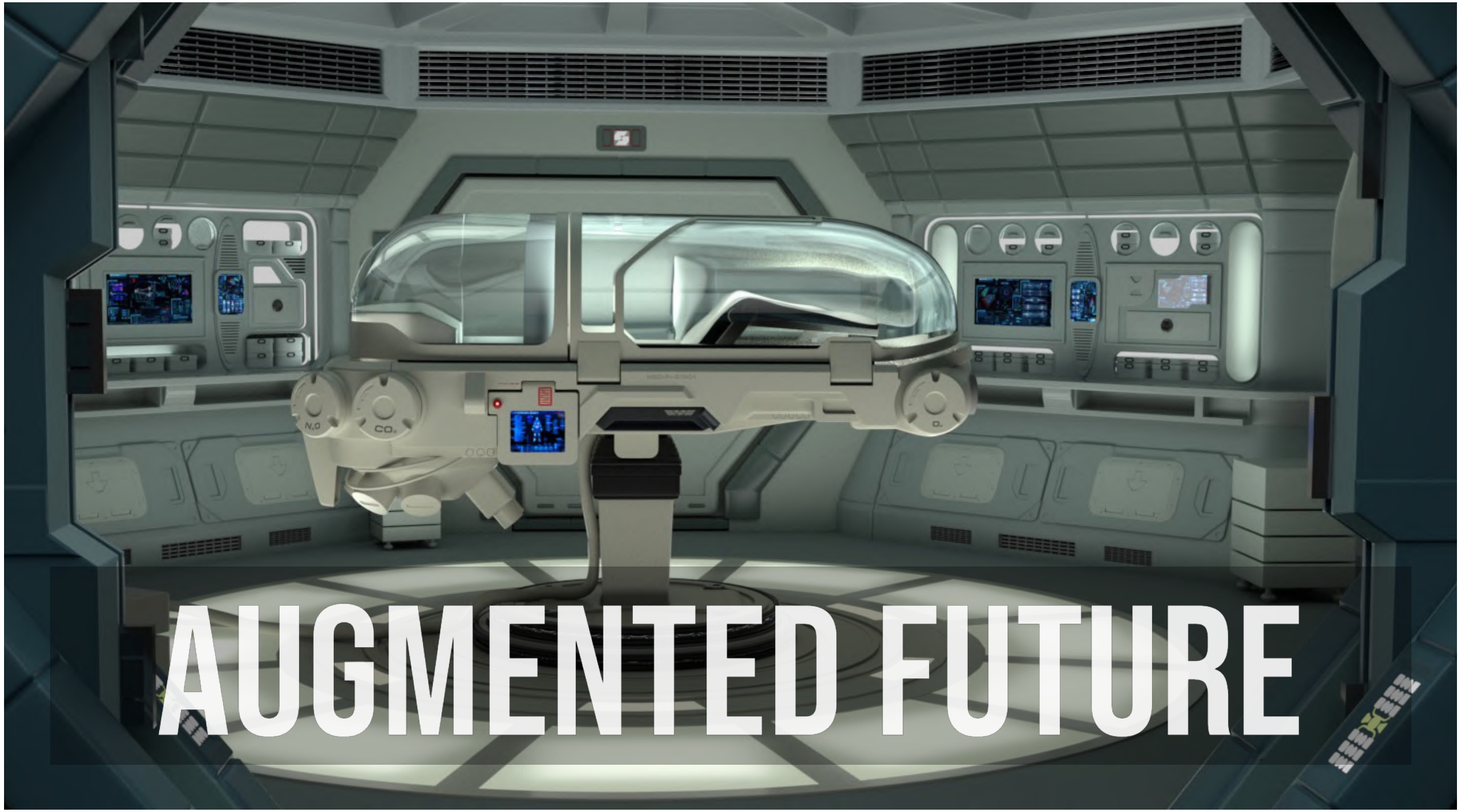
INTRODUCING NEW TECHNOLOGY SAFELY, MYTTON, 2010

KEY STAGES IN INTRODUCING HEALTH TECHNOLOGY:

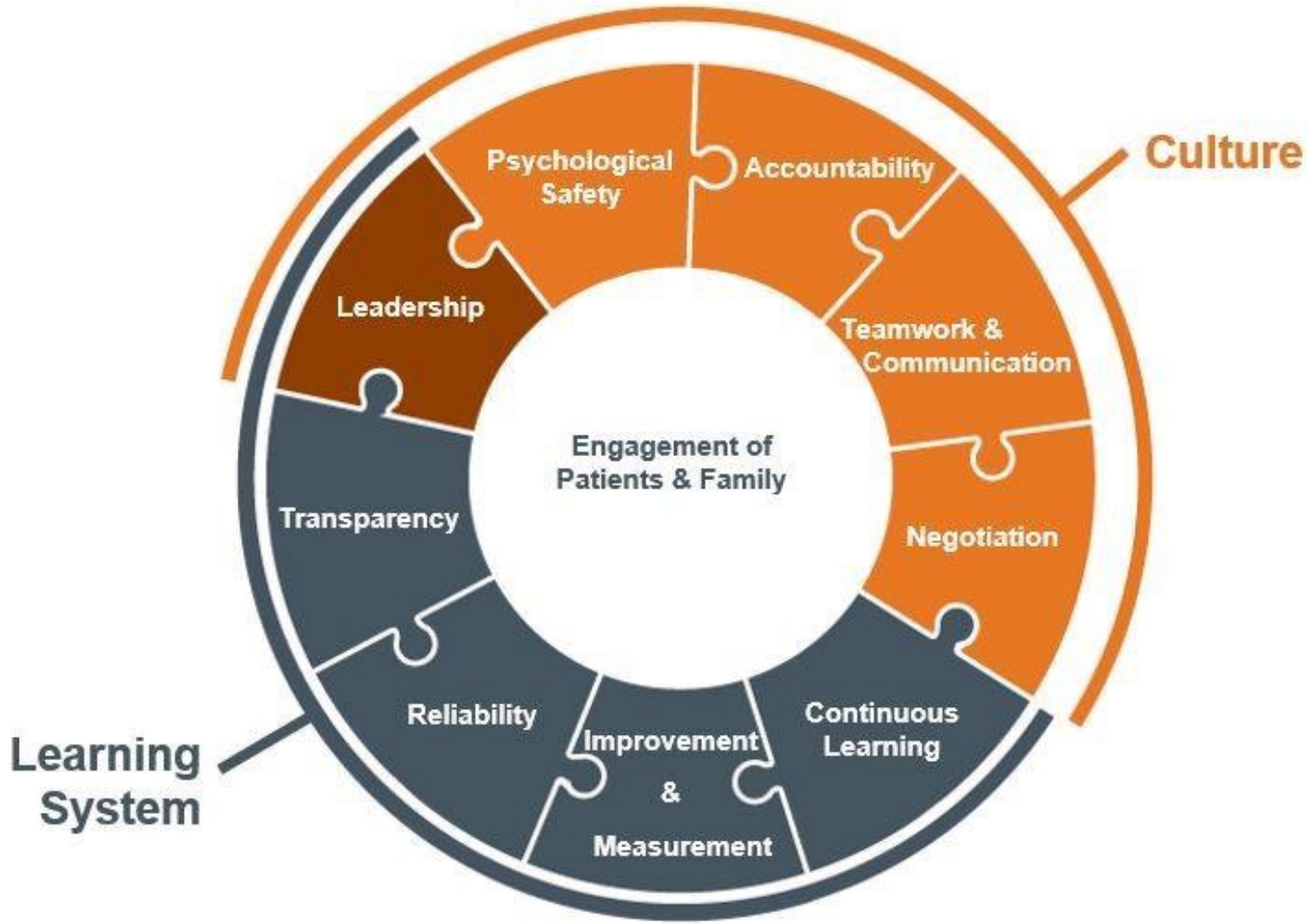
- Regulation
- Health Technology Assessment (HTA)
- Clinical Engineering
- Training
- Surveillance

ADDRESSING THE CHALLENGES OF AI

- Develop Explainable AI Systems
- Clinical validation
- Create Adaptive Regulatory Frameworks
- Technology literary + Collaboration

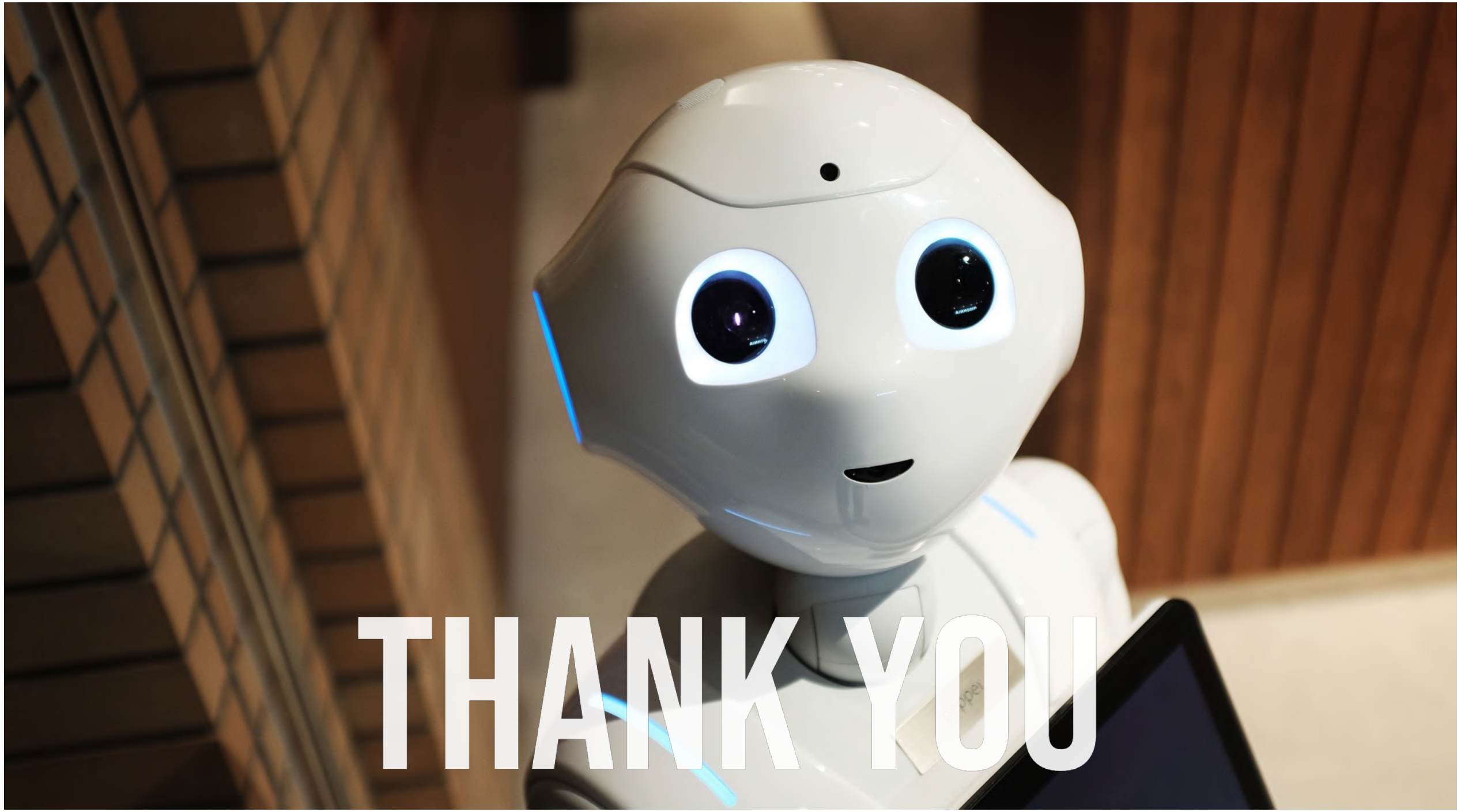

AUGMENTED FUTURE

Framework for Safe, Reliable, and Effective Care



"MEDICINE AND THE PRACTICE OF ANESTHESIOLOGY IS STILL, AT ITS CORE, A UNIQUELY HUMAN ENDEAVOR AS BOTH SCIENCE AND ART. "

"Artificial Intelligence in Anesthesiology: Current Techniques, Clinical Applications, and Limitations"
Hashimoto, Anesthesioslogy 2020


THANK YOU