Technology in Healthcare

A Mixed Blessing

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a Berkshire Hathaway company

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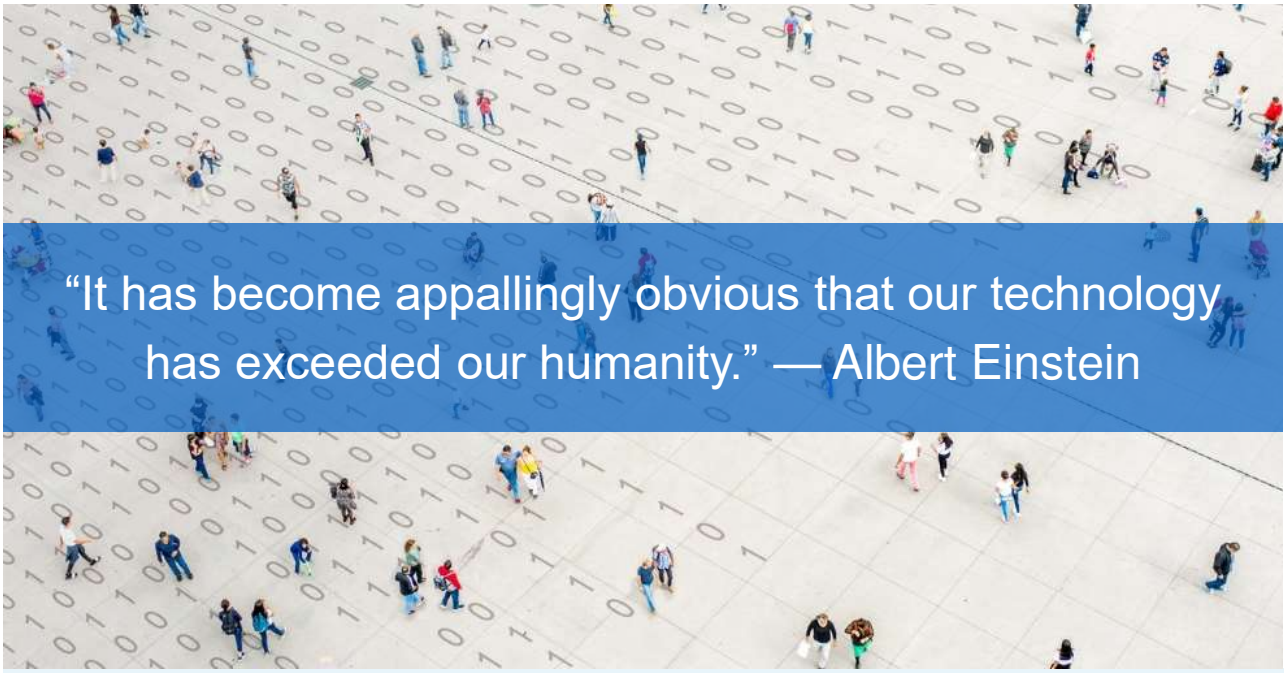
“It has become appallingly obvious that our technology has exceeded our humanity.” — Albert Einstein

Speaker bio

Graham Billingham, MD, FACEP, FAAEM, Chief Medical Officer, MedPro Group
(Graham.Billingham@medpro.com)

Dr. Billingham has 35 years of experience as an emergency medicine physician. He speaks nationally and internationally and has lectured in more than 350 continuing medical education courses on risk management, operations, patient safety, documentation, information technology, coding and billing, and malpractice prevention.

As MedPro's Chief Medical Officer, he is responsible for leading the company's Risk Solutions department and working with other leaders to support clinical risk, claims, underwriting, and sales efforts. His team focuses on improving patient safety and outcomes, decreasing risk and preventing claims before they happen.

Prior to joining MedPro, Dr. Billingham served as president and CEO for EPIC RRG. He also served on the physician advisory boards of several technology companies and the American College of Emergency Physicians' Medical Legal Committee and Coding and Nomenclature Committee. He is emeritus chairman of the Emergency Medicine Patient Safety Foundation and has served on the Emergency Department Practice Management Association's Board of Directors.

Dr. Billingham also founded and served as medical director for the Center for Emergency Medical Education and was a co-founder of the National Emergency Medicine Board Review Course.

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Today's faculty, as well as CE planners, content developers, reviewers, editors, and Risk Solutions staff at MedPro Group, have reported that they have no relevant financial relationships with any commercial interests.

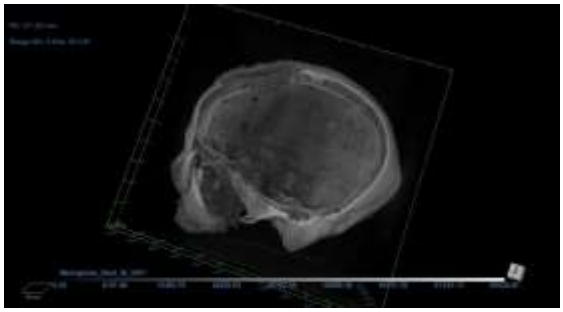
Objectives

At the conclusion of this program, participants should be able to:

- Cite the drivers and barriers to adopting technology in medicine
- Understand the risks and benefits associated with healthcare technology
- Explain why selection, training, and security are top risk concerns for all new technologies
- Define the impact of technology on patient safety and professional medical liability
- Identify emerging technology risks

Healthcare evolution

Skull E270, dating from between 664 BC and 343 BC



Metastatic lesions on skull display cut marks

Health technology milestones

Antiquity–1700

- Knives, saws, drills, and other surgical instruments
- Prosthetic devices
- Compound microscope
- Mercury-in-glass thermometer

1700–1940

- Stethoscope, ophthalmoscope, hypodermic syringe
- Iron lung, X-rays, ECG, EEG
- Electron microscope
- Artificial heart

1940–Present

- Heart pump and pacemaker
- MRI and CT scans
- Insulin infusion pump
- Artificial kidney and pancreas

We've come a long way

Modern healthcare: complex risks

Healthcare delivery changes

Corporatization of medicine

Including private equity investments

CV19 impact on population health

Deferred care, missed care, etc.

Healthcare consolidation

Larger, more complex healthcare systems

Healthcare staffing

Contract staffing, provider burnout, turnover, violence

Physician employment

Less private practice, more corporate/hospital

Scope of practice

Expanding for PAs, NPs, CRNAs, etc.

Shifting environment of care

More outpatient, home health, telehealth, etc.

Technology innovations

Artificial intelligence (AI), genetics, etc.

Technology's key role

•Technology is an increasingly important component of healthcare.

- Clinicians and healthcare staff use technology to communicate.
- Clinicians and patients use technology to interact and facilitate care delivery.
- Patients use technology to monitor their health, receive education, adhere to treatment plans, and more.

The paradox: beneficial and detrimental

Scenario	Academic medical center used smartphones to enter orders.
Case overview	Resident was in the process of discontinuing warfarin; at the same time, she received a text message. She ultimately did not discontinue the medication.
Outcome	Three days later, the patient had a bleeding crisis that required surgery.
Key issue	Did personal use of mobile technology cause the distraction, which resulted in the adverse outcome?

Healthcare in the digital age

A thing of the past?

Is the physical exam dead?

Digital healthcare: drivers and barriers

- Consumerism
- Convenience
- Cost transparency
- Private equity
- Consolidation on all fronts
- Emerging technologies
- Wearables
- AI and big data
- Amazon and Google

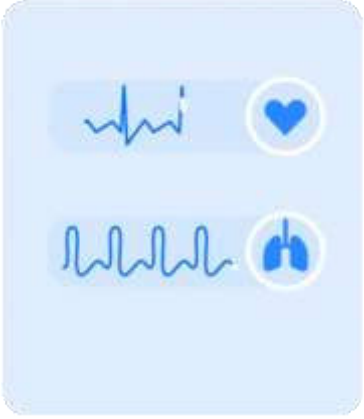
- Cost
- Privacy concerns
- Poor usability
- Patient safety
- Existing workflow
- Liability concerns
- Connection to EHR system
- Reimbursement
- Digital divide

Consumer sentiment: digital technology

45% of consumers own a wearable health device or use a smartphone to track wellness.

55% of patients allow information to be sent directly from their devices to a physician's office.

57% believe the data is useful and want their doctors to collect it.



Consumer sentiment: digital technology

More than 1 million smart rings were sold in 2022.

More than 7 million continuous glucose sensors were sold in 2023.

Bloomberg estimates the wearables market will grow to $76 billion by 2028.

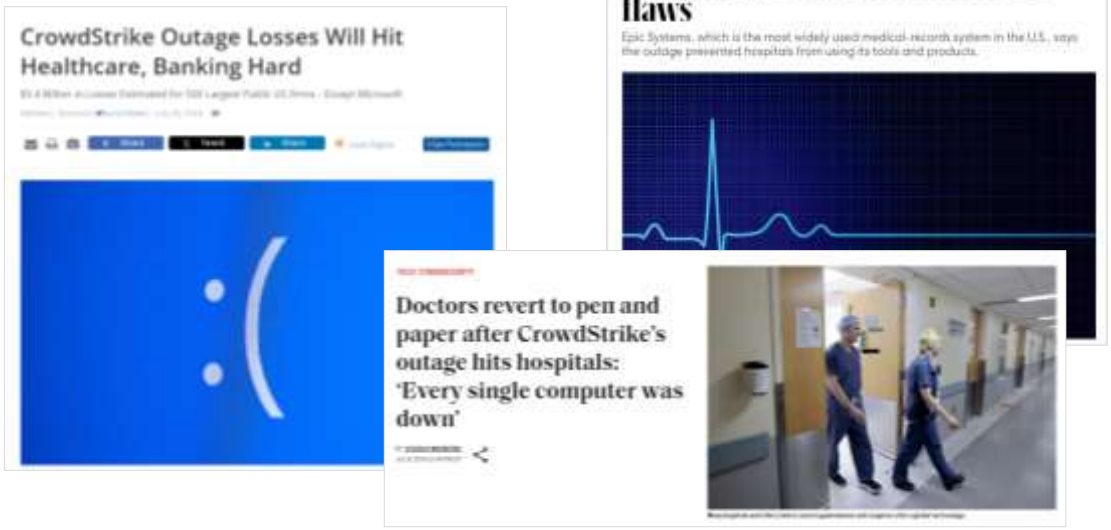
Physician's practice in the digital age

- Research and data collaboration
- Simulation training
- Predictive analytics
- Virtual reality
- Artificial organs
- New medications and therapies

- Rapid access to data
- Improved efficiency and outcomes
- Care coordination
- Remote patient monitoring
- Patient engagement
- Clinical decision support

The intersection of technology, patient safety, and risk management

What could possibly go wrong?



Top 10 healthcare technology hazards in 2024 per ECRI

1. Medical Devices May Pose Usability Challenges for Home Users, Risking Misuse and Patient Harm
2. Inadequate or Onerous Device Cleaning Instructions Endanger Patients
3. Sterile Drug Compounding Without the Use of Technological Safeguards Increases the Risk of Medication Errors
4. Overlooked Environmental Impacts of Patient Care Endanger Public Health
5. Insufficient Governance of AI Used in Medical Technologies Risks Inappropriate Care Decisions

6. Ransomware Targeting the Healthcare Sector Remains a Critical Threat
7. Increased Burn Risk With Single-Foil Electrosurgical Return Electrodes
8. Infusion Pump Damage Remains a Medication Safety Concern
9. Poor QC of Implantable Orthopedic Products Can Lead to Surgical Delays and Patient Harm
10. Third-Party Web Analytics Software Can Compromise Patient Confidentiality

Serious and significant questions

- How will technology affect the standard of care?
- How will technology affect patient safety?
- How will technology affect malpractice liability?
- What is the ethical and moral impact of technology?
- Are appropriate safeguards in place?

General risk management concerns in relation to technology

- Lack of awareness regarding learning curve and path to proficiency (volume)
- External pressures (e.g., patients, hospitals, private equity, and regulators)
- Patients unaware of risks
- Patients unrealistic about outcomes
- Inadequate informed consent
- Overestimation of benefits

"I have to tell you, I got a totally different diagnosis from someone named PookyPoo on medi-answer.com."

General risk management concerns in relation to technology

- Automation bias
- No universally accepted training and credentialing guidelines
- Evolving standards of care that cannot keep pace with technology
- Privacy/security concerns
- Inadequate implementation planning
- Lack of governance

"That's the diagnosis of my diagnostic desktop. If you want a second opinion, I'll ask my diagnostic tablet."

Electronic health records: benefits

EHRs have revolutionized the documentation of patient care and represent one of the most consequential technological advances in modern medicine.

- Increased access to patient data
- Increased efficiency
- Improved care coordination
- Secure data sharing
- Convenience
- Improved patient engagement
- Safer prescribing
- Clinical decision support

Electronic health records: risks

Incorrect information in the EHR system	Copy/paste errors	Conversion issues
Hybrid records (paper and electronic)	Poor system design and user interface	Data routing failures
System malfunctions	Metadata and audit trails	Alert fatigue

Social media: benefits

- Communication
- Marketing/advertising
- Patient education
- Networking
- Recruiting
- Collaboration

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Social media: risks

- Boundary violations
- Negative online reviews
- Breaches in confidentiality
- Bullying/harassment
- Misinformation
- HIPAA violations
- Loss of reputation

Telehealth: benefits

- Accessibility
- Convenience
- Staffing solutions
- Choice of care
- Cost efficiency
- Infection prevention
- Patient satisfaction

Telehealth: risks

- Barriers (e.g., implementation, patient access)
- Licensing
- Credentialing/privileging
- Online prescribing
- Informed consent
- Privacy/security
- Lack of physical exam
- Depersonalized experience

The Interstate Medical Licensure Compact

Robotic surgery: benefits

Revenue/market share

Competitor edge

Patient satisfaction

Greater precision/ visualization

Smaller scars

Quicker recovery

Lower infection rates

Less pain

Robotic surgery: risks

- Lack of standardized training
- Lack of uniform credentialing criteria
- Steep learning curve
- Inadequate standards on proficiency
- Inadequate informed consent

OR Black Box®: benefits

- Teaching/team training
- Performance
- Transparency
- Compliance
- Recall bias
- Human factors
- Environmental factors

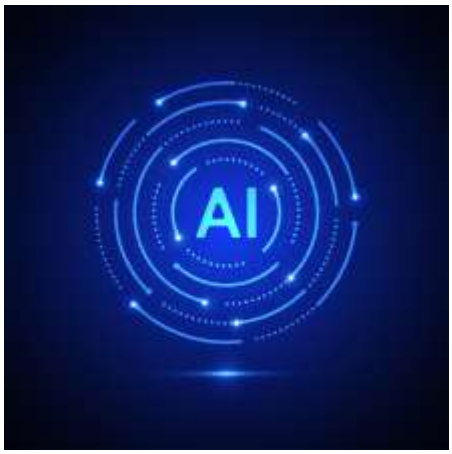
OR Black Box®: risks

Implementation	Workflow modification	Surgical team reluctance
Privacy/security	Punitive culture	Legal implications

Artificial intelligence: benefits

AI's potential seems almost infinite, with promises across the healthcare spectrum.

- Sophisticated diagnostic and treatment tools
- Precision medicine
- Expanded virtual care
- Faster drug discovery
- Enhanced data analysis and management
- Automated administrative functions
- Improved efficiency
- Enhanced cybersecurity



Artificial intelligence: risks

- Ethical considerations
- Automation bias
- Biased algorithms
- Hallucinations
- Privacy and security
- Patient expectations
- Black-box reasoning
- Training
- Informed consent
- Governance/oversight

The Risks of Botshit – Harvard Business Journal 7/25/24

- Botshit — made-up, inaccurate, and untruthful chatbot content that humans uncritically use for tasks
- Google – Bard – 2022 James Webb Space Telescope. This wrong answer by the chatbot led to a 9% drop in the stock price of Alphabet, Google's parent company — at the time, $100 billion in market value
- In 2023, two lawyers were fined by the Federal District Court of New York for submitting legal briefs containing fictional cases and legal citations generated by the chatbot ChatGPT
- At the 2023 annual meeting of the American Society for Health-Systems Pharmacists found that currently about three-quarters of responses generated by ChatGPT about questions related to drugs were inaccurate or incomplete. Worse still, when researchers asked the tool for references to support responses, it generated fake citations as a type of hallucination.
- Babylon Health - BBC's Newsnight featured a story with a doctor demonstrating how the app suggested two conditions that didn't require emergency treatment, when in fact the symptoms could have been indicators of a heart attack.

Cybersecurity: benefits

Promoting a strong culture of security can:

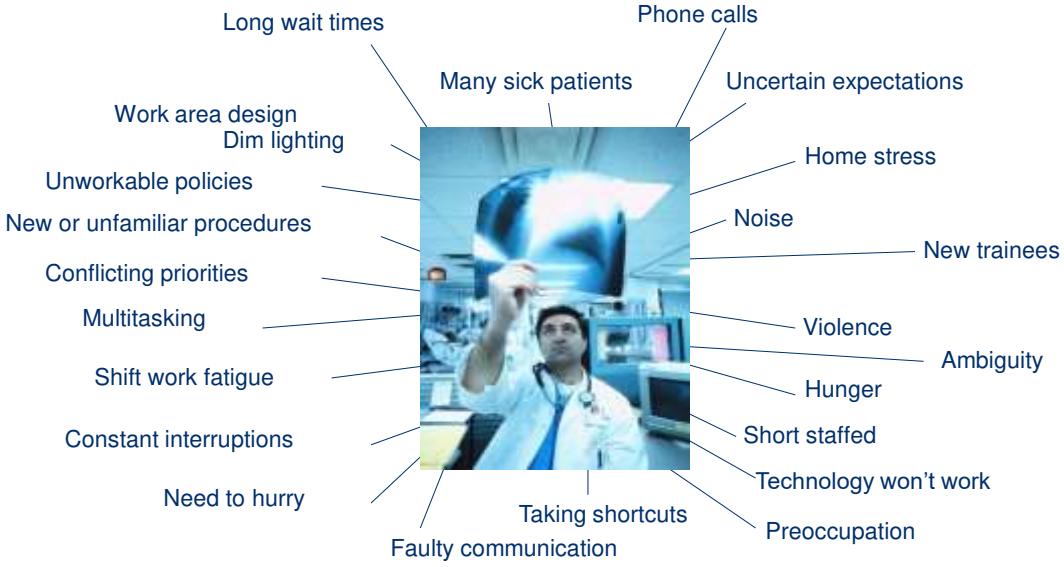
- Protect patient data and other sensitive/proprietary information.
- Support legal compliance.
- Help employees make educated decisions that do not compromise security.
- Keep systems up and running.
- Protect networks and devices.

Cybersecurity: risks

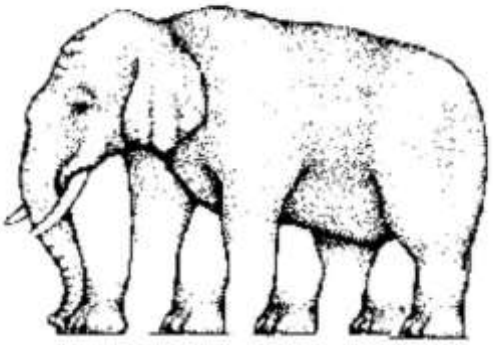
- Legal violations
- Financial impact
- Breaches of privacy/confidentiality
- Loss of systems and data
- Loss of reputation

Human factors engineering

Complex systems



Perception



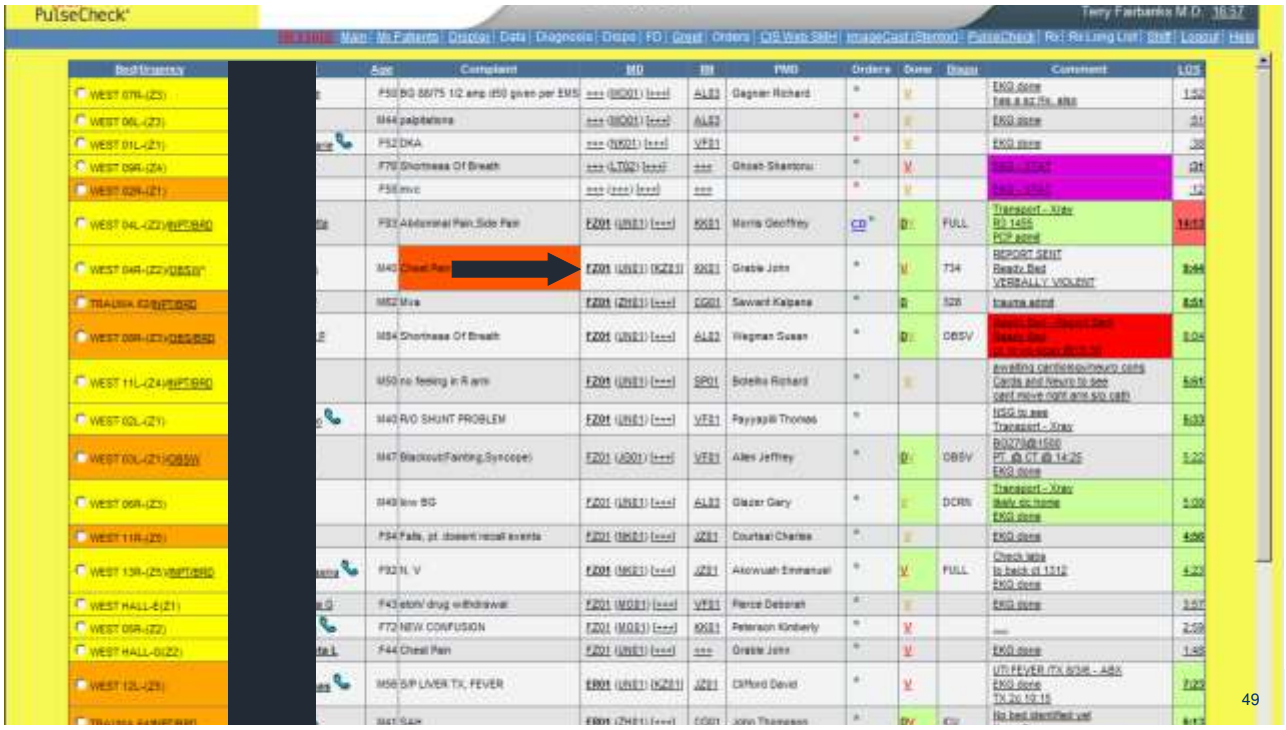
How many legs does this elephant have?

Wrong dose, wrong medication

Design flaws

Design remedy


NOT ON DUTY
TBC
TBC
TBC
Syncope
Face CT
Ophtho Clinic
Pelvic US
LATEX
ENG
D/C


PulseCheck
Terry Fairbanks M.D. 16:57
Main | My Patients | Display | Data | Diagnosis | Drugs | FD | Chart | Orders | ER Work Sheet | ImageCast (Remote) | PulseCheck | Rx | Rx Long List | Staff | Logout | Help
Bed/Urgency
Age
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PMD
Orders
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Drugs
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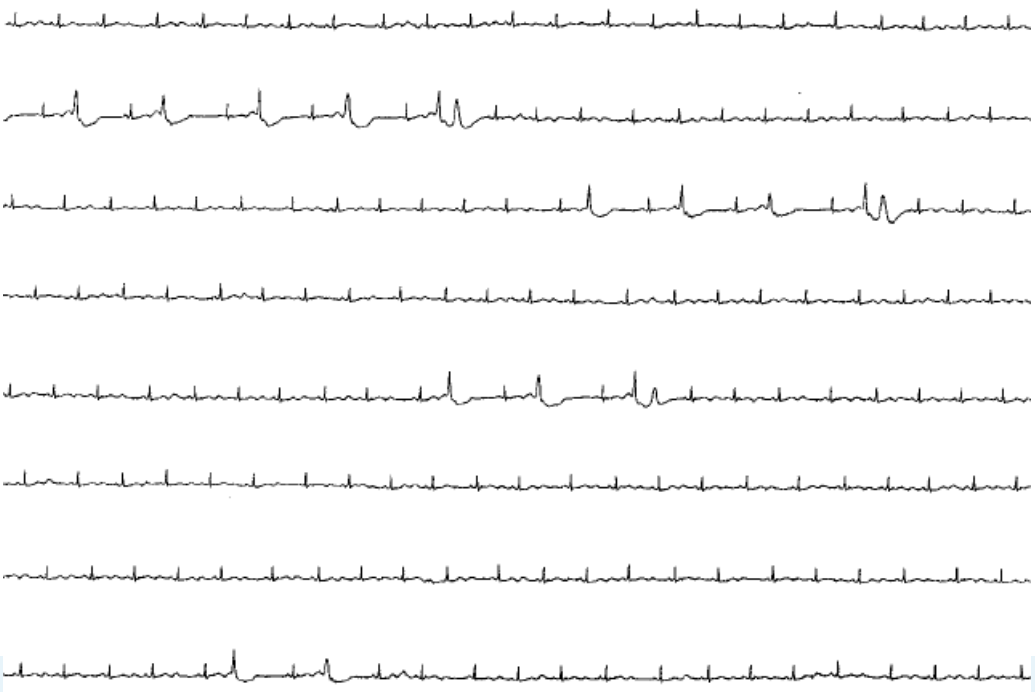
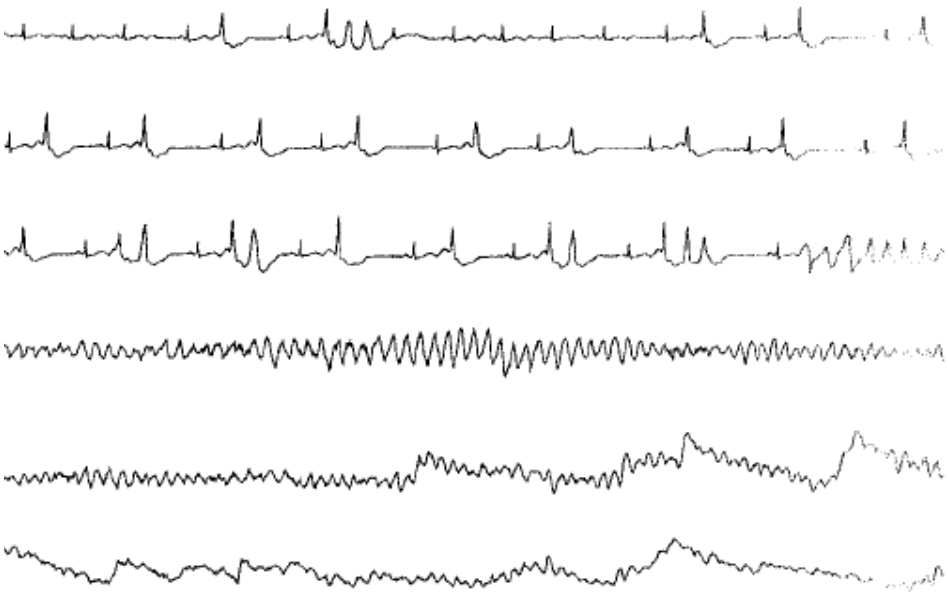
WEST 07R-(Z3)
WEST 06L-(Z3)
WEST 01L-(Z1)
WEST 09R-(Z4)
WEST 02R-(Z1)
WEST 04L-(Z2)WPT/BRD
WEST 04R-(Z2)OBS/IV*
TRAUMA #2/WPT/BRD
WEST 08R-(Z1)OBS/BRD
WEST 11L-(Z4)WPT/BRD
WEST 02L-(Z1)
WEST 03L-(Z1)OBS/IV
WEST 06R-(Z3)
WEST 11R-(Z5)
WEST 13R-(Z5)WPT/BRD
WEST HALL-E(Z1)
WEST 05R-(Z2)
WEST HALL-D(Z2)
WEST 12L-(Z5)
M40 Chest Pain
FZ01 (UNE1) (KZ21)
KK21
Grable John
M56 S/P LIVER TX, FEVER
ER01 (UNE1) (KZ21)
JZ01
Clifford David
EKG done
Transport - Xray
RD 1455
PCP admit
REPORT SENT
Ready Bed
VERBALLY VIOLENT
trauma admit
awaiting cardiology/neuro cons
Cards and Neuro to see
cant move right arm s/p cath
NSG to see
Transport - Xray
Ready go home
EKG done
Check labs
to back at 1312
EKG done
UTI FEVER /TX 6/3rd - ABX
EKG done
TX 2x 10:15
No bed identified yet

Case study: inadequate monitoring

- A 74-year-old woman presents to the ED for syncope.
- She has a negative workup, but she's admitted for monitoring.
- The hospital is full, so the patient becomes an ED "boarder."
- She remains on bedside monitor with telemetry.
- At 3:30 a.m., the patient has blood drawn; she's fine at this point.
- At 5:30am . . .





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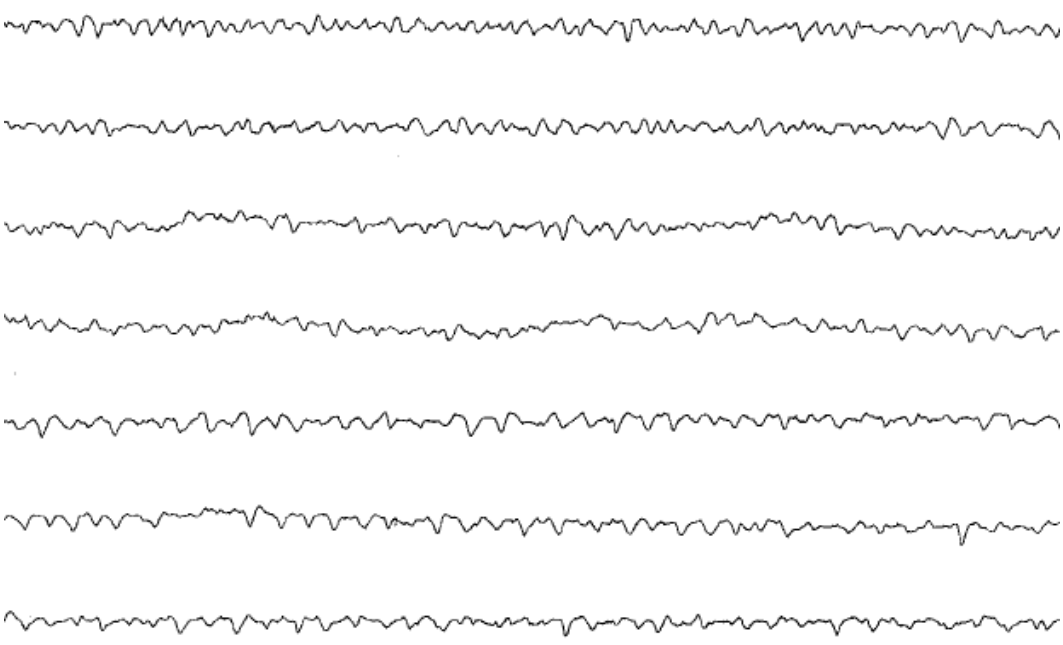

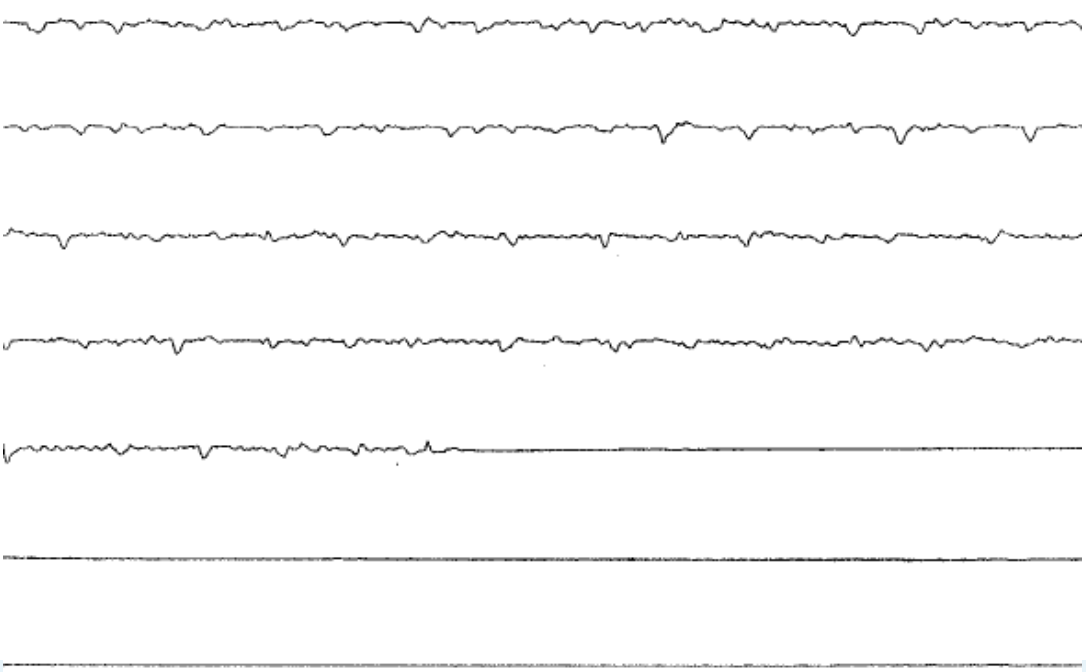

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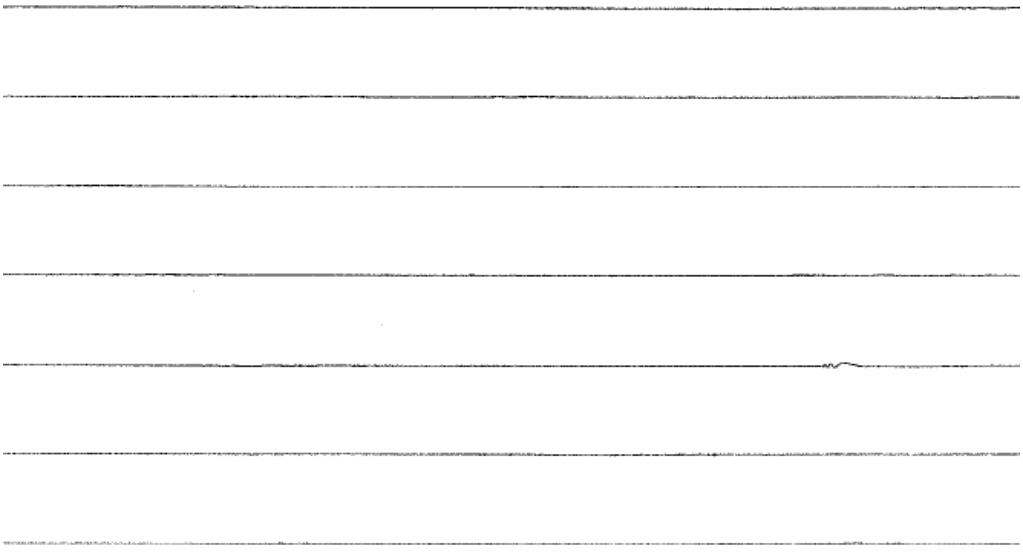

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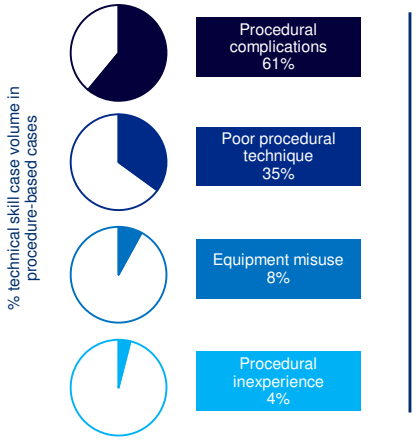
Liability concerns

Technical skill factors

Technical skill factors are noted in 95% of all procedure-based* case types. This is a broad factor category, reflecting procedural complications, procedural technique, equipment misuse, among others. Below is a focus on specific issues.



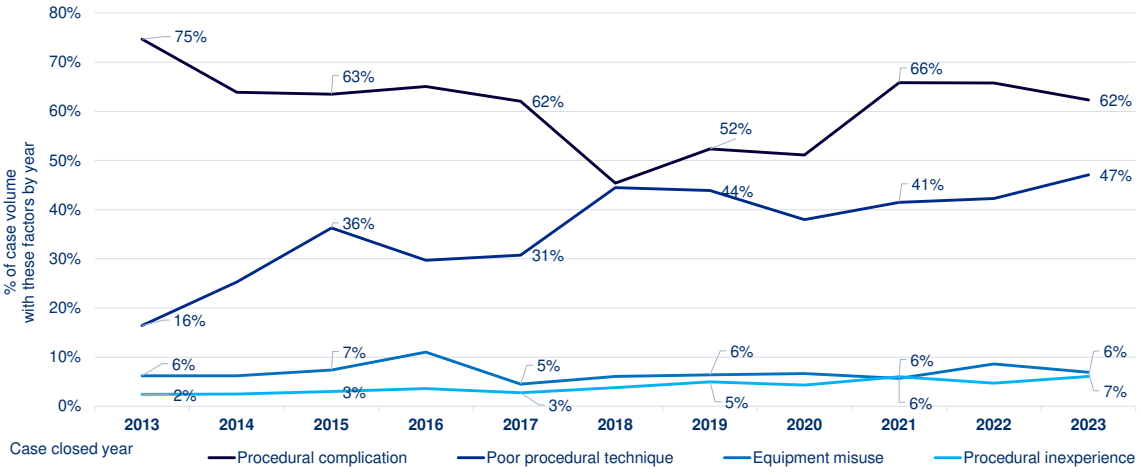
% each procedure-based case type with these four factors

	Surgical cases	Medical cases	Anesthesia cases
Procedural complications	65%	56%	67%
Poor procedural technique	34%	38%	29%
Equipment misuse	5%	10%	8%
Procedural inexperience	4%	4%	3%

MedPro Group + MLMIC procedure-based case types closed 2013-2023 with a "technical skill" contributing factor (N=7,089); More than one factor possible per case, thus totals >100%; *Procedure-based case types = performance of surgical, medical, and anesthesia procedures

Technical skill factors: distribution by year

Procedural complication cases were initially declining as a proportion of case volume, but have since increased. Procedural technique cases rose sharply. Equipment misuse cases are evenly distributed. Procedural inexperience cases have increased over the past 5 years.



MedPro Group + MLMIC procedure-based case types closed 2013-2023 with an "technical skill" contributing factor (N=7,089); More than one factor possible per case, thus totals >100%

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Technical skill factors: clinical* & financial severity

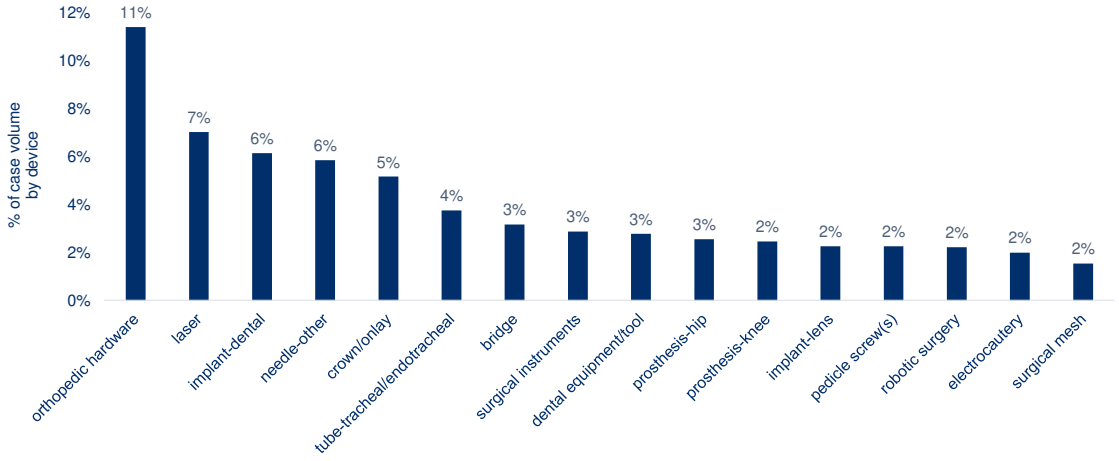
Although procedural inexperience cases account for the lowest case volume in this dataset (4%), they reflect the highest percentage of clinically severe patient outcomes, the highest proportion of cases closed with indemnity paid, and the highest average indemnity payment.

	% of cases by factor with high clinical severity outcomes	% of cases by factor closed with indemnity paid	Average indemnity payment
Procedural complications	31%	35%	$275K
Poor procedural technique	40%	62%	$289K
Equipment misuse	33%	64%	$252K
Procedural inexperience	41%	70%	$334K

MedPro Group + MLMIC procedure-based case types closed 2013-2023 with an "technical skill" contributing factor (N=7,089); more than one factor possible per case, thus totals >100%; *Severity codes reflect National Association of Insurance Commissioners (NAIC) injury severity scale

Technical Skill Factors: Which Devices are Most Commonly Involved?

Devices are identified if they specifically were involved with the injury.



MedPro Group + MLMIC procedure-based case types closed 2013-2023 with an "Technical Skill" contributing factor (N=7089)

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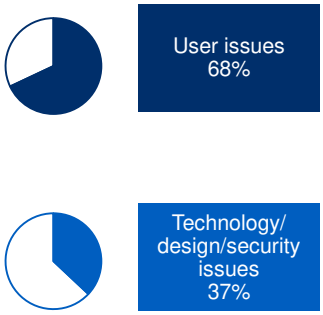
EHR-related case details

Although the volume of cases reflecting EHR issues is low, valuable insights are available.



Categories	Specific issues	% total case volume
User issues	Copy/paste/prepopulating	22%
	Incorrect information	14%
	Hybrid record/conversion issues	12%
	Training/education	7%
	Workarounds (EHR & CPOE)	2%
	Alert fatigue	1%
	Miscellaneous other user errors	17%
Technology/design/security issues	Design issues	14%
	Failures in electronic routing process	7%
	Integration failures/incompatible systems	6%
	Lack of/failures related to alerts, alarms & decision support tools	3%
	Fragmented record	2%
	Insufficient space/area for documentation	1%

MedPro Group + MLMIC cases opened 2012-2023 with an "EHR" contributing factor (N=449); more than one factor possible per case, thus totals >100%

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Telehealth

•Per CRICO study of telehealth-related claims:

- 66% were related to misdiagnosis.
- 12% were associated with surgical treatment.
- 11% were related to medical treatment.
- 5% were associated with medication issues.

Remote patient monitoring/wearable allegations

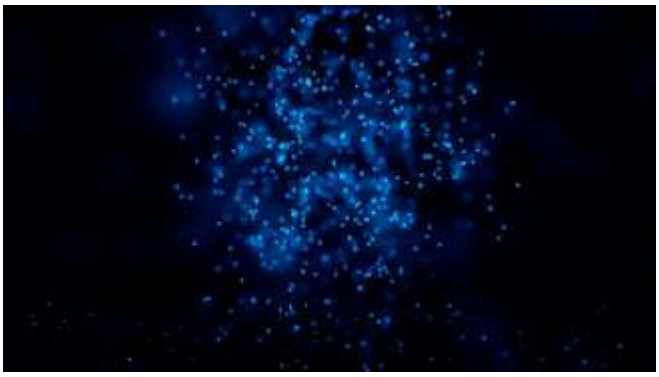
- Failure to educate/train patient in use of device/technology
- Failure to educate/train staff on device/technology, data interpretation, etc.
- Failure to monitor/ treat/detect/respond to incoming data, resulting in missed/delayed diagnosis
- Failure to ensure adequacy/accuracy of technology being recommended
- Communication breakdowns
- Failure to protect data

Artificial intelligence and the burden of responsibility

An AI system misidentifies a lesion as benign, and a long period of nontreatment occurs with the patient's condition deteriorating; the patient files a lawsuit.

Who is liable:

- The treating provider?
- The healthcare organization?
- The system designers?
- The software engineers?
- The hardware engineers?



Artificial intelligence and medical tort law

Can you sue an algorithm for malpractice?

- AI personhood
- Enterprise liability
- New standard of care

FDA regulations and preemption.

Adaptive algorithms vs. static algorithms.

Steep technology learning curve.

High probability is not 100% accurate (AI will make mistakes).

Accuracy of AI vs. accuracy of clinicians (e.g., chest X-ray).

Every article says AI “shows promise.”

- Include that in informed consent?
- Would you fly on a plane that “shows promise?”

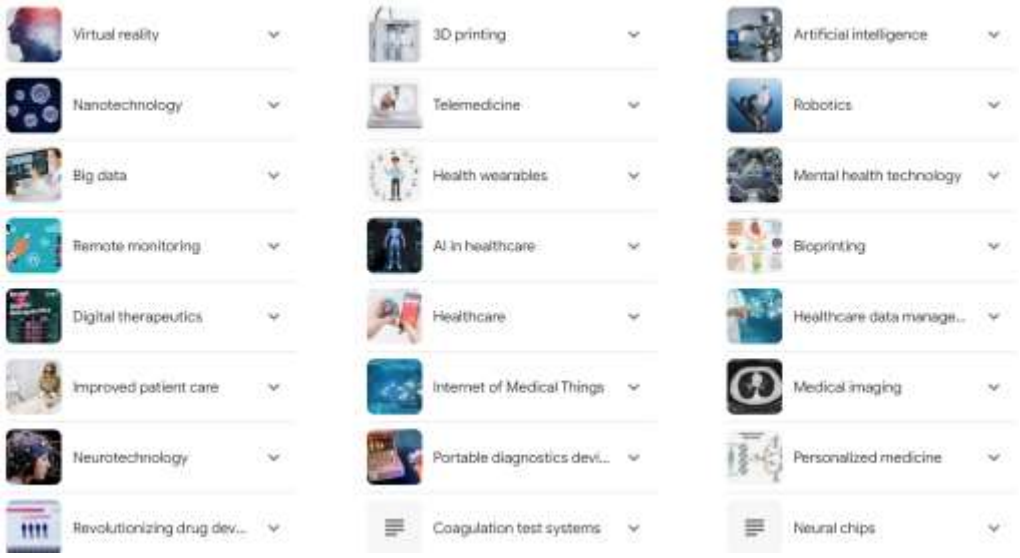
Artificial intelligence and the standard of care

- Will the standard of care require the physician to review the AI system's recommendation?
- Will some physicians come to entirely rely on the AI system's choice, never reviewing the recommendation?
- If so, would the physician's failure to review recommendations mean they should bear all of the liability?
- How will AI ultimately affect the standard of care?

The future is here now

The impact of artificial intelligence on healthcare

Google results for “healthcare technology” search



Direct patient support apps

Provide support between healthcare visits:

- Medication reminders
- Reporting dashboards
- Vital sign monitoring and feedback
- Symptom checkers
- Patient education materials
- Fitness/diet tracking
- Health coaching
- Virtual appointments/scheduling

Very useful for remote patient support, and some apps can initiate a conversation with a real physician or clinician.

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Wound care app

AI startup developed a mobile app that assesses chronic wounds and presents a preliminary assessment to nurses or other healthcare workers.

The app was shown to be 80% as accurate as human nurses, and at times was able to surpass their ability.

Ultimately, the app is aiming to be at least 90% as accurate as human nurses.

The technology was benchmarked against the head nurse at a community hospital in Singapore.

Ophthalmology

Numerous researchers have validated the use of multi-label classification to detect diabetic retinopathy (DR).

Ting, et al., used 494,661 retinal images to train a deep learning system to detect DR, glaucoma, and age-related macular degeneration.

Gulshan, et al., used 118,419 images in two data sets to train a deep convolutional neural network to detect and classify DR and diabetic macular edema.

JAMA Ophthalmology

Conclusions of study exploring AI and glaucoma/retina management

- “This study accentuates the comparative proficiency of LLM chatbots in diagnostic accuracy and completeness compared with fellowship-trained ophthalmologists in various clinical scenarios. “
- “The LLM chatbot outperformed glaucoma specialists and matched retina specialists in diagnostic and treatment accuracy, substantiating its role as a promising diagnostic adjunct in ophthalmology.”

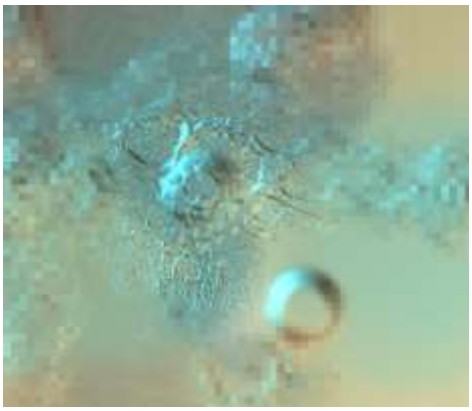
FDA approves first AI-powered skin cancer diagnostic tool

Handheld device that uses AI to noninvasively detect skin cancer

Can detect all three common types of skin cancer

Has a sensitivity of 96% across all forms of skin cancer and across different skin types

Reduces the number of missed skin cancer diagnoses by half



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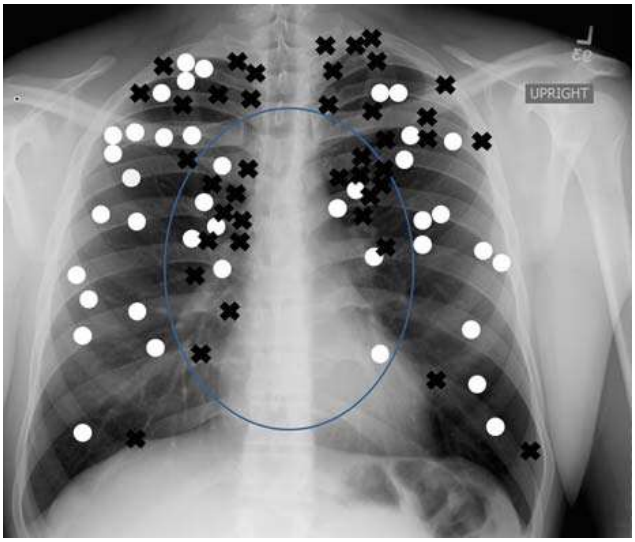
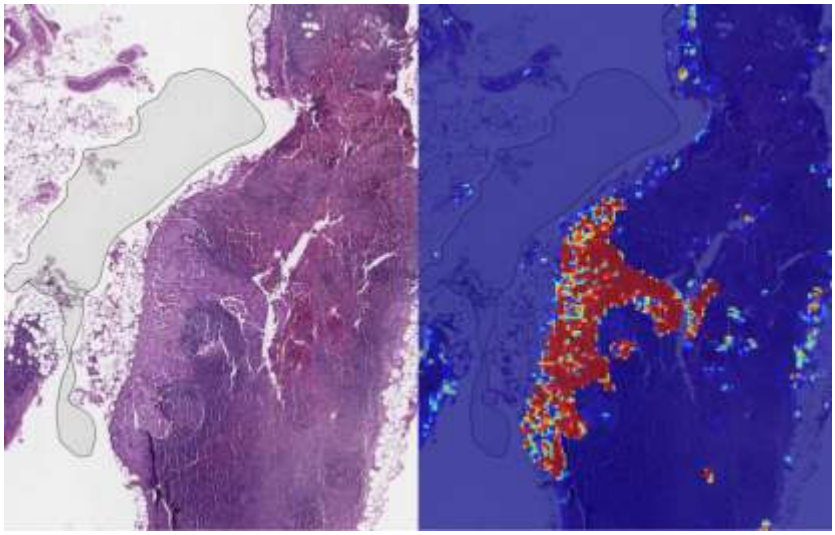
Computer-aided diagnosis



“Spell check” for doctors




TED

Genomics landscape

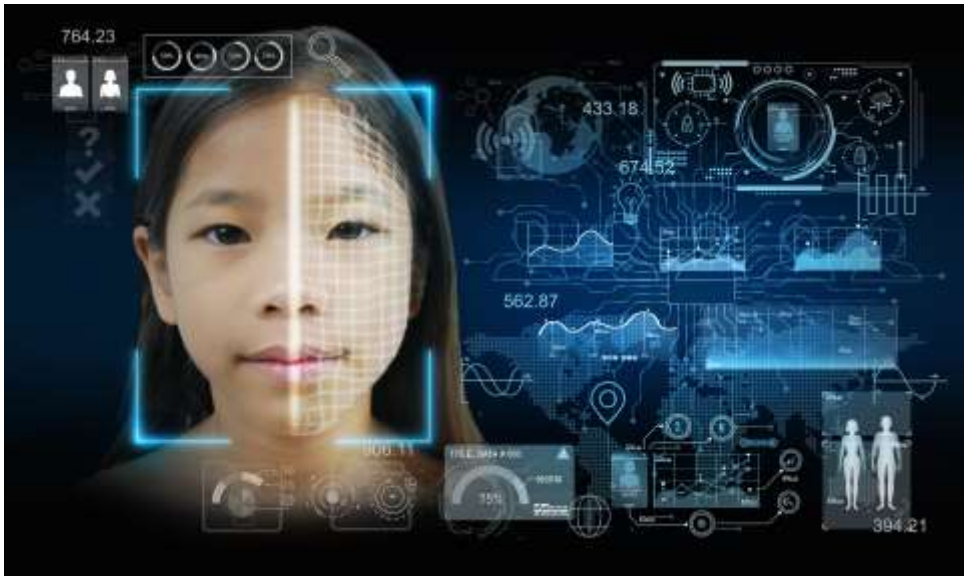
- Diagnostic testing
- Predictive genetic testing
- Carrier testing
- Prenatal testing
- Preimplantation testing
- Newborn screening
- Pharmacogenetic testing
- Research genetic testing
- Genetic counseling

3D printing

Healthcare drones

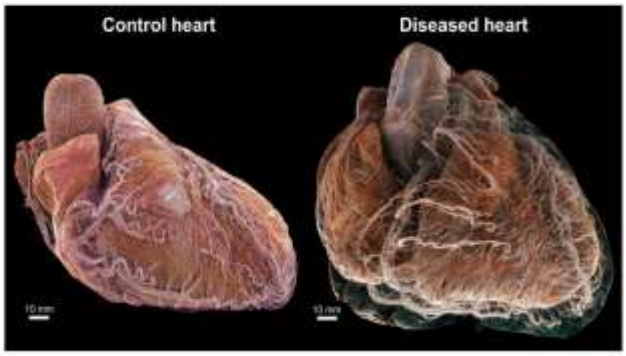
- Blood products
- Defibrillators
- Lab samples
- Medical supplies
- Contraceptives
- Vaccinations

DeepGestalt

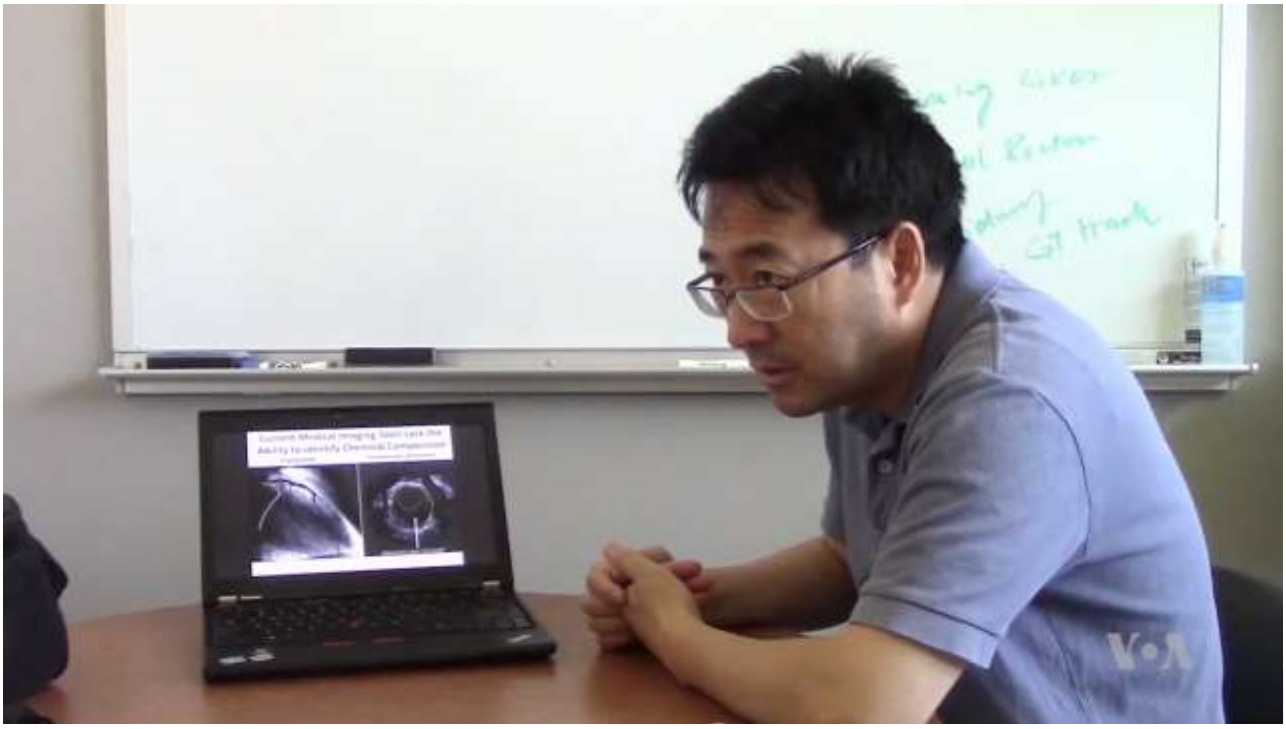


Radiology

Adult Heart in Health and Disease Using Hierarchical Phase-Contrast Tomography



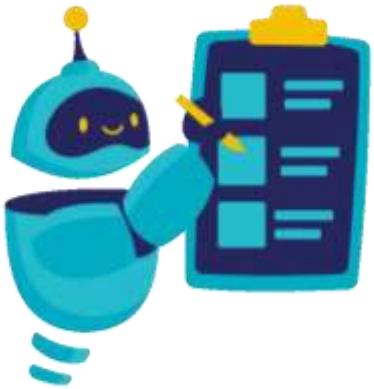
- Hierarchical phase-contrast tomography (HiP-CT) allows microstructural isotropic imaging of two adult human hearts (one control, one pathologic) without contrast agents.
- HiP-CT shows zoomed-in high-spatial-resolution imaging with microscopic to cellular-level detail, anywhere in the heart, including myocardium, valves, and coronary arteries.



Lessons learned

Risk strategies for new technology

- Better training/documentation of training
- Procedures for oversight/proctoring and ongoing competency assessment
- Regular patches, updates, and backups
- Governance policies and implementation planning
- Ongoing auditing and monitoring
- Disclosure of risks to patients/patient options (informed consent)
- Disaster recovery, system testing, and system maintenance



Technology takeaways

- First, do no harm.
- Technology has limitations and risks.
- Depersonalization will change the doctor–patient relationship.
- New technology has a steep learning curve and unintended consequences.
- Read your contract and understand indemnification clauses.
- You're likely being recorded.
- Practice disaster recovery (power, Wi-Fi, hardware, software).
- Have a "bring your own device" policy.
- Have a "ripcord strategy" — don't put your generators in the basement.
- Remember you are leaving a digital signature and footprint.
- Documentation outside of the EHR (e.g., texting) is discoverable.
- Workarounds can be dangerous.
- Setting realistic expectations (for yourself and patients) is imperative.
- We will get sued for using AI and for not using it.

The Cost of Technology

MedPro advantage: online resources

Find us online at www.medpro.com/dynamic-risk-tools

- Tools & resources
- Educational opportunities
- Consulting information
- Videos
- Breach Solutions

Follow MedPro on LinkedIn and X (@MedProProtector)

Education

- Materials and resources to educate followers about prevalent and emerging healthcare risks

Awareness

- Information about current trends related to patient safety and risk management

Promotion

- Promotion of new resources and educational opportunities