AI Revolution in Healthcare

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Baxter

INTRODUCTIONS

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Over 20 years of Healthcare IT and consulting experience, focusing on utilizing technology to transform healthcare delivery.

BACKGROUND

History and Fiona

AGENDA

1. Understand the Evolution of Medical Devices:

- The historic development of medical devices, highlighting key innovations that shaped healthcare.
- Review current challenges and barriers that exist with medical devices.

2. Examine the Stages of AI Integration in Medical Devices:

- Identify and explain the stages of AI evolution in healthcare, from data analysis and predictive modeling to autonomous systems.

3. Impact of AI on Healthcare Outcomes:

- How AI in medical devices contributes to improved patient outcomes, including faster diagnosis, and reduced healthcare costs.

4. What's next: Thoughts and Predictions on Future Trends

- Explore emerging technologies and innovations in AI that are likely to shape the future of medical devices.

EVOLUTION OF MEDICAL DEVICES

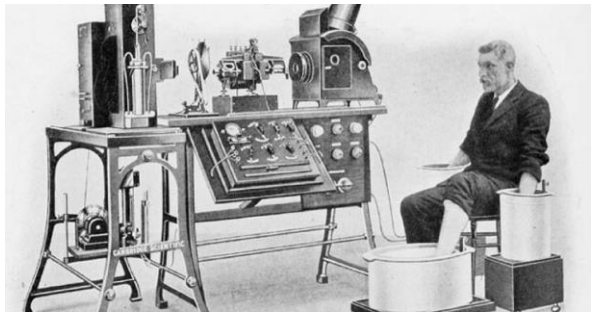
From the stone age to the modern era

Physical

Electric

Connected

First medical device in recorded history circa 4000 BCE is often considered to be the cranial drill



The first electric medical device is often considered to be the electrocardiograph 1903 Willem Einthoven, a Dutch physiologist

In 1983 the N-100 Pulse Oximeter with Networking was released. This would evolve into the modern landscape of networked medical devices.

BRIEF HISTORY

Case study – Connected devices in consumer vs medical markets

Mobile phone

Motorola DynaTAC 8000X first commercially available mobile phone
1983

GSM (Global System for Mobile Communications)
1991

Sharp J-SH04, first mobile phone with an integrated camera
2000

Samsung Galaxy S Android-iOS that defines the industry today
2010

Introduction of 5G
2019

Rise and Fall of RIM/Blackberry

1989
Motorola MicroTAC is introduced, the first flip phone

1992
IBM Simon is released, the first smartphone

2007
Apple introduces the iPhone

2016
Google Assistant, and a focus on AI and software integration

EHR

PROMIS
1969

1972
Regenstrief Institute

VA's VistA Initial Concept Development
1978

1979
Founding of:
Epic Systems
Cerner Corporation

VA decision to deploy DHCP nationally
1985

1987
HL7 was founded

Slow Adoption:
- High Costs
- Technological Limitations
- Lack of Standards Resistance to Change

1990's

2003
Kaiser Permanente EMR Go-Live

2009
The Health Information Technology for Economic and Clinical Health (HITECH) Act

2012 Fast Healthcare Interoperability Resources (FHIR)

2015
Widespread EHR Adoption Majority of hospitals and a significant percentage of office-based physicians have adopted EHR systems

DeepMind, a subsidiary of Google, develop an AI-driven app called Streams.
2017

EVOLUTION OF MODERN MEDICAL DEVICES

Data Growth
Connected devices

Huge
Reaching petabytes (PB) at the institutional level,

Large
Hundreds of gigabytes (GB) to terabytes (TB)

Medium
Generally in kilobytes (KB) per patient per day

Small
local storage or printouts.

2020: COVID-19 Surge in telehealth, accelerating the use of medical devices for remote monitoring.
2021: AI-driven devices emerged, monitoring and predicting health issues, like continuous glucose monitors (CGMs).
2023-2024: Regulatory focus on cybersecurity as more advanced and connected medical devices enter the market.

2010s: The healthcare industry adopts Internet of Things (IoT) devices, smart inhalers, connected blood pressure monitors, and wearables.
2015: Wearable devices like Fitbit and Apple Watch grow in popularity for monitoring vital signs
Late 2010s: Medical devices have become commonplace in home

Early 2000s: Start of internet-connected devices, cardiac monitors and insulin pumps.
2005: FDA begins approving medical devices with wireless communication.
Late 2000s: Implantable devices, defibrillators and insulin pumps, capable of communication

Early 1990s: Glucometers started transmitting data, enabling data transfer to computers.
Mid-1990s: Networkable ECG machines and patient monitoring systems introduced to the market

1980s: Early telemedicine focus on remote patient data monitoring.
Mid-1980s: infusion pumps developed with basic remote monitoring capabilities.

THE CURRENT STATE OF AI IN HEALTHCARE?

Expectation

VS

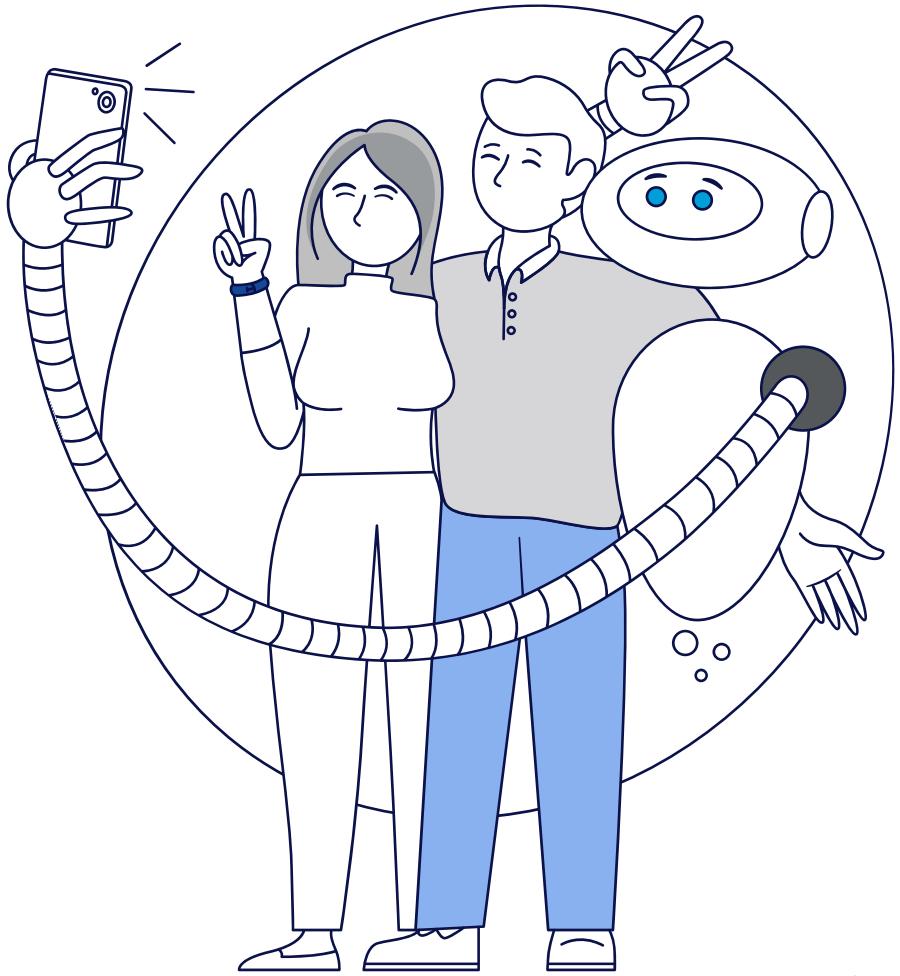
Reality

HOW IS AI EVOLVING?

The Unhelpful, Incompetent Assistant

The Somewhat Unhelpful but Competent Assistant

The Helpful but Competent Assistant



THE UNHELPFUL ASSISTANT

Symptom Checker Struggles

User inputted “headache and nausea” and the AI suggested, “Pregnant. Or rabies.”

AI symptom checkers have sometimes provided hilariously off-the-mark diagnoses.

Flirting with Danger

AI chatbot in a health app was supposed to offer mental health advice. Instead, when a user confessed feeling sad and lonely, the AI replied with, “You should try flirting.”

Not exactly the kind of emotional support that was needed

Naming Nightmare

AI transcription system misheard “meds” as “beds,” suggesting "reduce beds by half" instead of "reduce meds by half."

Cutting medications is one thing; halving beds would cause chaos!

CURRENT AI CHALLENGES

Barriers that exist with medical devices

Usability Challenges

Interoperability

Integrated Clinical Workflows

Data Overload

Operational Challenges

Cybersecurity

Regulatory Compliance

Maintenance and Reliability

USABILITY CHALLENGES

Barriers that exist with medical devices

Interoperability

- Proprietary System
- Fragmented Data
- Inconsistent Data
- Compatibility issues

Integrated Clinical Workflows

- New devices into existing workflows
- Impact on Efficiency
- Increased workload for healthcare providers

Data Overload

- Overabundance of Data
- Clinical fatigue
- Overwhelm healthcare providers
- Increasing the risk of errors

OPERATIONAL CHALLENGES

Barriers that exist with medical devices

Cybersecurity

- Cyberattacks
- Updating devices with security patches
- Balancing usability

Regulatory Compliance

- Evolving Standards
- Impact on Efficiency
- strict regulatory standards
- Keeping devices compliant
- Increase operational costs

Maintenance and Reliability

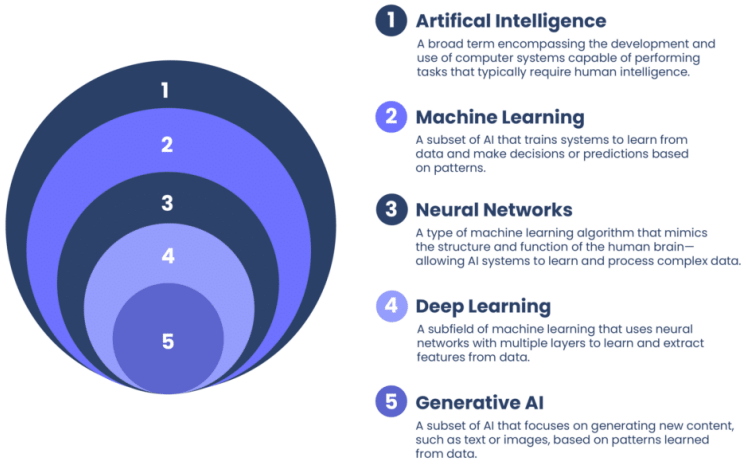
- Regular maintenance
- high-demand acute care settings
- Risk of Device Failures
- Danger to patients

WHAT IS AI?

New tools poise the industry for accelerated change

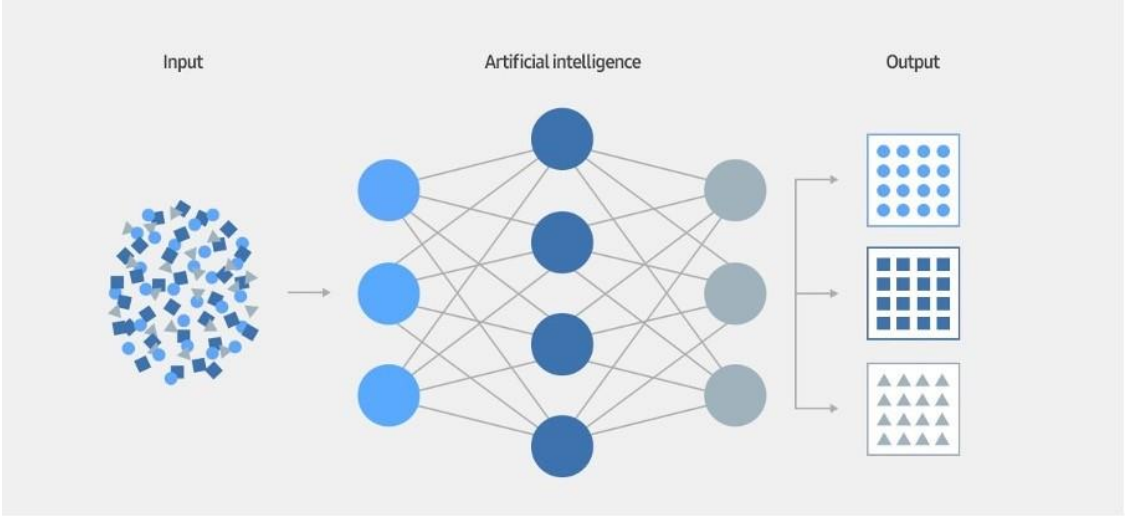
Artificial Intelligence ("AI")

- AI is technology that simulates human intelligence (e.g., learning, comprehension).
- Many disagree on what actually constitutes artificial intelligence.



Simple flow of AI model

- Input (e.g., a question)
- Processing (e.g., implements, defines, weights)
- Output (e.g., a response, answer)

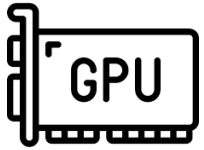


https://www.mycase.com/blog/ai/ai-vs-generative-ai/
https://www.linkedin.com/pulse/how-machine-learning-revolutionizing/

FUNDAMENTALS OF AI IN HEALTHCARE

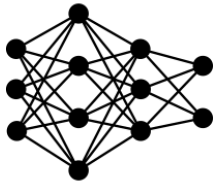
Barriers can be overcome and unlocked in the age of AI

Infrastructure

- Energy 
- Compute 

- Data & Data Centers 

Artificial Intelligence*

- Large Language Models 
- Robotics 
- Speech Recognition 

Clinical, Financial, and Operational Improvements

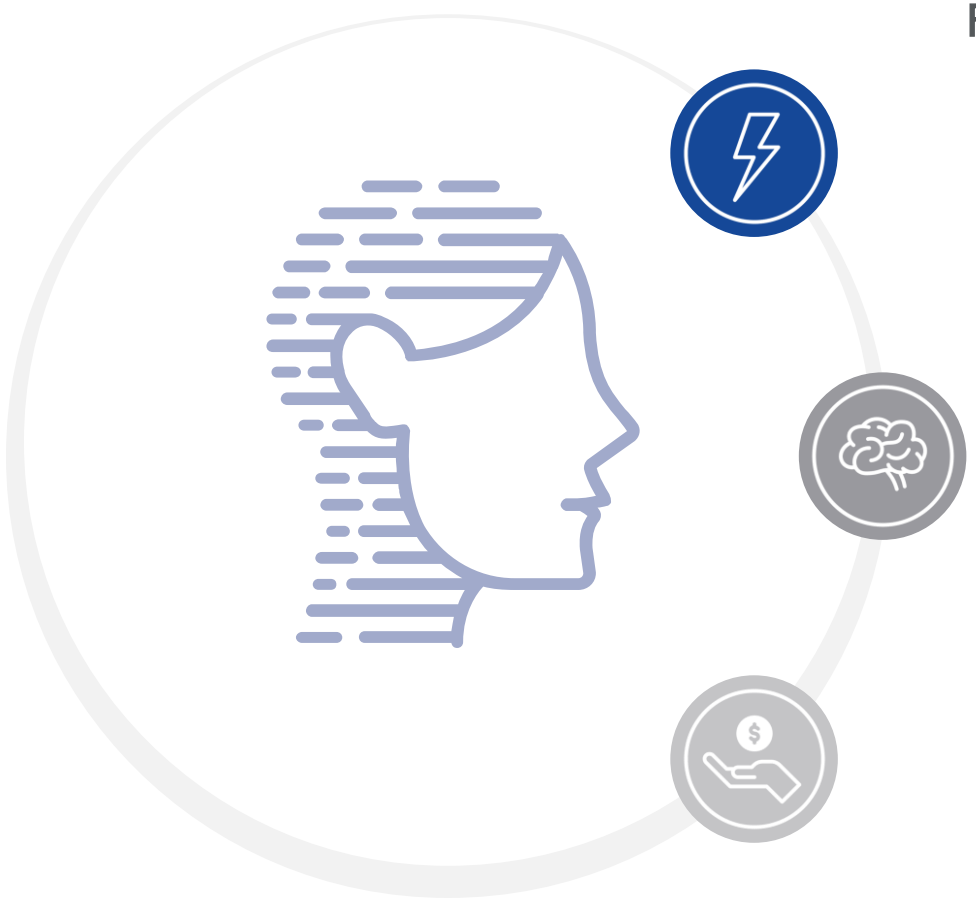
Within care settings

- Patients
- HCPs
- Devices & Technology

*Other AI systems include computer vision, natural language processing, machine learning, and expert systems

IMPACT OF AI ON HEALTHCARE OUTCOMES

Enhancing Patient Care through AI



Faster Diagnosis

AI in medical devices enables quicker and more accurate diagnoses, allowing for timely interventions.

Improved Patient Outcomes

By providing real-time insights and predictive analytics, AI enhances treatment plans, leading to better patient outcomes

Reduced Healthcare Costs

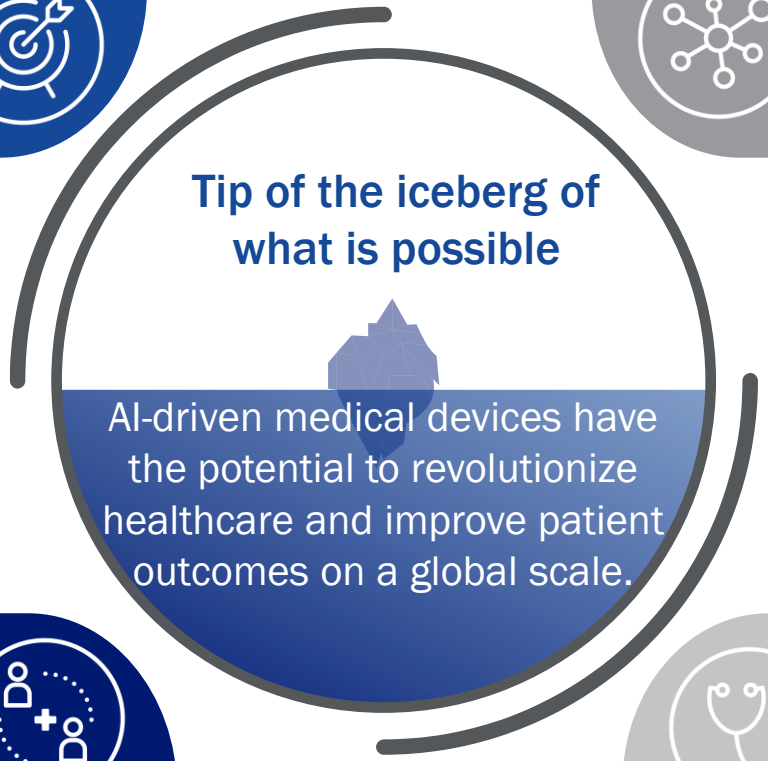
AI helps streamline processes, reduce errors, and optimize resource use, significantly lowering healthcare costs.

FUTURE TRENDS IN AI-DRIVEN MEDICAL DEVICES

Emerging Technologies Shaping Healthcare

Precision Medicine:
AI will drive further advancements in precision medicine, enabling highly personalized treatment plans based on genetic data.

AI-Enabled Wearables:
Next-generation wearables will leverage AI to provide real-time health monitoring and feedback, enhancing preventive care.



Telemedicine:
Telehealth platforms will increasingly integrate AI to enhance remote diagnosis, patient monitoring, and virtual care.

Diagnostics:
AI tools will evolve to diagnose complex conditions with greater accuracy and speed, transforming medical diagnostics.